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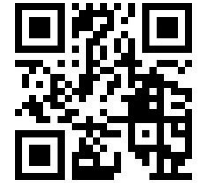
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Electrification through Renewable Energy in Nigeria an Exploration of Viable Technology Options Beyond Solar PV



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ABSTRACT: Nigeria has an electrification rate of 54%, with many of those who are connected to the grid experience severe power outages. The Energy Commission of Nigeria intends to address this challenge with the use of renewable technologies. This paper explores the viability of solar PV, biofuel, wind, and small-scale hydro as renewable energy options for electrifying Nigeria. I find that solar PV, biofuel and small-scale hydro show exciting potential in Nigeria, while wind energy has much less potential due to low wind speeds in the country. Ultimately, renewable technologies need to be considered based on the community in question, instead of attempts at a one-size-fits-all approach to electrifying every community in the country. However, hybrid systems combining various renewable technologies might just be the ideal solution to electrifying rural communities and getting the electrification rate in Nigeria to a hundred percent.

KEYWORDS: Renewable energy, Electrification, Sub-Saharan Africa, Solar PV, Biofuel, Wind, Hydro

1. INTRODUCTION

1.1. Background to electricity access challenge in Sub-Saharan Africa

Most of the 770 million people on earth without access to electricity live in Sub-Saharan Africa [1]. This makes it the most electricity-poor region in the world, accounting for the 10 least electrified countries in the world. According to the World Bank, only 48.4% of the population in Sub-Saharan Africa had access to electricity in 2020 [2]. Nigeria is the most populous black nation in Africa with an annual growth rate of 3.2% per annum [3]. Majority of Nigeria’s power is generated through natural gas, with hydropower being the other source of power generation [4]. Despite being rich in crude oil, coal and natural gases, 45% of its population is not supplied with electricity [5]. Amongst the population of Nigerians supplied with electricity, many of them still rely heavily on diesel and petrol generators due to severe outages of electricity supply [4].

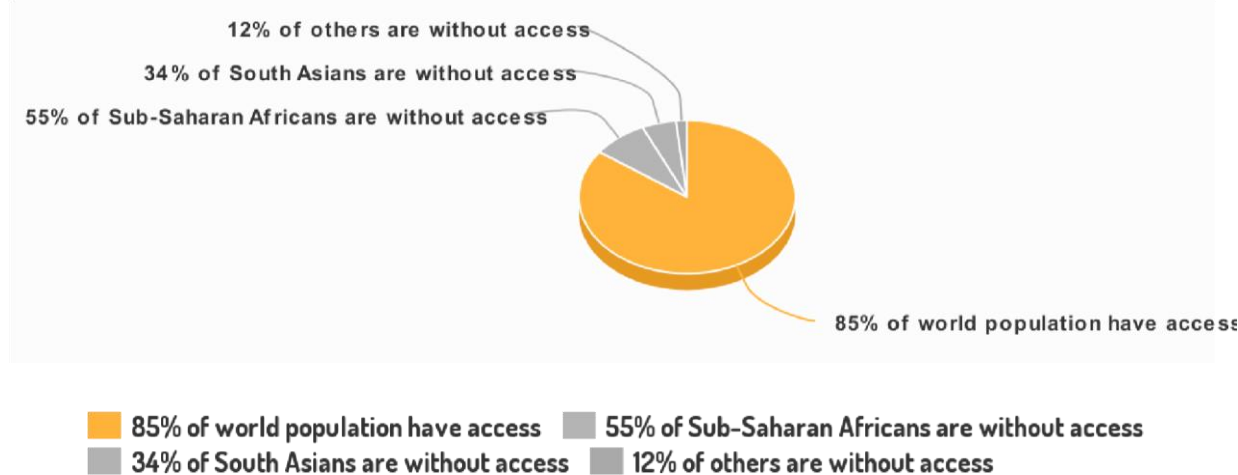


Figure 1. World electricity access and lack of access by region, 2012.

Source: [6].

The predominant means of generating energy around the world is by the use of fossil fuels which accounts for over 60% of the world’s energy generation [7]. Fossil fuels are the main source of energy in Africa as many African countries are rich in crude

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oil, coal and natural gas [8]. In Nigeria, natural gas accounts for 86% of power generated [4]. Due to the inconsistency of power supply through the national grid in Nigeria, a good amount of electricity used in homes is self generated. In urban areas this energy is produced from running petrol or diesel powered generator sets [4]. It is estimated that the total generator sets market in Nigeria is the largest in Africa in terms of revenue [9]. As of 2018, over 60 million Nigerians owned a generator [10]. A survey of 262 people conducted in Obantoko, Ogun State, Nigeria showed that 91.2% of the studied population owned generators, while 92% of their neighbours did [11]. However, these generators have challenges that come with their use. One major challenge is the pollutants released from their exhausts after burning fuel [12]. A large amount of noise pollution is another effect of running generator sets. The study conducted in Obantoko showed that 70.9% of residents in this community complained that their own generator sets are too noisy, while 61 % complained of their neighbours' being too noisy [11]. With generators often running all through the night in residential areas, urban dwellers are also at risk of health challenges that come with its use [13], [14]. In rural settlements where there is no access to electricity, residents depend on fuel-wood for energy supply [15]. This means of generating power through fossil fuels and fuelwood are dominant sources of environmental pollution as carbon dioxide is emitted into the atmosphere.

Electricity access is directly linked to an increased standard of living as there is a positive long-run relationship between household electricity consumption and level of education, poverty rate, per capita income and life expectancy [16]. About 45% of Nigeria's population is off-grid [5]. A lack of electricity in rural off-grid areas hinders the ability of its dwellers to improve livelihoods, secure high-quality public services, and rise out of poverty [17]. In rural communities, there are various income-generating activities that can be vastly improved in efficiency with a supply of electricity, such as sewing, food processing and several other artisan activities. Electricity access also positively impacts the health of consumers as alternative means of illumination such as kerosene lanterns or candles which are sources of indoor air pollution and are also fire hazards are avoided [18]. Education can also see an improvement as children in these areas are able to study at all times of the day with the provision of electricity.

The United Nations has the Sustainable Development Goal (SDG 7.1) to ensure access to affordable, reliable, sustainable and modern energy for all by 2030. With a large amount of Sub-Saharan Africa's poor living in dispersed rural settlements where the cost of extending the national grid connection is too costly, there is a need for decentralised energy technologies to serve these areas [19]. Renewable energy is often recommended as the ideal technology for these rural communities, with solar PV seen as the most attractive option in Africa. Thus, many countries in the continent have given priority to PV and have launched several PV projects. The United Nations Development Programme (UNDP) and the Energy Commission of Nigeria (ECN) drafted the Renewable Energy Master Plan (REMP) for Nigeria in 2005 [20]. The plan set an installed capacity target of 14,000 MW of renewable energy-based power generation by 2015. However, the International Renewable Energy Agency (IRENA) records that Nigeria's renewable capacity was only 2,153 MW as at 2020 [21], [22]. According to Akuru et al. [21], wind and solar energy projects to alleviate Nigeria's energy gap continue to fail or face delays. Akuru et al. gave the example of over 10 Independent Power Producers (IPPs) having issues with tariff structures after announcing that they would deploy 1.5 MW solar capacity in 2016. This has then led to construction delays and possible failure of these projects.

1.2. Objectives

The objective of this paper is twofold. To assess the:

- (1) appropriateness of electrifying homes and communities in Nigeria with solar energy;
- (2) viability of other renewable energy options in electrifying homes or communities in Nigeria.

1.3. Methods

To achieve the objectives outlined above, I conducted a literature review using secondary data from peer-reviewed publications using the Scopus database. I executed search strings covering the past 20 years, searching for "electrification of homes". I then proceeded to refine the search results with the strings "renewable energy" and then "developing countries". The first search string "electrification of homes" produced 634 results. After refining with the strings "renewable energy" and "developing countries", I received 455 and 233 results, respectively. Afterwards, I sorted the results by the highest cited publications.

I also executed another search on Scopus, searching for "electrification" and refining with "renewable energy" and "africa" which produced 17875, 6873 and 1698 results, respectively. To get papers that focus on specific renewable technologies, I finally refined the results with "solar", "biofuel", "wind" and "hydro." This produced 1349, 126, 770 and 434 journals for "solar", "biofuel", "wind" and "hydro" search strings, respectively.

2. LITERATURE REVIEW

2.1. Solar PV as a renewable energy source in Nigeria

Solar PV has seen some success in Africa for several decades. A survey was carried out in the rural unelectrified community of Nyimba in Zambia [23]. An Energy Service Company had operated 100 Solar Home Systems (SHSs) from the year 2000 in this community. Although having to pay more for energy than before the installation of these 50 Wp solar home systems, clients were generally satisfied with the service provided after almost 3 years of service when the survey was conducted in 2003. The major advantage of the SHSs was the greater quality of light provided by solar lamps when compared to candles or kerosene lamps. This greater quality of light was especially advantageous in the education of their children as they were able to study more conveniently at night. Another benefit of these SHSs was the ability to power TVs and video sets which served as a means of entertainment. The study was able to show how attractive the energy services from these solar systems were. However, more than 40% of those surveyed commented on the low capacity of the systems.

Nigeria receives an abundance of solar radiation every year with an average of about 5.5 kWh/m²/day. In a situation where solar systems with 5% efficiency are used to cover 1% of the country, an equivalent of 2.541 x 10⁶ MWh of electricity can be generated daily [24]. This makes solar PV a very enticing prospect for solving the electricity crisis in the country. Yet, despite receiving such considerable amounts of solar radiation, considerations need to be made concerning the implementation of solar energy in a country whose priority is the long-term development of electricity systems with as low a cost as possible.

The Nigerian government has set clear targets under its National Renewable Energy Action Plan (NREAP) in exploiting its renewable resources potentials. The National Renewable Energy and Energy Efficiency Policy (NREEEP) 2015 aims for renewable energy to account for 16% of Nigeria's electricity consumption by 2030 [25]. The Energy Commission of Nigeria (ECN) estimates that solar PV can account for about 5.9% of this target. Rural solar PV projects began in Nigeria almost four decades ago. From as early as 1985, the Sokoto State Government financed the PV lighting project in Gotomo and Tunga-Buzu villages, which had a power output of 7 kWp [26]. In 1993, the ECN and the Sokoto Energy Research Centre executed the Kwakwalawa PV-powered electrification scheme which provided power to a village of 60 households through a PV power plant [27]. The power output of this system which consisted of 204 solar modules, four 2.5 kW inverters and 28 deep cycle batteries was 7.21 kWp, and it had a total storage capacity of 4270 Ah. This project was created to serve as a model for future rural electrification projects through PV. The Rural Electrification Agency (REA) was launched in 2005 to provide electricity to off-grid communities in Nigeria. As at 2017, the REA had deployed several projects including twelve mini-grid projects ranging between 30 and 100 kW with a total capacity of 1,016 kW. It had also deployed over 19,130 units of Solar Home Systems [28]. Home Solar Systems are also used in urban communities in Nigeria. While they are costly to set up, their minimal maintenance, modularity and the fact that they do not produce noise makes them an alternative to generators.

According to Lahimer et al. [29], despite its technological advantages, PV is not a cost-effective option for electrifying off-grid communities because of its high capital cost. While worldwide costs of solar PV systems have decreased over the years, these systems remain quite expensive for many rural residents in Nigeria. With batteries required to maintain energy supply when there is little or low availability of solar radiation, the cost of a solar PV system only increases. From Baurzhan el's findings in 2016 [30], the initial investment cost of a 100 Wp solar PV system is sufficient to purchase a diesel generator of up to 1.2 kWp capacity. This means that much more power-hungry activities like water pumping, irrigation and several income generating activities become possible. Solar PV often fails to meet the energy requirement of communities beyond lighting and other low power applications. In fact, Baurzhan et al. share that the Deutsche Gesellschaft für Internationale Zusammenarbeit (GTZ) concluded that rural households buy SHSs for improved services such as longer TV viewing and better lighting quality, not because these SHSs actually reduce their energy costs. This ties closely to the point made by Karekezi et al. [19] that "the most successful renewable technologies in rural Africa are likely to be the ones that can generate income and facilitate the start-up of small micro-enterprises". With rural small and micro-enterprises needing about 100 - 1000 times the amount of energy a typical solar system can provide (40 - 100Wp), these systems are not a necessity for many rural dwellers. In the sections that follow below, I discuss alternative options to solar PV.

2.2. Biofuel as a renewable energy source in Nigeria

Bioenergy production and applications have made great strides in more developed continents. As with many other things, Africa has been left lagging behind the rest of the world. With the continent being abundantly blessed with favourable climate, fertile soils and enormous land mass which are vital in driving the technology, it is pertinent for Africa to follow suit in the development of bioenergy. Biofuel is a non-fossil fuel derived biomass. Hoffmann et al. [31] defines it as a "renewable energy source produced from natural (bio-based) materials which can be used as a substitute for petroleum fuels". Biofuels can be produced from several processes; bioethanol can be produced from cellulosic materials, biomethanol can be produced from

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organic wastes, hydrogen can also be generated from organic wastes, and biodiesel can be produced from vegetable oils [32]. According to Adewuyi [33], bioethanol and biodiesel are the most sustainable forms of biofuel in Nigeria and there has been success in preliminary studies done with oil palm and cassava for the production of biofuel. Dahunsi et al. [8] also tells us that *Jatropha curcas* plantations—which is a biodiesel feedstock—exist across all geopolitical zones of the country. Bioethanol and biodiesel are considered as economically feasible and have been commercialised in some countries. For example, Malawi in the 80s began producing bioethanol from sugarcane molasses. This bioethanol then goes into a 1:9 ratio blend with gasoline for the purpose of transportation [8]. The National Renewable Action Plan (NREAP) has a target of biodiesel contributing to 17.45% of the national diesel and fuel-oil consumption by 2030 [25].

Biogas projects have seen success in rural counties in China. The Minhe Biogas project which is the largest chicken waste biogas energy plant in China has a 3 MW biogas generation plant. The plant consumes 300 t of manure and 500 t of waste-water daily to generate electricity for the local grid, with the leftover matter from the process used for fertiliser [34]. Adewuyi argues that the Nigerian waste system, if effectively managed, has the potential of generating sufficient energy to drive the economy and serve as means of employment. Likewise, Dahunsi et al. state that biogas generated from the annual 545 million tons of organic municipal wastes can potentially generate up to 173,458 MWh of electricity. Amuzu-Sefordzi et al. [35] make a similar argument, claiming that biomass-derived hydrogen energy has the potential to displace more than 240% of annual electricity consumption in Nigeria.

2.3. Wind as a renewable energy source in Nigeria

Wind energy is a technology that could be cost-effective and efficient in generating power when utilised. Lahimer et al. [29] claim that a study showed that stand-alone wind systems are preferable to stand-alone PV systems where both resources are abundant. However, it is site-specific as it is only feasible for use in locations with high wind speeds and thus is only cost-competitive in coastal regions of Africa. Seyedhashemi et al. [36] claim that in these regions it is likely even more economically advantageous than diesel systems. Just like with other forms of renewable technologies like solar PV and hydrokinetic technology, low or fluctuating resource availability reduces the ability of this technology to provide energy to power connected loads. Hence, batteries are required to complement this technology. In regions where wind speeds are low, a larger number of batteries will be required. This then significantly increases the cost of generating electricity.

Wind energy in Nigeria is at its infancy or almost nonexistent, with the International Renewable Energy Agency (IRENA) stating that Nigeria had generated 0 GWh of electricity through this technology at the end of 2019 [22]. When compared to other African countries like Egypt, South Africa, Morocco and Tunisia, the potential for wind energy in Nigeria is much lower. At the end of 2009, with installed capacities of 430 MW, 253 MW and 54 MW respectively, Egypt, Morocco and Tunisia led the continent in wind energy. In South Africa where wind speeds range from 4.0 - 5.0 m/s for most of the coastal regions and is approximately 8.0 m/s in some mountain regions, they had over 30,000 water pump systems utilising wind energy as at 2006 [37]. Nigeria however has much lower wind speeds with an annual average of 2.0 - 4.0 m/s at 10 m height [38]. Because of this, Seyedhashemi et al. [36] and Gabra et al. [39] conclude that in more central African countries like Nigeria, wind speeds are just too low for wind to be a suitable means of generating electricity.

Despite the challenges, such as low wind speeds in Nigeria, the Energy Commission of Nigeria (ECN) has made clear its intentions of developing the wind energy capacity and integrating it into the electricity supply mix of the country with the following policies and objectives stated in the National Energy Masterplan 2022 [38].

Policy focus and directions. The nation shall:

1. commercially develop its wind energy resource and integrate this with other energy resources into a balanced energy mix.
2. take necessary measures to ensure that this form of energy is harnessed at sustainable costs to both suppliers and consumers in the rural areas.
3. apply global best practices in the exploitation of wind energy resources.
4. encourage the utilisation of wind energy for agricultural purposes.

The corresponding objectives are to:

1. develop wind energy as an alternative energy resource.
2. develop local capability in wind energy technology.
3. use wind energy for provision of power to rural areas and remote communities far removed from the national grid.
4. apply wind energy technology in areas where it is technically and economically feasible.
5. encourage the utilisation of wind energy for agricultural purposes.

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2.4. Small-scale hydropower as a renewable energy source in Nigeria

Small-scale hydropower (SHP) is another technology that can be considered in rural electrification whenever a suitable site is available. **Table 1** shows the classification of hydropower in Nigeria. It is similar to wind technology in rotor blade configurations and that their power outputs depend on flow speed. Lahimer et al. [29] claims that it can potentially be the most cost-effective means of rural electrification ahead of wind, PV and diesel generators.

Table 1. Classification of hydropower in Nigeria

Hydropower category	Power range
Micro	0 - 500 kW
Mini	500 - 1000 kW
Small	1 - 30 MW
Large	> 30 MW

Source: [40]

Ebhota et al. [5] share that there are over 278 rivers around Nigeria identified as potential sites for micro and mini hydropower systems with a total capacity of 734 MW. A number of off-grid SHP projects by the Nigerian Electricity Supply Company (NESCO) exist in Plateau State with capacity ranges of between 3 and 40 MW [41]. Hydroelectricity is still underexploited in Nigeria despite its large potential. Small hydropower was first used in Nigeria in 1925, yet as of 2018, only a fraction of the estimated 3500 MW of exploitable small hydropower potential in the country has been tapped [37], [38], [41]. There is an urgent need to develop these surveyed potential SHP sites. As of 2012, the small hydropower schemes that existed in Nigeria are listed in **Table 2**.

Table 2. Existing small hydropower schemes in Nigeria

S/N	River	State	Installed capacity (MW)
1	Bagel I and II	Plateau	1.0 and 2.0
2	Bakalori	Zamfara	3.0
3	Kurra	Plateau	8.0
4	Lere I and II	Plateau	4.0 and 4.0
5	Oyan	Ogun	9.0

Source:

[41]

Its advantages include low installation and maintenance costs and options for local manufacturing. This can be implemented in the form of hydrokinetic systems, which refers to hydroelectric systems which harness energy from flowing water. Meaning energy can be captured from waves, tides or rivers. Koko et al. [42] points out that “in rural areas with high water density, a small-scale hydrokinetic river system can generate electricity markedly cheaper than a small-scale wind system”. It was shown in their paper that hydrokinetic power was cheaper than a wind system in a rural area of South Africa. Kusakana [43] concluded in their paper that using hydrokinetic-based hybrid systems reduces the cost and increases the reliability of both single energy systems like solar PV, wind and diesel generators, as well as hybrid systems combining the other technologies.

3. FINDINGS AND DISCUSSIONS

Cost is the main limiting factor in supplying power to rural communities. Ideally, grid connected power is the best means of electrifying these low-income communities. However, because rural communities are dispersed, have low population densities and have harsh terrain between them and mainland areas, it is just not profitable for distribution companies to build infrastructure to electrify these communities.

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Diesel generators are the most cost effective solution for electrifying rural communities in Nigeria and certainly have a lower cost per unit of electricity than solar PV [30], [39]. Its relatively simple technology, easy installation and sufficient knowledge on maintenance makes it an attractive solution. It is however not the perfect solution for generating electricity as the fluctuating price of diesel fuel and the need for frequent maintenance serve as drawbacks to the use of this technology. Also, due to environmental degradation from the use of fossil fuels, the world is searching for alternative means of generating electricity, and this can be through renewable energy. Renewable energy is energy from naturally replenishing sources that do not get exhausted after use. This includes wind energy, solar PV, hydropower, etc.

Table 3. Estimate of Nigeria’s renewable resources reserves

Renewable resource	Estimated Potential Capacity/Reserves	Region with greatest potential for these resources
Large hydropower	24,000 MW	Southern and Plateau areas of the country
Small hydropower (<30 MW)	3,500 MW	Southern and Plateau areas of the country
Fuelwood	13 million hectares	Savanna region of the country
Animal Waste	61 million tonnes/yr	
Crop residue	83 million tonnes/yr	Savanna region of the country
Solar radiation	3.5 - 7.0 KWh/m ² /day	Northern part of the country
Wind	2.0 - 4.0 m/s (annual average) at 10 m height	Jos and northwest geopolitical zone

Source: [38], [44]

Nigeria had a 38% target for the renewable energy share of the electricity mix in its grid connected generation for 2020 [22], [25]. Of the total 33,552 GWh generation in 2019, only 8,492 GWh was from renewables, with hydro and marine contributing 8,430 GWh of that. Solar and bioenergy contributed a mere 41 and 21 GWh, respectively. No other sources of renewable energy contributed to the power generation in 2019. This means that the renewable energy share of the electricity mix at the end of 2019 was only 25.3 %.

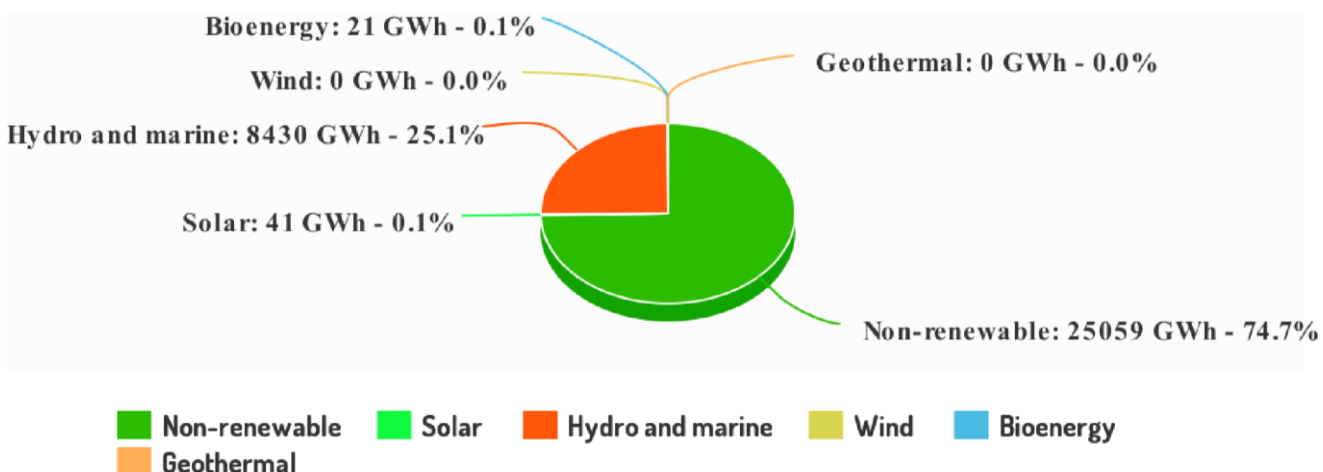


Figure 2. Nigeria’s electricity generation in 2019.

Source: [22]

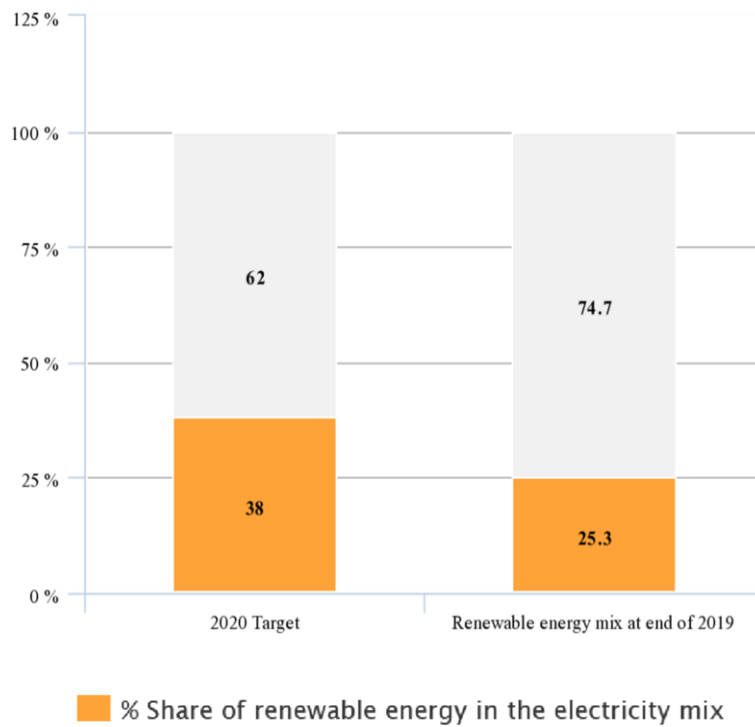


Figure 3. Nigeria’s target for the renewable energy share of electricity mix in grid connected generation (including medium and large hydropower).

Source: [6], [22], [25].

The Energy Commission of Nigeria (ECN) has made clear its intentions of developing the renewable energy capacity of the country and integrating it into the electricity supply mix of the country. The National Renewable Energy and Energy Efficiency Policy (NREEEP) 2015 aims for renewable energy to account for 16% of Nigeria’s electricity consumption by 2030 [25]. The ECN estimates that solar PV can account for about 5.9% of this target while hydropower, biomass and wind can account for about 7.07%, 2.78% and 0.25% respectively. They aim for renewable energy to account for 29% of grid connected generation and 40% of off-grid electricity generation by 2030. These targets as well as the barriers, policies and regulations for achieving them are stated in the National Renewable Energy Action Plan (NREAP) under the National Energy Master Plan 2022 [38]. The latest version of this document was approved by the National Council on Power (NACOP) on the 14th of July, 2016. To achieve the country’s target of renewable energy accounting for 16% of its electricity consumption by 2030, several policies and measures to promote the use of RE resources have been put in place. **Table 4** below outlines some of these measures and their expected results.

Table 4. Overview of policy instruments for RE in Nigeria

Name of the measure	Grid or off-grid connected RE	Type of measure	Expected results	Target group	Start and end dates of the measure
Feed-in Tariffs (FIT)	Grid connected	Regulatory	Increase generation of renewable electricity from 1MW to 5MW for PV and biomass, and from 1MW to 10MW for wind, small and medium hydropower plants	Primarily medium scale renewable electricity generation by Independent Power Producers (IPPs)	Start in 2016 with no end date defined.

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Competitive Procurement Programme	Grid connected	Regulatory	Increase generation of renewable electricity from 5MW and above for PV and from 10MW and above for wind, small and medium hydro power	Primarily medium scale renewable electricity generation by energy companies	Start in 2016 with no end date defined.
GIZ-Nigerian Energy Support Programme: Capacity Building Component	Grid connected	Capacity Building	Develop professional and technical courses on renewable energy and energy efficiency	Working with National Power Training Institute of Nigeria and aimed at both public and private institutions of power sector	March 2013 March 2018
National Policy on Public Private Partnership (PPP)	Grid connected	Policy	Guidelines, policies, and procurement process for PPP	Collaborate with the States of the Federation to promote an orderly and harmonised framework for the development	2012 to date
				and market for PPPs	
National Renewable Energy and Energy Efficiency Policy (NREEEP)	Grid connected	Policy	Promote renewable energy and energy efficiency	Public and private sector	2015 to date
Soft loan	Off-grid	Financial	Assist with soft loans with low interest rates through the Bank of Industry	Small scale renewable energy generation companies	

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Renewable Energy Subsidy and Grant	Off-grid	Financial	Provision of subsidy of up to 30% of initial costs of renewable energy utilisation facilities	Communities, enterprises, and individuals that embark on RE generation projects	
Rural Electrification Strategy and Implementation Plan	Off-grid	Strategy/Plan	Promote electricity in rural areas	Public and private sector	
National Biofuel Policy		Policy	To integrate the agriculture sector to the downstream section	Petroleum Industry	2007 to date

Source: [25]

There are potentials for the implementation of the renewable technologies explored in this paper in Nigeria. There are also challenges that exist with every form of these renewable technologies. Solar energy is very promising in Nigeria. The amount of sunlight received in Nigeria and much of Africa makes this technology extremely attractive and useful in solving its energy crisis. Hence, the Federal Government has put in place schemes, policies and targets to develop its potential in Nigeria. The Nigeria Electrification Project (NEP) is one of these initiatives that have been set in place under the Rural Electrification Agency to solve this crisis. This private sector driven initiative aims to supply electricity to rural communities through the deployment of mini grids and Solar Home Systems. As at the time of writing, this initiative claims to have supplied electricity to 3.8 million people in 680 thousand households [45]. Yet, despite the falling price of PV systems, many researchers believe solar PV not to be the ideal solution to electrifying Nigeria and Africa due to the fact that it cannot compete economically with existing grids or diesel generators [19], [29], [30], [46]. Furthermore, it also has little use beyond powering lighting and low power devices since PV systems for powering more powerful equipment are often too costly.

Bioenergy in the form of bioethanol, biodiesel and biogas is a very promising form of renewable energy in Nigeria. However, the availability of land for growing feedstock and food security are serious considerations that come with the use of this technology. For example, a study was conducted in the village of Laela in Western Tanzania through surveys, focus group discussions and expert interviews [31]. The analysis aimed to evaluate the impact the use of sunflower and groundnut oils for local biofuel production had on development and food supply in the village. It was concluded that replacing food crops with biofuel producing crops is likely to increase hunger and existing economic gaps in the village. Extensive research is thus needed in potential rural sites for this technology to establish its viability in that community or village. For the urban communities in Nigeria, challenges to this technology exist in developing an effective waste management system that is able to convert municipal waste to biogas. Other challenges like high production cost, non-favourable government policies and technical knowledge can also harm the potential of this technology in Nigeria.

In the case of wind energy, due to the need for high wind speeds for wind systems to be competitive in cost with the grid and solar PV, this technology is not suitable for generating electricity in many parts of Nigeria.

While there are existing SHP schemes in Nigeria, this technology needs to be developed beyond its existing state as there is an abundance of flowing water bodies in the country. This technology can be used alongside other renewable energy technologies in hybrid systems to lower energy costs and increase the reliability of energy supply. Flow rate fluctuation is a key challenge faced by hydropower systems due to changing weather and climatic conditions in Nigeria. In dry season and monsoons, there could be little to no power provided by SHP systems. As a result of flow rises and falls, a stand-alone hydropower system can fail to meet its demand during these periods [29].

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Various renewable technologies can be best implemented in various parts of the country and can serve varying purposes to different communities or villages across the country. Different communities might value the benefits and can better manage the challenges provided by certain technologies above that provided by others. Thus, case-based research needs to be made in evaluating the renewable technologies to be implemented in electrifying communities in Nigeria. I agree with the statement by Karekezi et al. [19] that “a renewable energy strategy that relies on a wider range of renewable technologies can ensure that the poor select the technology that best fits their comparative advantage as well as their incomes”.

4. CONCLUSION

Improving electricity access in Nigeria is of immense importance and is a major challenge. With about 45% of the country's population living off-grid and electricity supply being terribly unreliable to the grid connected population, the challenge of electricity access is one faced by the entire nation. Since reliable and cheap energy is a key driver of economic growth and improves the livelihood of citizens, Nigeria has worked on improving its electricity access, especially to its rural areas. The United Nations Development Programme (UNDP) and the Energy Commission of Nigeria (ECN) drafted the Renewable Energy Master Plan (REMP) for Nigeria in 2005 to coordinate the development and implementation of renewable energy in its energy sector. This development has caused organisations including the National Electricity Supply Company (NESCO) and the Rural Electrification Agency (REA) to develop schemes that have made some progress in generating electricity through renewable technologies [5], [41]. Nigeria has huge renewable energy potentials that have unfortunately been underutilised. Of the various forms of renewable energy sources available in Nigeria, solar PV has had the most capacity growth over the years. It also has the largest electricity generation target above small hydro, wind energy and biomass [22], [38]. However, because of the high cost of this technology and its typically low power application, other renewable technologies need to be considered in solving the nation's electricity crisis.

Bioenergy shows a lot of potential in Nigeria. Bioethanol, biodiesel and biogas are possible biofuels that can be successfully produced in the country. The presence of abundant land mass and favourable climate means that feedstock to produce bioethanol and biodiesel can be grown. Likewise, municipal wastes can be used to generate biogas.

The effectiveness and economic advantage of small hydro energy is highly subjective to the particular area or community considered. Even in areas where there is an abundance of flowing water, the technology's strong reliance on weather and climatic conditions and its resource dependent power output is something to consider [43]. The case of wind technology is similar to small hydro in that it is highly dependent on weather conditions, however the potential for wind is even much less than small hydro in most parts of Nigeria.

Hybridization of some of these renewable technologies can create a scenario where one or more technologies serve to compensate for the disadvantages of the other(s) and fill in the gap for energy shortages from one or more sources. This is a solution that the renewable energy developers in Nigeria should put into consideration as they seek to develop these technologies and solve the electricity crisis in the country.

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REFERENCES

- 1) 'World Energy Outlook 2021 – Analysis', *IEA*.
<https://www.iea.org/reports/world-energy-outlook-2021> (accessed Aug. 30, 2022).
- 2) 'Access to electricity (% of population) - Sub-Saharan Africa | Data'.
<https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=ZG> (accessed Aug. 30, 2022).
- 3) A. I. Akinyemi and U. C. Isiugo-Abanihe, 'Demographic dynamics and development in Nigeria', *Afr. Popul. Stud.*, vol. 27, no. 2, p. 239, Mar. 2014, doi: 10.11564/27-2-471.
- 4) T. R. Ayodele, A. S. O. Ogunjuyigbe, O. D. Ajayi, A. A. Yusuff, and T. C. Moseitlhe, 'Willingness to pay for green electricity derived from renewable energy sources in Nigeria', *Renew. Sustain. Energy Rev.*, vol. 148, p. 111279, Sep. 2021, doi: 10.1016/j.rser.2021.111279.

Electrification through Renewable Energy in Nigeria an Exploration of Viable Technology Options Beyond Solar PV

- 5) W. S. Ebhota and P. Y. Tabakov, 'The place of small hydropower electrification scheme in socioeconomic stimulation of Nigeria', *Int. J. Low-Carbon Technol.*, vol. 13, no. 4, pp. 311–319, Dec. 2018, doi: 10.1093/ijlct/cty038.
- 6) B. Lohani *et al.*, 'REN21. 2015. Renewables 2015 Global Status Report (Paris: REN21Secretariat).'
- 7) S. Rahman and A. de Castro, 'Environmental impacts of electricity generation: a global perspective', *IEEE Trans. Energy Convers.*, vol. 10, no. 2, pp. 307–314, Jun. 1995, doi:10.1109/60.391897.
- 8) S. O. Dahunsi, O. O. Fagbiele, and E. O. Yusuf, 'Bioenergy technologies adoption in Africa: A review of past and current status', *J. Clean. Prod.*, vol. 264, p. 121683, Aug. 2020, doi:10.1016/j.jclepro.2020.121683.
- 9) A. Babajide and M. C. Brito, 'Solar PV systems to eliminate or reduce the use of diesel generators at no additional cost: A case study of Lagos, Nigeria', *Renew. Energy*, vol. 172, pp. 209–218, Jul. 2021, doi: 10.1016/j.renene.2021.02.088.
- 10) T. Kemabonta and M. Kabalan, 'Using What You Have, to Get What You Want – A Different Approach to Electricity Market Design for Local Distribution Companies (DISCOs) in Nigeria', in *2018 IEEE Global Humanitarian Technology Conference (GHTC)*, Oct. 2018, pp. 1–2. doi:10.1109/GHTC.2018.8601910.
- 11) A. Azodo and S. B. Adejuyigbe, 'Examination of Noise Pollution from Generators on the Residents of Obantoko, Ogun State, Nigeria', *ASIAN J. Eng. Sci. Technol.*, vol. 3, pp. 31–41, Mar. 2013.
- 12) O. Oguntoke and A. Adeyemi, 'Degradation of urban environment and human health by emissions from fossil-fuel combusting electricity generators in Abeokuta metropolis, Nigeria', *Indoor Built Environ.*, vol. 26, no. 4, pp. 538–550, Apr. 2017, doi: 10.1177/1420326X16629818.
- 13) N. Singh and S. C. Davar, 'Noise Pollution-Sources, Effects and Control', *J. Hum. Ecol.*, vol. 16, no. 3, pp. 181–187, Nov. 2004, doi: 10.1080/09709274.2004.11905735.
- 14) M. S. Hammer, T. K. Swinburn, and R. L. Neitzel, 'Environmental Noise Pollution in the United States: Developing an Effective Public Health Response', *Environ. Health Perspect.*, vol. 122, no. 2, pp. 115–119, Feb. 2014, doi: 10.1289/ehp.1307272.
- 15) O. Oguntoke, B. O. Opeolu, and N. Babatunde, 'Indoor Air Pollution and Health Risks among Rural Dwellers in Odeda Area, South-Western Nigeria', *Ethiop. J. Environ. Stud. Manag.*, vol. 3, no. 2, Sep. 2010, doi: 10.4314/ejesm.v3i2.59833.
- 16) M. C. Ezeh, U. C. Nwogwugwu, and O. N. Ezindu, 'Impact of Household Electricity Consumption on Standard of Living in Nigeria', *J. Energy Technol. Policy*, Feb. 2020, doi:10.7176/JETP/10-1-05.
- 17) International Energy Agency, International Renewable Energy Agency, United Nations, World Bank Group, and World Health Organization, *Tracking SDG7: The Energy Progress Report 2018*. World Bank, Washington, DC, 2018. doi: 10.1596/29812.
- 18) I. A. Olanrele, A. I. Lawal, S. O. Dahunsi, A. A. Babajide, and J. O. Iseolorunkanmi, 'The impact of access to electricity on education and health sectors in Nigeria's rural communities', *Entrep. Sustain. Issues*, vol. 7, no. 4, pp. 3016–3035, Jun. 2020, doi: 10.9770/jesi.2020.7.4(30).
- 19) S. Karekezi and W. Kithyoma, 'Renewable energy strategies for rural Africa: is a PV-led renewable energy strategy the right approach for providing modern energy to the rural poor of sub-Saharan Africa?', *Energy Policy*, vol. 30, no. 11–12, pp. 1071–1086, Sep. 2002, doi:10.1016/S0301-4215(02)00059-9.
- 20) U. B. Akuru and O. I. Okoro, 'Renewable energy investment in Nigeria: A review of the renewable energy master plan', in *2010 IEEE International Energy Conference*, Dec. 2010, pp. 166–171. doi:10.1109/ENERGYCON.2010.5771668.
- 21) T. Kemabonta, A. Geoffrey, O. Apena, and S. Uzzle, 'What Went Wrong And How Can We Fix It: Renewable Energy and Mini-Grid Policies in Nigeria', in *2019 IEEE PES/IAS PowerAfrica*, Aug. 2019, pp. 76–80. doi: 10.1109/PowerAfrica.2019.8928648.
- 22) International Renewable Energy Agency, 'IRENA/Statistical_Profiles/Africa/Nigeria_Africa_RE_SP', Sep. 2021. [Online]. Available: https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Nigeria_Africa_RE_SP.pdf [23]
- 23) M. Gustavsson and A. Ellegård, 'The impact of solar home systems on rural livelihoods. Experiences from the Nyimba Energy Service Company in Zambia', *Renew. Energy*, vol. 29, no. 7, pp. 1059–1072, Jun. 2004, doi: 10.1016/j.renene.2003.11.011.
- 24) J. O. Ojosu, 'The iso-radiation map for Nigeria', *Sol. Wind Technol.*, vol. 7, no. 5, pp. 563–575, Jan. 1990, doi: 10.1016/0741-983X(90)90065-A.
- 25) 'Nigeria National Renewable Energy Action Plan (NREAP).pdf', INTER-MINISTERIAL COMMITTEE ON RENEWABLE ENERGY AND ENERGY EFFICIENCY (ICREEE). [Online]. Available: https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/Country_PANER/Nigeria_National_Renewable_Energy_Action_Plans_.pdf

Electrification through Renewable Energy in Nigeria an Exploration of Viable Technology Options Beyond Solar PV

- 26) O. U. Oparaku, 'Photovoltaic systems for distributed power supply in Nigeria', *Renew. Energy*, vol.25, no. 1, pp. 31–40, Jan. 2002, doi: 10.1016/S0960-1481(00)00203-2.
- 27) H. N. Yahya and A. S. Sambo, 'Solar photovoltaic-powered village electrification at Kwankwalawa in Sokoto State', *Renew. Energy*, vol. 6, no. 3, pp. 307–309, Apr. 1995, doi:10.1016/0960-1481(95)00028-1.
- 28) RURAL ELECTRIFICATION AGENCY, 'REF Call 1', *Rural Electrification Agency*, Apr. 12, 2021. <https://rea.gov.ng/ref-call-1/> (accessed Jul. 12, 2022).
- 29) A. A. Lahimer, M. A. Alghoul, F. Yousif, T. M. Razykov, N. Amin, and K. Sopian, 'Research and development aspects on decentralized electrification options for rural household', *Renew. Sustain. Energy Rev.*, vol. 24, pp. 314–324, Aug. 2013, doi: 10.1016/j.rser.2013.03.057.
- 30) S. Baurzhan and G. P. Jenkins, 'Off-grid solar PV: Is it an affordable or appropriate solution for rural electrification in Sub-Saharan African countries?', *Renew. Sustain. Energy Rev.*, vol. 60, pp. 1405–1418, Jul. 2016, doi: 10.1016/j.rser.2016.03.016.
- 31) H. Hoffmann, G. Uckert, C. Reif, F. Graef, and S. Sieber, 'Local biofuel production for rural electrification potentially promotes development but threatens food security in Laela, Western Tanzania', *Reg. Environ. Change*, vol. 15, no. 7, pp. 1181–1190, Oct. 2015, doi:10.1007/s10113-014-0596-x.
- 32) A. H. Demirbas and I. Demirbas, 'Importance of rural bioenergy for developing countries', *Energy Convers. Manag.*, vol. 48, no. 8, pp. 2386–2398, Aug. 2007, doi: 10.1016/j.enconman.2007.03.005.
- 33) A. Adewuyi, 'Challenges and prospects of renewable energy in Nigeria: A case of bioethanol and biodiesel production', *Energy Rep.*, vol. 6, pp. 77–88, Feb. 2020, doi: 10.1016/j.egyr.2019.12.002.
- 34) Z. Bie and Y. Lin, 'An Overview of Rural Electrification in China: History, technology, and emerging trends.', *IEEE Electrification Mag.*, vol. 3, no. 1, pp. 36–47, Mar. 2015, doi:10.1109/MELE.2014.2381606.
- 35) B. Amuzu-Sefordzi, J. Huang, D. M. A. Sowa, and T. D. Baddoo, 'Biomass-derived hydrogen energy potential in Africa', *Environ. Prog. Sustain. Energy*, vol. 35, no. 1, pp. 289–297, Jan. 2016, doi: 10.1002/ep.12212.
- 36) H. Seyedhashemi, B. Hingray, C. Lavaysse, and T. Chamarande, 'The Impact of Low-Resource Periods on the Reliability of Wind Power Systems for Rural Electrification in Africa', *Energies*, vol. 14, no. 11, p. 2978, May 2021, doi: 10.3390/en14112978.
- 37) M. Shaaban and J. O. Petinrin, 'Renewable energy potentials in Nigeria: Meeting rural energy needs', *Renew. Sustain. Energy Rev.*, vol. 29, pp. 72–84, Jan. 2014, doi: 10.1016/j.rser.2013.08.078.
- 38) 'National Energy Masterplan (NEMP)', Energy Commission Of Nigeria. Accessed: Aug. 12, 2022. [Online]. Available: https://www.energy.gov.ng/Energy_Policies_Plan/APPROVED_NEMP_2022.pdf
- 39) S. Gabra, J. Miles, and S. A. Scott, 'Techno-economic analysis of stand-alone wind micro-grids, compared with PV and diesel in Africa', *Renew. Energy*, vol. 143, pp. 1928–1938, Dec. 2019, doi: 10.1016/j.renene.2019.05.119.
- 40) 'DRAFT NATIONAL RENEWABLE ENERGY AND ENERGY EFFICIENCY POLICY(NREEEP)', Energy Commission Of Nigeria. Accessed: Aug. 12, 2022. [Online]. Available: https://www.energy.gov.ng/Energy_Policies_Plan/natonal_renewable_energy_and_energy_efficiency_policy.pdf
- 41) A. Omojola and O. Oladeji, 'Small Hydro Power for Rural Electrification in Nigeria', *Am. J. Sci. Eng.*, vol. 1, pp. 29–34, Jan. 2012.
- 42) S. P. Koko, K. Kusakana, and H. J. Vermaak, 'Micro-hydrokinetic river system modelling and analysis as compared to wind system for remote rural electrification', *Electr. Power Syst. Res.*, vol. 126, pp. 38–44, Sep. 2015, doi: 10.1016/j.epsr.2015.04.018.
- 43) K. Kusakana, 'Techno-economic analysis of off-grid hydrokinetic-based hybrid energy systems for onshore/remote area in South Africa', *Energy*, vol. 68, pp. 947–957, Apr. 2014, doi:10.1016/j.energy.2014.01.100.
- 44) A. T. Brimmo, A. Sodiq, S. Sofela, and I. Kolo, 'Sustainable energy development in Nigeria: Wind, hydropower, geothermal and nuclear (Vol. 1)', *Renew. Sustain. Energy Rev.*, vol. 74, pp. 474–490, Jul. 2017, doi: 10.1016/j.rser.2016.11.162.
- 45) 'About NEP – Nigeria Electrification Project'. <https://nep.rea.gov.ng/about-nep/> (accessed Aug. 18, 2022).
- 46) N. Wamukonya, 'Solar home system electrification as a viable technology option for Africa's development', *Energy Policy*, vol. 35, no. 1, pp. 6–14, Jan. 2007, doi: 10.1016/j.enpol.2005.08.019.



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Effect of FatSecret App Implementation on Increased Physical Activity and Weight Loss



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ABSTRACT: This study aims to (1) determine the effect of applying the FatSecret application on increasing physical activity (2) determine the effect of applying the FatSecret application on weight loss.

This research method is an experimental method (quazi experiment) using a one group pre-test and post-test design, ie: experiments carried out on one group only without a comparison group that is given treatment. The sample in this study amounted to 24 people selected using purposive sampling. The sampling criteria in this study are (1) aged 18-65 years, (2) able-bodied, (3) BMI 25-49.9m kg/m² (4) interested in losing weight, (5) have access to smart phones. Data collection instruments used the GPAQ questionnaire, digital scales, measuring tape and FatSecret application. The normality test used the Kolmogorov-sminorf test. Data analysis techniques using SPSS.25 to determine the effect of FatSecret application on increasing physical activity and weight loss using t-test.

The results showed that (1) from the t test analysis, the t value was obtained (-12.231) > t table (2.068), with these results it was concluded that there was an effect of applying the FatSecret application on weight loss. (2) the results of the t test analysis on physical activity obtained the value of t count (2.643) > t table (2.068), from these results it can be concluded that there is an effect of applying the FatSecret application on increasing physical activity.

KEYWORDS: Physical Activity, FatSecret App, Weight Loss

I. INTRODUCTION

A common cause of death is non-communicable diseases related to daily activities. According to the World Health Organization, 74% of global deaths per year (41 million) are caused by non-communicable diseases (WHO, 2020: 1). The development of non-communicable diseases causes long-term pain and suffering for patients and their families (Kuper, 2019). Genetic factors also influence non-communicable diseases although in smaller amounts.

To improve public health, healthy living behaviors are needed. This healthy behavior needs to be improved through education about health maintenance and the welfare of individuals and communities. The influence of healthy living behavior is decisive in addition to genetics, social circumstances, health care and social factors (Currie *et al.*, 2012).

Physical activity is a form of body movement produced by skeletal muscles that results in considerable energy expenditure and is divided into light, medium and heavy groups. Each activity requires a different amount of energy depending on the length of intensity and muscle work (FKM-UI, 2007). According to WHO estimates, body weight and physical activity are closely related to various chronic diseases and are generally the cause of death globally (WHO, 2010: 1). WHO recommends moderate or high intensity physical activity of at least 60 minutes per day in children, and adolescents or at least 150 minutes per week in adults.

Strong scientific evidence suggests that physical activity is beneficial in preventing chronic diseases. Regular physical activity or physical exercise is not only the key to achieving optimal health but is considered a medicine that cannot be replaced by any pill or supplement. Diet is one of the fundamental pillars for optimal health and well-being and can also serve as medicine for good health if it is well planned and balanced.

An unbalanced and uncontrolled diet will lead to obesity. Obesity affects millions of adults worldwide and the number is increasing (Safaei *et al.*, 2021). According to WHO (2018) that overweight and obesity as a health problem and a threat to well-being.

Based on the results of basic health research or Riskesdas (Kemenkes RI, 2018), the obesity rate in adults in Indonesia increased to 21.8%. This prevalence increased from the 2013 Riskesdas results which showed that obesity in Indonesia only reached 14.8%. Obesity itself refers to a condition where the body mass index is above 27. Similarly, the prevalence of overweight, with a body

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mass index between 25 and 27, increased from 11.5% in 2013 to 13.6% in 2018. The condition of increasing obesity rates in Indonesia can be suppressed by public awareness in carrying out the healthy living movement through exercise as an important necessity. This sport serves to maintain the health and physical fitness of the body and improve physical appearance to look attractive and more confident.

Research shows that obesity is an inherited disease that is highly dependent on lifestyle patterns, including lack of regular physical activity and overeating (Safaei *et al.*, 2021). Weight loss programs require full commitment and effort from the individual concerned. The rapid development of information technology also affects efforts to improve weight loss programs with smartphone-based applications. Counseling and weight loss programs are successfully carried out through digital health technology with smartphone applications (Turner-McGrievy *et al.*, 2019).

Based on research, mobile apps help users to adhere to self-monitoring and weight loss goals better than traditional pen and paper methods and other mobile health interventions (web-based or PDA) (Carter *et al.*, 2013). According to (Mateo *et al.*, 2015), conducted the first meta-analysis focusing on mobile apps and found a weight loss of -1.04kg (95% CI -1.75 to -0.34kg = 41%) among mobile app users. Most interventions were conducted through smartphone apps in combination with other non-mobile behavioral interventions, but it is unclear whether the effect of apps on weight loss was solely due to their use or the addition of a behavioral component.

One of the apps for weight loss is FatSecret which is a calorie counter app. The app provides information on the calories contained in the food the user consumes. This smart phone app also encourages self-monitoring by prompting the user to enter daily physical activity execution, calorie expenditure based on activity, and calories that need to be expended to achieve ideal weight loss. Weight loss can be enhanced by an increase in daily physical activity.

Yogyakarta State University education personnel based on sources from <http://pdpt.uny.ac.id/dttendik>, a total of 896 people spread across various units. From the author's observation, there are 10% of the education personnel of Yogyakarta State University who are overweight. Based on the author's observations, some of the education personnel of Yogyakarta State University have work patterns that are mostly carried out in a sitting position, so that the intensity of physical activity is less. Therefore, the author wants to know the effect of applying the FatSecret application on increasing physical activity and weight loss.

II. MATERIAL AND METHOD

The method used in this research is an experimental method (quasi experiment) using a research design of one group pre-test and post-test design, namely, experiments carried out in one group only without a comparison group that is given treatment. Pretest and posttest design is a technique to determine the impact before and after treatment. This study did not use a comparison class but had used an initial test, so that the magnitude of the effect or influence of the treatment could be known with certainty. The pretest data collection began on Monday and Tuesday, October 23-24, 2023, in the Yogyakarta State University environment. The study was conducted for 5 weeks with treatment carried out 16 times doing physical activity with a frequency of physical activity three times a week with an ideal duration of 30-60 minutes and recording daily calories on the FatSecret application. The post-test was conducted on November 27 and 28, 2023 by filling out the GPAQ questionnaire and measuring weight loss. The independent variable in this study is the application of FatSecret application, while the increase in physical activity and weight loss as the dependent variable. Data obtained from the initial test (pretest) and the final test (posttest) will be analyzed descriptively using the t test using the SPSS 25 computer program with a significance level of 5%. This t test aims to determine whether there is an effect of applying the FatSecret application on increasing physical activity and weight loss.

III. RESULT

The classification of Yogyakarta State University Education Personnel respondents based on age is presented in **Table 1** below.

Table 1. Classification of Respondents by Age

Age	Quantity	Percentage (%)
21 – 30	1	4,17
31 – 40	7	29,17
41 – 50	11	45,83
51 – 60	5	20,83
Total	24	100,0

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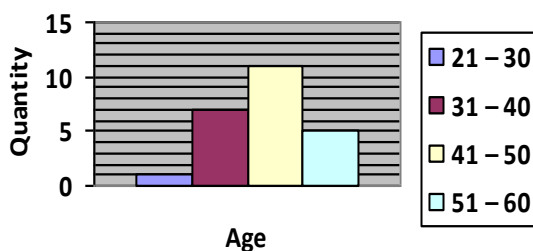


Figure 1. Classification of Respondents by Age

The classification of respondents of Yogyakarta State University Education Personnel based on gender can be seen in **Table 2** below.

Table 2. Classification of Respondents by Gender

Gender	Quantity	Percentage (%)
Female	12	50,0
Male	12	50,0
Total	24	100,0

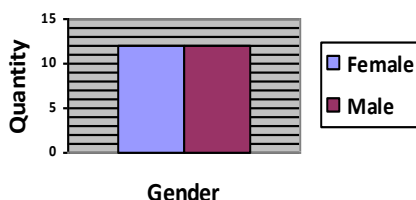


Figure 2. Classification of Respondents by Gender

The classification of respondents based on the occupation of Education Personnel of Universitas Negeri Yogyakarta is presented in **Table 3** below.

Table 3. Classification of Respondents by Occupation

Occupation	Quantity	Percentage (%)
Administration	10	41,7
Laboratory	3	12,5
Students	1	4,2
Librarian	8	33,3
Technician	2	8,3
Total	24	100,0

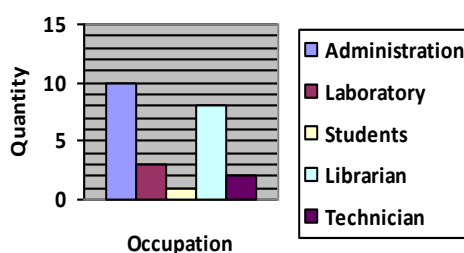


Figure 3. Classification of Respondents by Occupation

The classification of respondents based on the Education Work Unit of Universitas Negeri Yogyakarta is presented in **Table 4** below.

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Table 4. Classification of Respondents by Work Unit

Work Unit	Quantity	Percentage (%)
Direktorat Akademik, Kemahasiswaan dan Alumni (DAKA)	10	41,66
Direktorat Riset dan Pengabdian kepada Masyarakat (DRPM)	1	4,17
Fakultas Ilmu Sosial, Hukum, dan Politik (FISHIPOL)	1	4,17
Fakultas Matematika dan Ilmu Pengetahuan Alam (FMIPA)	11	45,83
Sekolah Pascasarjana (SPs)	1	4,17
Total	24	100,0

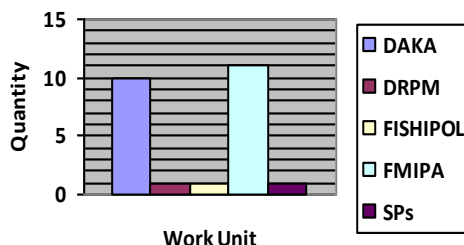


Figure 4. Classification of Respondents by Work Unit

The normality test in this study was used to determine whether a distribution was normal or not. The criteria used to determine whether a distribution is normal or not is if $p > 0.05$ (5%) the distribution is declared normal, and if $p < 0.05$ (5%) the distribution is said to be abnormal. The results of the normality test can be seen in **Table 5** below.

Table 5. Normality Test Results

Variable	Z	P	Sig 5 %	Description
Body Weight	1,881	0,069	0,05	Normal
Physical Activity (MET)	1,332	0,057	0,05	Normal

Based on the data in **Table 5**, it is known that the Yogyakarta State University Education Personnel obtained $p > 0.05$. The results can be concluded that the research data is normally distributed.

The homogeneity test is useful for testing the similarity of the sample, namely whether the sample variants taken from the population are uniform. Homogeneity criteria if $F \text{ count} < F \text{ Table}$ test is declared homogeneous if $F \text{ count} > F \text{ Table}$ test is said to be inhomogeneous. The results of the homogeneity test of this study can be seen in **Table 6** below.

Table 6. Homogeneity Test Results

Test	df	F Table	F hit	P	Description
Body Weight	1:46	4,05	3,390	0,072	Homogen
Physical Activity (MET)	1:46	4,05	0,170	0,682	Homogen

Based on the data in **Table 6**, the value of $F \text{ count} < F \text{ Table}$ (4.05) is obtained, with the results obtained it can be concluded that the variance is homogeneous.

The t test was conducted to determine the effect of applying the FatSecret application on increasing physical activity and weight loss. The results of the first hypothesis test can be seen in **Table 7** below.

Table 7. Results of the t-test

Pretest – posttest	df	t Table	t count	P	Sig 5 %
Body Weight	23	2,068	-12,231	0,005	0,05
Physical Activity	23	2,068	2,643	0,015	0,05

Based on the results of the t test analysis in **Table 7**, the weight loss data obtained t value (-12.231) $>$ t Table (2.068) and p value (0.005) $<$ from 0.05. The calculated t value is absolute so that these results state that there is an effect of applying the

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FatSecret application on weight loss. Based on the results of the t test analysis on physical activity, the t value (2.643) > t table (2.068) and p value (0.015) < from 0.05. The calculated t value is greater than the t table. This shows that there is an effect of applying the FatSecret application on increasing the physical activity of Yogyakarta State University Education Personnel.

IV. DISCUSSION

Regular physical activity or physical exercise is not only the key to achieving optimal health but is considered a medicine that cannot be replaced by any pill or supplement. Physical activity is also beneficial in preventing chronic diseases.

Lifestyles such as lack of physical activity can influence one's health condition. Physical activity is required to burn energy from the body. If energy intake is excessive and not balanced with physical activity, it will make it easier for a person to experience excessive fatigue. According to the WHO health agency, physical activity is the movement of limbs that causes energy expenditure which is very important for maintaining physical and mental health, as well as maintaining the quality of life to stay healthy and fit throughout the day (Rismayanthi, 2018).

Good physical activity can be done with good physical conditions as well, one of the characteristics of a good physique is ideal body weight. The problem faced by someone who is getting older is weight. This happens to some UNY education personnel. Excess weight can lead to obesity and disease. Therefore, this study intends to determine the effect of applying the FatSecret application on increasing physical activity and weight loss.

To increase physical activity in UNY Education Personnel, Social Cognitive Theory (SCT) is one of the recommended theories to be applied. SCT focuses on the reciprocal relationship between humans and their environment. SCT concepts include self-efficacy, outcome expectancy, and self-regulation. Self-efficacy in this context refers to confidence in maintaining physical activity despite barriers. Outcome expectancy in this context is defined as the expected benefits when performing physical activity activities. Finally, self-regulation refers to an individual's ability to maintain physical activity (e.g. by planning, scheduling, and goal setting). The results suggest that self-regulation is the most important socio-cognitive process that determines physical activity levels (Rahayu *et al.*, 2022). Therefore, improving self-regulation skills is essential to increase physical activity levels.

The results of the t test analysis in this study obtained the value of t count (12.231) > t Table (2.068). This shows that there is an effect of applying the FatSecret application on weight loss. Based on the results of the t test analysis on physical activity, the t value is obtained (2.643) > t Table (2.068). This shows that there is an effect of the FatSecret application on increasing the physical activity of Yogyakarta State University Education Personnel. Routine and regular physical activity will be one of the factors to reduce one's weight. This is because when the body does physical activity a lot of fat and sweat comes out, so it will reduce excess weight.

Overweight is a state of imbalance between body mass and body fat, where there is excessive fat accumulation in adipose tissue. This situation arises because of poor eating arrangements and a sedentary lifestyle (hypokinetic). Excess food intake consumed accumulatively will be stockpiled or stored as energy reserves in the form of body fat. The imbalance between the incoming energy and the energy released or used by the body is what causes weight gain, resulting in excess body weight (Yuniana, 2020).

The large number of weight loss apps available has led to the development of a variety and combination of features and behavior change techniques. One of the most common behaviors change techniques built into weight loss apps is the ability to self-monitor food intake, physical activity and/or weight (Breton, 2011). Self-monitoring is a key component of behavior-based weight loss programs, and this technique has been shown to significantly increase the effectiveness of an intervention (Michie, 2009). Smart phone apps can help reduce the burden associated with this important strategy (Tang, 2015). Daily weight or various aspects of physical activity including type, duration and intensity of exercise can be monitored manually on the app. Apps can also provide access to a comprehensive food database so that users do not need to search for nutritional information online or in separate books. Specific items and portion sizes of food consumed can be selected to automatically generate an estimate of the number of calories consumed.

To further simplify and reduce the time required to self-monitor food intake, some apps now include barcode scanning, use food category or portion entries rather than detailed item entries or require users to take photos of food (Carter, 2013).

V. CONCLUSIONS

Based on the research results, it shows that from the t test analysis, the calculated t value was obtained (-12.231) > t table (2.068), with these results it was concluded that there was an effect of implementing the FatSecret application on weight loss. The results of the t test analysis on physical activity obtained a calculated t value (2.643) > t table (2.068), from these results it can be concluded that there is an influence of implementing the FatSecret application on increasing physical activity.

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REFERENCES

- 1) Breton, E.R., Fuemmeler, B.F. & Abrams, L.C. (2011). Weight loss-there is an app for that! But does it adhere to evidence-informed practices?. *Transl Behav Med.* 1(4): 523–529.
- 2) Carter, M.C., Burley, V.J., Nykjaer, C. & Cade, J.E. (2013). Adherence to a smartphone application for weight loss compared to website and paper diary: pilot randomized controlled trial. *J Med Internet Res.* 15(4): 32. doi: 10.2196/jmir.2283
- 3) Currie, C., Zanotti, C., Morgan, A., Currie, D.M., Roberts, C. & et al. (2012). Social determinants of health and well-being among young people: health behaviour in school-aged children (HBSC) study: international report from the 2009/2010 survey. *Health Policy for Children and Adolescents*, 6.
<https://www.euro.who.int/en/countries/armenia/publications/social-determinantsof-health-and-well-being-among-young-people.-health-behaviour-in-school-aged-children-hbscstudy>
- 4) FKM – UI. 2007. *Aktivitas Fisik*. Diunduh dari: <http://lontar.ui.ac.id/>.
- 5) Mateo, G.F., Granado-Font, E., Ferré-Grau, C. & Montaña-Carreras, X. (2015). Mobile phone apps to promote weight loss and increase physical activity: a systematic review and meta-analysis. *J Med Internet Res.* 17(11). 253. doi: 10.2196/jmir.4836
- 6) Kemenkes RI. (2018). *Hasil Utama RISKESDAS 2018*. Indonesia: Balitbangkes Kementerian Kesehatan Badan Penelitian dan Pengembangan Kesehatan.
- 7) Michie, S., Abraham, C., Whittington, C., McAteer, J. & Gupta, S. (2009). Effective techniques in healthy eating and physical activity interventions: a metaregression. *Health Psychol.* 28(6): 690–701.
- 8) Kuper, H. & Prynne, J.E. (2019). Perspective on disability and non-communicable diseases in low- and middleincome countries, with a focus on stroke and dementia. *Int J Environ Res Public Health.* 16(18): 3488.
- 9) Rahayu, A., Sumaryanti, & Arovah, N.I. (2022). Physical activity and social cognitive processes among adolescents. *Jurnal Pendidikan Jasmani dan Olahraga.* 7(2). 130-139. <https://doi.org/10.17509/jpjo.v7i2.48817>.
- 10) Rismayanthi, C. (2018). *Olahraga Kesehatan*. Mentari Jaya.
- 11) Safaei, M., Sundararajan, E.A., Driss, M., Boulila, W. & Shapi, A. (2021). A systematic literature review on obesity: Understanding the causes & consequences of obesity and reviewing various machine learning approaches used to predict obesity. *Computers in Biology and Medicine.* <https://doi.org/10.1016/j.combiomed.104754A>
- 12) Tang, J., Abraham, C., Stamp, E. & Greaves, C. (2015). How can weight-loss app designers' best engage and support users? A qualitative investigation. *Br J Health Psychol.* 20(1): 151–171.
- 13) Turner-McGrievy, G.M., Dunn, C.G., Wilcox, S., Boutté, A.K., Hutto, B., Hoover, A. & Muth, E. (2019). Defining adherence to mobile dietary self-monitoring and assessing tracking over time: Tracking at least two eating occasions per day is the best marker of adherence within two different mobile health randomized weight loss interventions. *National Institute of Health.* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6856872/>
- 14) WHO. (2010). *Physical Activity*. Diunduh dari: http://www.who.int/topics/physical_activity/en/.
- 15) World Health Organization. *Physical Activity*. Available online: <https://www.who.int/news-room/fact-sheets/detail/physical-activity>
- 16) WHO. (2020). *Physical activity*. Diakses: 3 April 2023 pukul 19.20 WIB. <https://www.who.int/newsroom/fact-sheets/detail/physical-activity>
- 17) Yuniana, R. (2020). Effect of aerobic and load exercises on body fat and lung vital capacity. *Medikora.* 19(2). 82-87.



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Factors Affecting Poverty in Central Java Province for the Period 2017-2022



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ABSTRACT: Poverty is a serious issue that is hard to ignore in many Indonesian provinces, especially the province of Central Java. This study uses secondary data in the form of a datapanel with cross-section 35 districts / cities and time series for 6 years to measure four independent variables—the city minimum wage (UMK), open unemployment, the human development index (HDI), and foreign investment—and one dependent variable—the poverty variable (Y). The goal is to determine the factors that affect poverty in the province of Central Java. This study's data analysis technique is panel data regression with a Fixed Effect Model (FEM) approach, which is handled with version 12 eviews. Because the District Minimum Wage (UMK) variable had a probability value of $0.0001 < 0.05$ and a coefficient value of -5.73000 , the study's findings demonstrated that it had a negative and substantial impact on poverty. With a prob value, the Open Unemployment variable statistically significantly and favorably affects poverty. 0.0000 less than 0.05 . Furthermore, because the HDI variable has a prob value, research has demonstrated that it significantly and negatively affects poverty. the HDI's ability to lower the number of people living in poverty ($0.0008 < 0.05$). However, because the Foreign Investment variable has a low value, it was unable to demonstrate that it had an impact on poverty. The results indicated that the poverty rate was unaffected by the amount of foreign direct investment, with $0.7696 > 0.05$. The study's overall findings demonstrate that 56.8% of poverty can be described by the four independent factors, with the remaining 43.2 percent being explained by variables not included in the research model.

KEYWORDS: MSE; Open unemployment; HDI; Foreign Investment; Poverty.

I. INTRODUCTION

The Central Statistics Agency (BPS) released data in 2023 showing that the percentage of Indonesians living in poverty as of September 2023 was 7.53 percent of the country's total population. This represents an increase from the 7.50 percent of the population as of March 2022. One of the biggest issues facing the administration is poverty. Lack of fundamental needs, including essential food, shelter, health care, and vital safety, is the cause of living in poverty (Bradshaw, 2007). Poverty is a serious issue that is hard to ignore in many Indonesian provinces, including Central Java Province. According to the 2023 BPS report, Central Java ranks seventh among 34 provinces in Indonesia in terms of the number of people living in poverty, with a rate of 10.98 percent as of September 2022—up from 10.93 percent as of March 2022. The growing rate of poverty is viewed as a sign that the government is failing to provide prosperity for its citizens. There are more and more people who are illiterate, unwell, and hungry. This occurs as a result of their struggles to obtain adequate housing, health care, education, and basic necessities. Furthermore, being impoverished can make a person more susceptible to local criminal dangers (Rohima et al., 2013).

The HDI growth, minimum wage, open unemployment, and foreign direct investment in the province of Central Java indicated that in 2021 the HDI was on a scale of 72.16, up 2.3 percent from 2017, but this was less than the national HDI, which is on a scale of 72.29. The increase was not very significant. According to MSEs, the average in 2021 was IDR 2,041,504, up 24.2 percent from the previous year. The percentage of the people experiencing open unemployment in 2021 was 5.95 percent; this represents a 23.2 percent increase from the 4.57 percent rate in 2017. In contrast, foreign direct investment fell by 30.4 percent from 2017 to IDR 1,820,244 million in 2021. Based on these data, it can be concluded that the number of people living in poverty may increase due to the HDI, MSEs, open unemployment, and foreign direct investment. A society's lifestyle and economic conditions are reflected in its HDI (Resce, 2021). The HDI is a composite indicator that evaluates the standard of living, health, and education as the three fundamental components of development (Ladi et al., 2021; Jain & Nagpal, 2019). The findings of earlier research demonstrated that Prasada et al. (2020); Pertiwi & Purnomo (2022) that the HDI has an impact on reducing poverty. But those findings run counter to the study. Sinaga (2020) that the HDI does not help to reduce poverty.

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In order to raise the minimum wage, people must earn more money in order to live comfortably and below the poverty line (Jadoon et al., 2021). Because high pay gains can cover basic expenses, children's education, family health, and the ability to save money for the future, they have an effect on reducing poverty. Previous research findings have demonstrated that raising the minimum wage can have an impact on reducing poverty (Saari et al., 2016; Syaquiah et al., 2022). On the other hand, very low wages might exacerbate poverty (Maroto & Pettinicchio, 2022). However, contrary to research by Bird & Manning (2008); Jadoon et al. (2021) that poverty is unaffected by minimum wage. Open unemployment is a socioeconomic issue that can negatively impact people, families, communities, and countries all over the world (Mseleku, 2022). As stated by Saunders (2002) Open unemployment can exacerbate poverty and inequality by creating social sequences that can lessen an individual's, their family's, and their community's open unemployment.

Foreign direct investment is crucial to a nation's development (Ullah & Tahir, 2022). Foreign direct investment in emerging nations that depend on capital inflows to support their economies' expansion (Kumari & Sharma, 2017). This is being done in an effort to boost job creation and infrastructure development, which will boost regional economic growth and reduce the rate of poverty. According to the preceding explanation, the Central Java Province's poverty is influenced by a number of factors, including a dropping HDI, low MSEs, high open unemployment, and a lack of foreign direct investment. Drawing on prior studies and issues contributing to the rise in poverty, the investigator aims to examine the effect of HDI, minimum wage, open unemployment, and foreign direct investment on poverty in Central Java Province for the 2017-2022 period.

II. METHOD

One kind of scientific inquiry that aims to identify cause-and-effect links between variables is called causal inference research. Poverty (Y), Open Unemployment (X2), UMK City Minimum Wage (X1), Human Development Index (X3), and Direct Foreign Investment (X4) are the four primary variables that are associated with poverty (X4). The Central Bureau of Statistics (BPS) of Central Java Province conducted a survey on the state of poverty in the province from 2017 to 2021, and the results were processed into the poverty statistics used in this study. This study was carried out in the province of Central Java, encompassing six cities and 29 regencies. Static panel analysis of research data evaluated with the Eviews program utilizing the Fixed Effect Model (FEM).

III. RESULTS AND DISCUSSION

RESULTS

This study examines factors that may have an impact on poverty in the province of Central Java between 2017 and 2022. through the use of four independent variables: foreign direct investment, HDI, open unemployment, and MSEs. The percentage of the impoverished in each of the districts and cities in the province of Central Java is listed below:

Table 1. Data Cross Section Research

No	Regency / City Name	Percentage of Poor People
1	Cilacap District	11,02
2	Banyumas District	12,84
3	Purbalingga District	15,30
4	Banjarnegara District	15,20
5	Kebumen District	16,41
6	Purworejo District	11,53
7	Wonosobo District	16,17
8	Magelang District	11,09
9	Boyolali District	9,82
10	Klaten District	12,33
11	Sukoharjo District	7,61
12	Wonogiri District	10,99
13	Karanganyar District	9,85
14	Sragen District	12,94
15	Grobogan District	11,80
16	Blora District	11,53
17	Rembang District	14,65

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18	Pati District	9,33
19	Kudus District	7,41
20	Jepara District	6,88
21	Demak District	12,09
22	Semarang District	7,27
23	Temanggung District	9,33
24	Kendal District	9,48
25	Batang District	8,98
26	Pekalongan District	9,67
27	Pemalang District	10,06
28	Tegal District	7,90
29	Brebes District	16,05
30	Magelang City	7,10
31	Surakarta City	8,84
32	Salatiga City	4,73
33	Semarang City	4,25
34	Pekalongan City	7,00
35	Tegal City	7,91

Source: Statistical Centre Body (BPS) Year 2022

Kebumen Regency is the most impoverished region in Central Java Province, according to the table above. Kebumen's poverty rate in 2022 is 16.41 percent of the total population. Semarang City comes in last on the Central Java Province's list of impoverished people, with 4.25 percent of the whole population. The Central Java Province is represented in the table by 27 regencies and 8 cities, of which 5 regencies and/or cities contribute the most to the variables measuring MSE, unemployment, HDI, and foreign investment. Here is what's offered: Table 5 Cities / Districts The following individuals had the highest contributions to the study's independent variables:

Table 2. District/City Category of the highest contributor in Central Java Province

No	District Minimum Wage (Rp)	Open Unemployment (%)	Human Development Index (Scale)	Foreign Investment (Million Rupiah)	Poverty (Thousand Souls)
1	Semarang City 3.060.348	Brebes District 9,48	Salatiga City 84,35	Cilacap District 34992291,60	Brebes District 290,66
2	Demak District 2.680.421	Tegal District 9,04	Semarang City 84,08	Demak District 2495472,80	Banyumas District 220,47
3	Kendal District 2.508.299	Semarang District 7,60	Surakarta City 83,08	Sukoharjo District 1670938,10	Kebumen District 196,16
4	Semarang District 480.988	Kendal District 7,34	Magelang City 80,39	Boyolali District 1518219,50	Pemalang District 195,84
5	Kudus District 2.439.813	Banyumas District 7,05	Wonogiri District 78,66	Semarang District 1156629,60	Cilacap District 190,96

Source: Central Agency for Statistics (BPS)

A. Description of Research Variables

The five primary factors under investigation in this study are MSEs, Open Unemployment, HDI, Foreign Investment, and Poverty. In order to facilitate comprehension of each research variable under test, the features of the research data will be ascertained by descriptive statistical analysis. The outcomes of the research variable description are as follows:

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Table 3. Characteristics of Research Variables

Variable	Average	Standard Deviation	Minimal	Maximum
MSE (Rp)	1.876.413,41	292.724,09	1.370.000	3.060.348
Open Unemployment (%)	5.09	1.78	1.76	9.82
HDI (Skala)	71.86	4.91	60.44	84.35
Foreign Investment (Million Rp)	309683.50	2429369.50	.00	34992291.60
Kemiskinan(Ribu Jiwa)	114.35	65.16	8.65	343.50

Table 3 illustrates that in the province of Central Java, the average MSE across 29 regencies and 6 cities is Rp 1,876,413.41, with a variation of Rp 292,724.09. In 2022, Semarang City had the highest MSE of IDR 3,060,348; in 2017, Banjarnegara Regency recorded the lowest MSE of IDR 1,370,000. In the meantime, open unemployment had an average rate of 5.09 percent and a 1.78 percent variability. In 2020, Tegal Regency had the greatest rate of open unemployment (9.82 percent), while Rembang Regency had the lowest rate (1.76 percent) in 2022. The Central Java Province's average HDI, with a variability of 4.91, is 71.86 in 29 regencies and 6 cities. Salatiga City recorded the greatest HDI in 2022 at 84.35, while Banyumas Regency recorded the lowest HDI in 2021 at 60.44. In the meantime, the average amount of foreign direct investment was 309,683.50 million rupiah, with a 24-29369.50 million rupiah fluctuation. The Cilacap Regency saw the largest foreign investment in 2022, totaling 34992291.60 million rupiah, whereas Temanggung Regency saw the lowest foreign investment in 2017, Pekalongan Regency in 2018, 2019, 2020, and Pekalongan City in 2017. In the province of Central Java, the average poverty rate is 114,350 thousand, with a variation of 65.16 thousand individuals among 29 regencies and 6 cities. 343.5 thousand people lived in the Brebes Regency at the highest point of poverty in 2017, whereas 8.65 thousand people lived in Magelang City at the lowest point in 2022. The trends for the 2022 era are also evident in the description of the research variables.

B. Uji Hypoplant

Ghozali (2018) states that the t test is an individual test used to determine the correlation between independent and bound variables (partial). In this investigation, the t-test was applied at a significance level of 0.05.

Table 4. Partial Test (T Test)

Variable	Coefficient	Standard Deviation	t-Statistics	Probability
C	32.8310	2.725352	12.046517	0.0044
MSE	-5.73000	1.310000	-4.374046	0.0001
Pengangguran Terbuka	3.45168	1.079126	3.198588	0.0000
HDI	-5.0420	1.043300	-4.832742	0.0008
Investasi Asing	-3.96000	3.050000	-1.298361	0.7696

The value of prob. on the MSE variable (X1) of 0.0001 with a coefficient value of -5.73000 can be determined from the given table. This indicates that Poverty (Y) is significantly and partially impacted by the MSE variable (X1); for every unit increase in MSE (X1), Poverty (Y) will drop by 5.73000 units. Therefore, hypothesis 1 (H1) is agreed upon. Conversely, prob. Foreign Investment (X4) has a coefficient value of 3.45168 and a value of 0.0000. This indicates that Poverty (Y) is somewhat positively and significantly impacted by the Open Aggression variable (X2); for every unit rise in X2, Poverty (Y) will increase by 3.45168 units. The acceptance of hypothesis 2 (H2) follows. In the HDI variable (X3), prob. has a value of 0.0008 and a coefficient value of -5.0420. This indicates that Poverty (Y) is significantly and partially impacted by the HDI variable (X3); for every unit rise in X3, Poverty (Y) will drop by 5.0420 units. The acceptance of hypothesis 3 (H3) follows. In the variable Foreign Investment (X4), prob. has a value of 0.7696 and a coefficient value of -3.96000. Thus, there is no partial significant influence of the Foreign Investment variable (X4) on Poverty (Y). Hypothesis 4 (H4) is therefore disproved.

The results of the variables MSE (X1), Open Unemployment (X2), HDI (X3), and Foreign Investment (X4) simultaneously effect Poverty (Y) based on Test F that was conducted on the aforementioned analysis's results. This is because the prob value obtained is 0.003, or smaller than 0.05. Ghozali (2018) claims that the R2 test basically calculates the proportion of the dependent variable's magnitude that can be accounted for by the independent variable employed as a criteria. The researcher acquired a coefficient of determination of 0.432566 for the number obtained based on the results of the R2 Test. This indicates that 43.2

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percent of the Poverty bound variable (Y) is explained by all independent variables (MSEs (X1), Open Unemployment (X2), HDI (X3), and Foreign Investment (X4)), with the remaining 56.8 percent being explained by factors not included in this research model.

DISCUSSION

The impact of MSEs on poverty in the province of Central Java is examined in this study from 2017 to 2022. The study's findings demonstrated that MSEs have a prob value. $0.0001 < 0.05$, indicating a statistically significant impact of MSEs on poverty. The study's findings were successful in supporting the premise put out in order for H1 to be approved. The findings of earlier research, such as that of Saari et al. (2016), which demonstrates that the minimum wage significantly affects the reduction of poverty, corroborate the findings of this study. MSE are used to measure minimum wage. By giving workers higher wages that can improve their standard of living and push them over the poverty line, an increase in MSEs can aid in the reduction of poverty. Minimum wage laws seek to guarantee that workers, particularly in low-wage industries, receive a specific amount of pay for their efforts by lowering the wage ceiling. This could lessen poverty among those who are most vulnerable and minimize income disparity.

The next variable's research results demonstrate that open unemployment has a prob value. Since open unemployment statistically influences poverty ($0.0000 < 0.05$), H2 is accepted. The findings of this study are consistent with a number of earlier investigations, including those carried out by Siyan et al. (2016), which demonstrated that open unemployment has a substantial impact on poverty increases. When someone is jobless, they frequently deal with a number of issues that can push them into poverty. People who are unemployed lose their income, which leaves them without the means to meet their fundamental necessities. It gets more difficult to pay for needs like food, housing, healthcare, and education when one does not have a consistent source of income. The following hypothesis looks at the correlation between poverty and the HDI and has a prob value. 0.0008 is less than 0.05 . According to the findings, HDI has a major impact on poverty, which is why H3 is approved. The findings of this investigation support those of Pertiwi & Purnomo's (2022) study, which found that HDI effectively reduces poverty. Countries with lower HDI values tend to have higher rates of poverty, whereas those with higher HDI values typically have lower rates. This relationship can be explained by the fact that elements that lower poverty and raise HDI, such as income, access to healthcare, and education, do both.

Research on the relationship between poverty and foreign investment has a prob value. by 0.7696 greater than 0.05 . These findings demonstrate that foreign investment has no discernible impact on poverty, leading to the rejection of H4. The findings of this study contradict those of Dhahri & Omri's (2020) research, which demonstrates that foreign investment significantly reduces poverty. The host nation may benefit from new industries and enterprises brought in by foreign direct investment. For instance, money needed to build factories, offices, and manufacturing facilities. The local labor force may be able to find job as a result, especially in industries that may not have had much development in the past. The creation of jobs can raise living standards and income levels, which will eventually lower the rate of poverty.

IV. CONCLUSIONS

Consistent with the conclusions of Saari et al., the study's results showed that the District Minimum Wage (UMK) significantly lowers the poverty rate (H1 received) (2016). According to research by Siyan et al., open unemployment contributes significantly favorably to poverty (H2 received) (2016). According to H3 received, the Human Development Index (HDI) significantly reduces poverty, which is consistent with Pertiwi & Purnomo's findings (2022). In contrast to Dhahri & Omri's results, foreign investment has not been demonstrated to significantly worsen poverty (H4 is rejected) (2020). One possible reason could be the inadequate infrastructure in Central Java Province, specifically in Kebumen District, which requires enhancement to boost investment appeal and reduce poverty.

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REFERENCES

- 1) Bird, K., & Manning, C. (2008). Minimum Wages and Poverty in a Developing Country: Simulations from Indonesia's Household Survey. *World Development*, 36(5), 916–933. <https://doi.org/10.1016/j.worlddev.2007.05.012>.
- 2) Bradshaw, T. K. (2007). Theories of Poverty and Anti-Poverty Programs in Community Development. *Community Development*, 38(1), 7–25. <https://doi.org/10.1080/15575330709490182>.

Factors Affecting Poverty in Central Java Province for the Period 2017-2022

- 3) Dhahri, S., & Omri, A. (2020). Foreign capital towards SDGs 1 & 2—Ending Poverty and hunger: The role of agricultural production. *Structural Change and Economic Dynamics*, 53, 208–221. <https://doi.org/10.1016/j.strueco.2020.02.004>.
- 4) Jadoon, A. K., Tanveer, A., Javed, M. F., & Sarwar, A. (2021). Minimum wages and poverty: A cross-country analysis. *Asian Economic and Financial Review*, 11(8), 632–643. <https://doi.org/10.18488/JOURNAL.AEFR.2021.118.632.643>.
- 5) Jadoon, A. K., Tanveer, A., Javed, M. F., & Sarwar, A. (2021). Minimum wages and poverty: A cross-country analysis. *Asian Economic and Financial Review*, 11(8), 632–643. <https://doi.org/10.18488/JOURNAL.AEFR.2021.118.632.643>.
- 6) Jain, M., & Nagpal, A. (2019). Relationship Between Environmental Sustainability and Human Development Index: A Case of Selected South Asian Nations. *Vision*, 23(2), 125–133. <https://doi.org/10.1177/0972262919840202>.
- 7) Kumari, R., & Sharma, A. K. (2017). Determinants of foreign direct investment in developing countries: a panel data study. *International Journal of Emerging Markets*, 12(4), 658–682. <https://doi.org/10.1108/IJoEM-10-2014-0169>.
- 8) Ladi, T., Mahmoudpour, A., & Sharifi, A. (2021). Assessing impacts of the water poverty index components on the human development index in Iran. *Habitat International*, 113, 1–10. <https://doi.org/10.1016/j.habitatint.2021.102375>.
- 9) Maroto, M., & Pettinicchio, D. (2022). Worth Less? Exploring the Effects of Subminimum Wages on Poverty among U.S. Hourly Workers. *Sociological Perspectives*, 5–21. <https://doi.org/10.1177/07311214221124630>.
- 10) Mseleku, Z. (2022). Youth high unemployment/unemployability in South Africa: the unemployed graduates' perspectives. *Higher Education, Skills and Work-Based Learning*, 12(4), 775–790. <https://doi.org/10.1108/HESWBL-06-2021-0114>.
- 11) Pertiwi, E., & Purnomo, D. (2022). Analysis of the Effect of Gross Regional Domestic Product (GRDP), Human Development Index (IPM), and Open Unemployment Rate (TPT) on Poverty Rate in Lampung Province. *International Conference on Islamic Economics, Islam Finance, & Islamic Law (ICIEFIL)*, 47–61.
- 12) Prasada, I. Y., Yulhar, T. F. M., & Rosa, T. A. (2020). Determinants of poverty rate in Java Island: Poverty alleviation policy. *Jurnal Ekonomi Pembangunan*, 18(2), 95–104. <https://doi.org/10.29259/jep.v18i2.11664>.
- 13) Resce, G. (2021). Wealth-adjusted Human Development Index. *Journal of Cleaner Production*, 318, 1–13. <https://doi.org/10.1016/j.jclepro.2021.128587>.
- 14) Rohima, S., Suman, A., Manzilati, A., & Ashar, K. (2013). Vicious Circle Analysis of Poverty and Entrepreneurship. *IOSR Journal of Business and Management*, 7(1), 33–46. <https://doi.org/10.9790/487x-0713346>.
- 15) Saari, M. Y., Rahman, M. A. A., Hassan, A., & Habibullah, M. S. (2016). Estimating the impact of minimum wages on poverty across ethnic groups in Malaysia. *Economic Modelling*, 54, 490–502. <https://doi.org/10.1016/j.econmod.2016.01.028>.
- 16) Saunders, P. (2002). The direct and indirect effects of unemployment on poverty and inequality. *SPRC Discussion Paper No. 118*, 118, 1–31.
- 17) Sinaga, M. (2020). Analysis of Effect of GRDP (Gross Regional Domestic Product) Per Capita, Inequality Distribution Income, Unemployment and HDI (Human Development Index) on Poverty. *Budapest International Research and Critics Institute (BIRCI-Journal): Humanities and Social Sciences*, 3(3), 2309–2317. <https://doi.org/10.33258/birci.v3i3.1177>.
- 18) Siyan, P., Adegioriola, A. E., & Adolphus, J. A. (2016). Munich Personal RePEc Archive Unemployment and Inflation: Implication on Poverty Level in Nigeria. *Munich Personal RePEc Archive*, 79765, 1–23. https://mpra.ub.uni-muenchen.de/79765/1/MPra_paper_79765.pdf.
- 19) Syauqiah, A. P., Pattiasina, K. W., & Firdausyah, S. (2022). the Effect of the Unemployment Rate and Minimum Wage on Poverty Rate in West Java. *Jurnal Ekonomi Trisakti*, 2(1), 215–226. <https://doi.org/10.25105/jet.v2i1.13567>.
- 20) Ullah, S., & Tahir, M. (2022). Determinants of foreign investment in Pakistan. *South Asian Journal of Business Studies*, 11(1), 67–81. <https://doi.org/10.1108/SAJBS-10-2019-0188>.



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Management and Utilization of the Culture of Customary Villages as “Local Wisdom” in Tourism Development in Bali



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ABSTRACT: Indonesia is a country that has many tourism provinces, one of which is Bali Island. One of the factors that supports the development of tourism in Bali is local wisdom. The purpose of this study is to determine How the management and utilization of Traditional Village Culture as “local wisdom” to support tourism development in Bali and What are the inhibiting factors in the management and utilization of Traditional Village Culture as “local wisdom” can play a role in supporting tourism development in Bali. This study uses the type of empirical legal research. The researchers found several obstacles that became obstacles, especially related to the availability of land or land that will be used as the location for the construction of tourism facilities and also the community's concern about the transfer of ownership of customary land to investors and the concern about the use of customary land that is not in accordance with local cultural values. that has the potential to damage the environment and the sustainability of Balinese traditions because in reality, Customary Land for the Traditional Village Community in Bali is their identity and identity that has been passed down from generation to generation. Therefore, indigenous peoples who act as guardians of local culture are expected to continue to develop their knowledge by paying attention to contemporary issues that require adaptation to solve the problems at hand. To ensure that the management and utilization of traditional village culture in Bali to support sustainable tourism does not damage the natural beauty and culture of Bali, investment can be focused on the development of environmentally friendly facilities and the implementation of programs to promote cleanliness and environmental conservation. By linking tourism investment with Balinese culture, it will increase its added value because tourists can not only enjoy the natural beauty, but also Balinese culture. This provides a great opportunity for Bali to attract investors and foreign tourists visiting Bali.

KEYWORDS: Local Wisdom, Culture, Traditional Village, Investor, Bali, Tourism.

I. INTRODUCTION

Indonesia is a country that has many tourist provinces, one of which is the island of Bali. Bali tourism is good with its rich customs, culture, artistic creations in various aspects of life, environment, natural resources, and its history that is relatively rich and serves as a foreign tourist destination. One of the factors that supports tourism development in Bali is local wisdom. Local wisdom consists of two words, namely "wisdom" which refers to wisdom and "local" which means local. Therefore, local wisdom can be interpreted as a wise and valuable idea that comes from the local community. Local wisdom includes good cultural values that exist in a society. To understand the local wisdom in a region, it is important to understand the good cultural values that exist in the region. These local wisdom values are usually taught down from generation to generation by the previous generation to the next generation. Examples of local wisdom are the culture of mutual cooperation, mutual respect, and mutual understanding. Local wisdom is the original knowledge and wisdom of a society that comes from the noble values of cultural tradition to regulate the order of community life. By utilizing local wisdom, people can regulate their lives wisely and in accordance with local cultural values (Putra Pamayun, 2018).

Bali Island has regencies and cities in Bali, there are traditional values that still exist, especially those concerning belief systems (religion), tradition, and local knowledge and they continue as a manifestation of local wisdom. This belief system also has a very strong influence on the sustainability of tradition, and in fact this tradition often becomes a guideline for community life. The values in the tradition are certainly an inseparable part of the local wisdom itself. Local wisdom can be interpreted as a problem-solving action carried out by the local community in order to fulfill their lives. Local wisdom is a life strategy which is a

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local policy or "local wisdom" or local knowledge or "local genius". Local wisdom can also be interpreted as a community's worldview and their knowledge (Samadro, 2018). In addition, there are other views that state local wisdom as all forms of knowledge, beliefs, understanding, insight, habits, and ethics that guide human behavior in life within an ecological community (Samadro, 2018).

The understanding of local wisdom is a translation of “local genius”. The term “local genius” was first introduced by Quaritch Wales in 1948-1949 to convey the ability of local culture to face the influence of foreign culture when the two cultures are in contact (Ajip Rosidi, 2011). Each region in Bali has a cultural pattern and characteristic in managing and utilizing it, adjusted to the local wisdom.

Therefore, local wisdom, culture, and nature play a significant role in tourism development and in attracting the interest of investors. These components provide a unique experience for tourists and are part of creating the overall appeal of a destination. By wisely capitalizing on the potential of local wisdom, culture, and nature, a tourism destination can create a unique, sustainable, and attractive experience for tourists while strengthening the local economy and protecting cultural heritage and environmental sustainability.

The management and use of traditional land should be done as optimally as possible to avoid conflicts between people, tribes, government, investor and other parties. Because in reality there are many conflicts that have occurred in Bali between the Traditional Village and investors due to various things. The occurrence of these cases raises a paradigm of thinking or assumption that the local community itself hinders the development of tourism in Bali. In this matter, a solution must be found, namely so that the balance of socio-economic life and culture that is supported by Hinduism can be maintained.

Based on the background description, the researcher can draw two problem formulations, namely: (1) How can the management and utilization of Indigenous Village Culture as "local wisdom" play a role in supporting tourism development in Bali? and (2) What are the inhibiting factors in the management and utilization of Indigenous Village Culture as "local wisdom" in tourism development in Bali?

II. RESEARCH METHOD

This research uses the type of empirical legal research (Zainuddin Ali, 2014), or what is commonly referred to as Non-Doctrinal Legal Research. This research uses the Statutory Approach, Case Approach, Analytical Approach, Customary Law Approach, and Sociological Research Approach, which views law as a social phenomenon that can be observed in people's life experiences because in this context the law is not autonomous, so that in the view of empirical legal science, the study of law not only concerns normative aspects, but also how the law can interact in people's lives (Husein Alting, 2010).

III. RESULT AND DISCUSSION

A. Management and Utilization of Indigenous Village Culture in Bali as Local Wisdom in Tourism Development

When discussing a society's culture, values and norms, it is important to bear in mind that cultural values and norms usually relate to the dominant group. However, it is necessary to recognize that, in today's world, significant changes are taking place. The emergence of various cultural identities within a nation indicates the presence of smaller yet significant cultural diversities. Therefore, the assumption that values and norms are based solely on the dominant group may overlook these changes (Esther Kuntjara, 2006).

Talking about Balinese indigenous culture, values, and norms related to Balinese culture are always being the main concerns. Bali is a place where the majority of its people are Hindu. Historically, Hinduism's influence is very dominant in constructing the culture in Bali. Therefore, when talking about Bali, Hinduism always becomes the distinct identity, even Bali is known as Hindu Dharma, which shows that the religious practices are deeply rooted in the Hindu religious tradition. The dominance and hegemony of Hinduism in Bali become something normal in Balinese society's development.

When observed from the perspective of the local traditions, cultures, and religions in Bali, it can be understood as a custom that has existed for a long time and has undergone complex developments in the lives of the people. This tradition is held in high esteem by the people and becomes a collective behavior that must be respected and implemented together. Thus, tradition emerges as a result of the existence of a specific tribe or ethnicity, which later becomes the identity of that tribe or ethnicity.

Balinese society has a way to manage culture through various expressions and diverse forms, even though they respect and honor each other. In this case, it can be seen from the constructions it has made. Concepts that are often used in this case are terms like village mawacara, village kala patra, and other terms to strengthen the existence of Balinese cultural values (I Gusti Ngurah Jayanti, I Wayan Rupa, I Made Sumarja, 2022).

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Customary communities or traditional villages of Bali generally have local wisdom (local knowledge, local wisdom), although there are variations in each village due to various factors. However, in general, the local wisdom that exists has been proven to be able to maintain the existence of the natural environment from degradation or damage caused by humans. Local wisdom is knowledge from a cultural community which is used to harmonize and achieve equilibrium in the relationship between humans and nature.

According to Law Number 32/2009 concerning Environmental Protection and Management, local wisdom means the noble values that apply in the life order of society to, among others, protect and manage the environment sustainably. Local wisdom is ideally referred to as the invention of tradition. Local wisdom as part of the life values inherited from one generation to the next generation which is in the form of religion, culture or customs that are generally in oral form, in the form of a social system of a society. The existence of local wisdom in society is the result of a hereditary adaptation process over a very long period of time to an environment that is usually inhabited or an environment where interactions often occur in it. Local wisdom can be understood as a human attempt by using reason to act and behave towards something, object or event that occurs in a certain space.

Local knowledge has several characteristics, namely: (Adytira Rachman, 2020)

1. Local wisdom is having a particular group, community, or collectivity that is localized.
2. Local wisdom formulates something assumed as true, because it has been continuously tested by experience.
3. Local wisdom is practical.
4. Local labels attached to local wisdom.
5. Local wisdom covers not only practical aspects, but also codes of conduct.
6. Local wisdom is holistic.
7. Local wisdom often has its own guardian
8. Local wisdom is often bound or integrated with religious teachings and practices.

Local wisdom plays an important role in preserving culture and the environment as a whole. The values that have been passed down from generation to generation, such as literature, traditions, mythology, and the like, are an integral part of local wisdom that must be preserved, developed, and disseminated to future generations. This is intended so that they can understand the function and meaning behind local wisdom policies. Thus, local wisdom can provide sustainable benefits for the people of Bali.

Customary Village has many potentials in supporting tourism in Bali. Among them are: (I Wayan Rideng, I Nyoman Putu Budiarta, 2020)

1. First the pattern structure of settled community in rural area based on the “Tri Hita Karana” concept, so it shows the special and unique characteristic in society life system in Bali;
2. Secondly, in line with the socio-religious nature of Balinese society, Hindu religious ceremonies are carried out in everyday life;
3. Third, Customary Village, besides radiating Hindu values, is also a center of Bali culture;
4. Fourthly, since the beginning the atmosphere of community life in the Customary Village has been safe and peaceful.

Balinese society in general, local wisdom actually includes folklore (mesatwa), folk games (children's dolanan), religious traditions or rituals such as ngusaba, life cycle rites from the womb (magedong-gedongan), to birth rituals. Puberty rites such as (menek kelih), Marriage (nganten) phase of married life, to death rites such as (ngaben). Mythology such as belief in something supernatural and magical like tenget. In addition, local wisdom is also reflected in scriptures, regulations such as awig-awig, leadership systems such as traditional villages (adat bendesa).

The knowledge system is similar to the subak system, namely the irrigation management system in Bali, the spatial planning of housing such as the concept of asta kosala and asta kosali, tri mandala, the concept of Tri Hita Karana, the concept of rwa Bhineda, namely the belief in binary opposition in life such as day (weak) and night (darkness), good (bad) and bad (melah), kaje-keled and others. Local wisdom also includes policies that are considered necessary and preventive in nature to guard against the influence of globalization. Not all globalization influences can be accepted because they contain elements that are considered inconsistent with the traditional cultural values of the local community.

Management and Utilization of the Village Culture of Customary Villages in Bali containing local wisdom or "Local Wisdom" is basically the basis for the development of tourism development in Bali. Because until now, Customary Villages in Bali still maintain the existence of noble culture as local wisdom or "Local Wisdom". Even culture in Customary Village as local wisdom or "Local Wisdom" is one of the strategies to attract investors in tourism development in Bali. It is hoped that by managing and

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utilizing the Culture of Customary Villages in Bali that contain local wisdom or "Local Wisdom", it can support the sustainability of tourism development in Bali in line with the existence of its Customary Villages.

Here are some ways in which local wisdom, culture and nature can contribute to tourism development and attract investors:

1. **Cultural Heritage Preservation** Local wisdom and cultural traditions are crucial assets for tourism development. Highlighting and preserving cultural heritage, such as traditional crafts, performing arts, rituals, and festivals, can attract tourists who are interested in authentic cultural experiences. This can lead to increased visitation and revenue, encouraging investors to support local tourism infrastructure.
2. **Experiential**, Local wisdom offers tourists genuine and immersive experiences that allow them to engage with local communities, traditions, and lifestyle. Visitors often seek authentic experiences that go beyond the main attractions. By showcasing local customs, traditions, and practices, destinations can differentiate themselves and appeal to tourists seeking meaningful and culturally enriching experiences.
3. **Nature-Based Tourism**: Many destinations are blessed with natural beauty, including mountains, forests, rivers, beaches, and wildlife. Preserving and promoting these natural assets can create opportunities for ecotourism and adventure travel, which are increasingly popular among tourists seeking sustainable and nature-oriented experiences. Investors are often drawn to supporting environmentally friendly tourism initiatives that align with conservation efforts.
4. **Engaging Local Communities**: Involving local communities in tourism development empowers them economically and socially. By integrating local communities into tourism activities, such as homestays, community-based tours, or cultural performances, destinations can create a sense of ownership and pride among residents. This engagement not only preserves local wisdom and traditions but also attracts investors interested in responsible and community-oriented tourism.
5. **Sustainable Development**: Investors are increasingly attracted to sustainable tourism projects that promote environmental conservation, support local communities, and minimize negative impacts on ecosystems. Integrating local wisdom and cultural practices into sustainable tourism initiatives can be an attractive proposition for investors seeking long-term, socially responsible projects.
6. **Unique Selling Point**, Local wisdom, culture and nature provide a unique selling point for a destination. They differentiate one location from another, offering visitors something they cannot find elsewhere. This uniqueness can attract tourists and investors who see the potential in developing and promoting a distinct destination.

B. Inhibiting Factors in Management and Utilization of Traditional Village Culture in Bali in Tourism Development

In the utilization and management of Balinese indigenous land by investors and customary villages, there are negative impacts on the environmental and socioeconomic aspects. From the environmental aspect, the utilization of Balinese natural and cultural resources in the context of tourism is considered threatening. Many buildings have been erected in areas that should be kept away from physical development, such as water catchment areas, ravines, or river basins. From a social perspective, tourism actually conditions social injustice. Tourism is not for everyone because only certain levels of Balinese society benefit from tourism. Likewise, economically, as a result of the uneven distribution of tourism, both between levels of society and between regions.

Responding to local wisdom becomes very important, the role of the customary village is very significant in dealing with various problems or challenges faced by the environment and society. They have the responsibility to solve problems in a good and proper way. In this context, local wisdom has a broader meaning, not only limited to traditional aspects, but also includes relevant and contemporary wisdom.

For the Balinese, land has a value and meaning that includes economic, social, cultural, and religious aspects. There are several areas in Bali that have the potential as tourist site that can be developed into a hotel industrial area. However, in those areas, there are cultural-religious assets that cannot simply be changed or removed. As a result, there are differences of opinion between investors and lovers of tradition, culture, and religion regarding the changes in these areas into tourist sites and hotel industrial areas. On the other hand, In the future, the natural support capacity in Bali will be increasingly threatened. This is due to the expansion of tourism and the designation of areas as increasingly wide tourist destinations.

The Balinese concept of local wisdom is based on the knowledge and management of natural resources originating from the indigenous people. This is due to the close relationship between them and the environment and natural resources. Through the process of interaction and adaptation taking place over a long time, the indigenous people of Bali have developed ways to sustain their lives by creating values, lifestyles, institutional systems, and laws in line with the conditions and availability of natural resources in the area where they live.

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In the provisions of the Bali Provincial Regulation Number 4 of 2019 concerning the Customary Village in Bali, by considering letter b, it is stated as follows:

“That the traditional villages as a unity of customary law communities based on the Tri Hita Karana philosophy rooted in the Hindu religion, cultural values and local wisdoms that exist in Bali, have a very big role in developing communities, nations and countries, thus they need to be nurtured, protected, fostered, developed and empowered in order to materialize the life of Krama Bali who are politically sovereign, economically self-reliant and possess cultural personalities”.

In Regional Regulation Number 5 of 2020 concerning the Standards for Implementing Balinese Cultural Tourism, there is Article 3 number 2 that explains the purpose of implementing cultural tourism. The objectives include preserving the natural environment and Balinese culture that is inspired by the philosophy of Tri Hita Karana, and based on the values of local wisdom of sad kerthi. In addition, the objectives also include improving the quality of tourism implementation in Bali.

Tourism discourse in Bali has always been interesting and often becomes the subject of debate. However, it is unfortunate that in many of these discussions, tourism is often interpreted very narrowly as an industry that only involves hotels, restaurants, bars, villas, travel agents, tourist attractions, and souvenirs. It is rare for us to hear discussions that encompass all aspects of tourism without preceding skepticism towards commercialization, which refers to changing something into a commodity.

In Bali, there is a customary law system which is recognized and practiced by the local community. Customary land plays an important role in the lives of Balinese society, both in terms of culture, spirituality, and economy. Researchers have analyzed from the perspective of the social and cultural aspects of the Balinese community. Balinese customary law can be understood as a system that has developed over time, influenced by factors such as tradition, cultural values, and patterns of social relations in the community. The analysis can be carried out according to the researcher's opinion by considering the following factors:

1. Culturally, Balinese culture is closely related to customary land. Cultural values, traditions and beliefs play an important role in customary land management. Taking into account this cultural aspect can influence policies and actions regarding customary land management in Bali.
2. Social Bonding, Balinese society has a strong and interconnected social structure. Utilization and management of customary land in Bali must consider the existing social relations in the community, including the rights and responsibilities of individuals and groups related to customary land.
3. National Law and Customary Law, Bali has a system of customary law that functions in parallel with national law. Formal law and customary law arrangements need to be wisely integrated to achieve justice in the use and management of customary land.
4. Development and Environment, Bali's economic development and construction also need to be considered in the context of customary land use. Environmental sustainability and the conservation of Bali's natural resources must be primary considerations in decision-making regarding customary land.

As an heirloom, the local community of the customary village has a deep understanding of the local physical and cultural resources that can be developed in the context of tourism. In the utilization and management of tourism resources, the responsibility of indigenous peoples is greater than that of non-indigenous peoples, because these activities have a direct impact on their lives. Therefore, indigenous peoples have a high moral responsibility to utilize the resources they have.

One of the main attractions in tourism investment in Bali is the local wisdom, cultural heritage preservation and nature-based tourism with the beauty of beaches, mountains, lakes, and stunning green rice fields. This attracts investors to make investments in the tourism sector in Bali by utilizing the beauty of natural resources, involving local communities, and highlighting unique selling points (USPs).

The situation motivates investors to allocate their capital in the tourism industry in Bali, such as establishing tourism infrastructure, hotels, villas, restaurants, and others. However, in the development process, there are some obstacles that become barriers, especially related to the availability of land or land to be used as the location for the construction of tourism facilities. In addition to the constraint of land availability, the researcher has conducted interviews with several informants as follows:

According to the statement of I Nyoman Rai as the Traditional Village Head Sub:

“Balinese people's concerns regarding the shift of customary land ownership to newcomers or investors. In addition, Balinese customary land that has changed its function caused changes. These changes can threaten the sustainability of local people's culture and life. The sale of customary land can lead to the loss of cultural heritage, reduced community involvement in local decision-making, and undesirable socio-economic changes”.

According to Gede Subawa, Secretary of the Kalibukbuk Traditional Village, it was stated that:

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“Balinese concerns over customary land go beyond monetary value, to its connections with Balinese cultural heritage and identity. Buyers of customary land for investment purposes, often expats or investors, may not have an emotional or historical connection to the local culture or traditions. This can lead to land use that is incongruent with local cultural values and potentially damaging to Balinese environmental and traditional sustainability”.

According to Ketut Suryawan as Village Head of Jumpai, he said that:

“Bali society's concern over the shifting of customary land ownership to outsiders could lead to the loss of local community control over land use and natural resource decision-making. This can disrupt the active participation and engagement of Balinese society in determining the direction of development and the preservation of their culture”.

According to I Komang Suartama as the Head of Baluk Traditional Village, it is stated that:

“The concerns of Balinese community, especially in Baluk traditional village, towards the influence of immigrant or investor population. Investment from outside or ownership by immigrant can cause changes in traditional cultural patterns. This can include changes in lifestyle patterns, values, and cultural practices that have been passed down from generation to generation. The increasing presence of new cultures can also shift local identities”.

According to I Made Sumawa as the Traditional Head of Beraban, he stated that:

“The issue of customary land ownership shifting from local Balinese towards newcomers or investors poses serious concerns that affect the identity, cultural sustainability, and well-being of the local community. Customary land is not simply a property asset, it is at the core of Balinese cultural heritage. Any shifts in ownership have detrimental ramifications. The change in customary land ownership can lead to changes in livelihood patterns, traditions, and cultural values that have been passed down through generations. The cultural identity of the Balinese community risks erosion with significant changes to their environment and daily life. Newcomers or investors may have different economic objectives than the needs and goals of the local community. This can lead to a diminished role for the Balinese community in decision-making processes related to the use of land and natural resources in their own region”.

According to Wayan Arta, the Bendesa Adat (Traditional Village Head) of Batur, he said that:

“Concerns over the changing function of customary land in Bali could alter the traditional cultural landscape. Locations with significant historical or cultural value may be revitalized for commercial or industrial purposes, leading to the loss of invaluable cultural and historical heritage. Conversion of customary land can also result in environmental degradation. Land previously preserved for specific purposes, such as traditional farming or natural conservation, may be diverted for developments that disrupt local ecosystems. Shifts in customary land ownership may also create socioeconomic imbalances between incoming migrants or investors and local communities. This could lead to disparities in economic status and resource access. In response to these concerns, it is crucial to maintain the original ownership and function of customary land while addressing the need for sustainable development. Strong regulations and legal protections for customary land, along with active community participation in decision-making, can be essential steps toward the future strengthening of villages”.

In the interview results, the information provided by Gede Subawa, Ketut Suryawan, I Komang Suartama, I Made Sumawa, and Wayan Arta regarding the Balinese people's concerns about the shifting of traditional land ownership, we can see several considerations that may be relevant to several theories of law and moral philosophy. Here is the analysis based on the theories of law used, among others:

1. Justice Theory (John Rawls)

Rawls emphasizes the principle of justice which involves a just social agreement. In this context, the concern of customary land tenure shift can be seen as an attempt to maintain social justice within the Balinese society, especially in relation to the sustainability of culture and identity.

2. Legal Certainty Theory (Gustav Radbruch)

Radbruch emphasizes the importance of legal certainty as an underlying principle of just law. Concerns about the shifting ownership of indigenous land can be interpreted as concerns about the stability of the law and the protection of traditional rights of the Balinese people.

3. Legal Systems Theory (Lawrence M Friedman)

Friedman argues that legal systems evolve from societal values. In this context, concerns over changing traditional cultural patterns can be seen as a response to the dissonance between Balinese societal values and outside investment that may erode their cultural heritage.

4. Legal Utilitarianism Theory (Jeremy Bentham)

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Bentham viewed justice from a utilitarian perspective, judging actions by their consequences. In this, the concern for the detrimental effects on Balinese cultural and environmental identity can be understood as promoting the overall happiness and well-being of the community.

The researcher concluded that from the information given by Balinese customary leaders and based on the analysis using the legal theory above, it reflects the complexity of issues of land ownership change of the customary land and it shows their attention to cultural values, justice and legal certainty.

V. CONCLUSIONS

Based on the description above, the Researcher can conclude that:

1. Tourism Development can be achieved well if the traditional village community can maintain the culture of the traditional village in Bali as "Local Wisdom" in Bali Province by involving the local community in its management and development because the local wisdom of Bali serves as the basic foundation underlying tourism development in Bali.
2. During the development process, the researchers encountered several obstacles, mainly related to the availability of land that will be used as the location for the construction of tourism facilities, as well as the community's concerns regarding the transfer of customary land ownership to investors and the concern that the use of customary land is not in accordance with local cultural values that have the potential to damage the environment and the sustainability of Balinese traditions because, in reality, customary land for the traditional village community in Bali is their identity and self-identity that has been passed down from generation to generation.

REFERENCES

- 1) Putra Pamayun, A.A Gde., 2018, *Ekonomi Kreatif Dan Kearifan Lokal Dalam Pembangunan Pariwisata Berkelanjutan Di Bali*, Universitas Pendidikan Nasional, Denpasar.
- 2) Samodro, 2018, “Upaya Meningkatkan Daya Saing Ekspor Produk UMKM Makanan dan Minuman Melalui Pengembangan Usaha dengan Berbasis pada Kearifan Lokal di Indonesia”, Dalam Prosiding: *Sembadha 2018 Seminar Hasil Pengabdian Kepada Masyarakat*, Vol.1, Edisi.1.
- 3) Rosidi Ajip, 2011, *Kearifan Lokal dalam Perspektif Budaya Sunda*, (Bandung: PT. Kiblat Buku Utama).
- 4) Zainuddin Ali, 2014, *Metode Penelitian Hukum*, (Jakarta: Penerbit Sinar Grafika).
- 5) Alting, Husein., 2010, *Dinamika Hukum Dalam Pengakuan Dan Perlindungan Hak Masyarakat Hukum Adat Atas Tanah-Masa Lalu, Kini dan Masa Mendatang*, (Yogyakarta: Laks Bang Pres Sindo bekerjasama dengan Lembaga Penerbitan Universitas Khairun Ternate, Maluku Utara).
- 6) Kuntjara Esther, 2006, *Penelitian Kebudayaan Sebuah Panduan Praktis*, (Jakarta; Graha Ilmu).
- 7) Jayanti, I Gusti Ngurah., Rupa, I Wayan., Sumarja, I Made., dan Rema, I Nyoman., 2022, “Nilai Kearifan Lokal Dalam Upaya Pelestarian Kebudayaan di Bali”, *Dharmasmrti: Jurnal Ilmu Agama & Kebudayaan*, Vol. 22, No. 2.
- 8) Purna, I Made., 2010, “Apresiasi Kearifan Lokal dalam Pembangunan Kebudayaan”, *Jurnal Jnana Budaya*, Edisi 15/VIII/2010.
- 9) Rahman Adytira Rachman, “Analisis SWOT sebagai Model Pengembangan Desa Wisata Berbasis Kearifan Lokal Bali Van Java”, *Jurnal Sains Manajemen dan Bisnis Indonesia*, Vol.10, No.2
- 10) Rideng, I Wayan., 2015, “Peran Majelis Desa Pakraman Dalam Penyelesaian Sengketa Antar Desa Pakraman di Bali”, *Disertasi*, Program Doktor Ilmu Hukum, Fakultas Hukum, Universitas Brawijaya, Malang.
- 11) Interview with I Nyoman Rai, Bendesa Adat, Traditional Village Subagan, Subdistrict Karangasem, Regency Karangasem, Province Bali, on 27 September 2023.
- 12) Interview with Gede Subawa, Sekretaris Desa Adat, Traditional Village Kalibukbuk, Subdistrict Buleleng, Regency Buleleng, Province Bali, on 07 November 2023.
- 13) Interview with Ketut Suryawan, Bendesa Adat, Traditional Village Jumpai, Subdistrict Klungkung, Regency Klungkung, Province Bali, on 17 Oktober 2023.
- 14) Interview with I Komang Suartama, Bendesa Adat, Traditional Village Baluk, Subdistrict Negara, Regency Jembrana, Province Bali, on 04 Oktober 2023.
- 15) Interview with I Made Sumawa, Bendesa Adat, Traditional Village Beraban, Subdistrict Kediri, Regency Tabanan, Province Bali, on 13 September 2023.
- 16) Interview with Wayan Asta, Bendesa Adat, Traditional Village Batur, Subdistrict Kintamani, Regency Bangli, Province Bali, on 07 November 2023.

Wellbeing in the Workplace: A Post Covid-19 Survey of Mental Health among Academic and Support Personnel



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ABSTRACT: This paper is a straightforward assessment of the mental health of the academic and support personnel in a university setting within the context of the post-era of the COVID-19 Pandemic. The study utilized a mental health questionnaire (Masanda, 2020) that covers a spectra of mental health functioning among adult individuals. Faculty members and academic support personnel across the 9 campuses of the National University Philippines participated in this study. Results yielded high scores which suggested that they were able to use various life skills effectively, able to work comfortably with other people, able to meet the demands of everyday life, have a healthy expression of emotions, generally optimistic, they tend to feel good about themselves, responsible, adaptable, assertive, and team players. Furthermore, there is no significant difference between the academic and support personnel in terms of their mental health ($t=2.04$, p value: 0.42). It can therefore be inferred that the academic setting among the participants provided an equal opportunity for their employees to flourish personally and grow professionally amidst the post-pandemic era. Pertinent recommendations about an institutionalized and comprehensive mental health program are put forth that are aimed to maintain a good, effective, and functioning mental health among its personnel.

KEYWORDS: Mental Health, Wellbeing, Academe, COVID-19, Psychosocial

Good mental health is an essential individual need that one must maintain (Shami, Tareh, & Taran, 2017). Thus, mental health is vital in maintaining an active life. It was found that during the Covid-19 pandemic, teachers suffered from mental health problems due to different socio-economic factors (Palma-Vasquez, Carrasco, & Hernando-Rodriguez, 2021). Although they found no direct causal relationship between socio-economic factors and mental health, they established that there is indeed a significant relationship. This poses an essential insight that mental health well-being should be viewed as a social issue that needs to be addressed by different institutions. Despite the wide range of academic and contextual approaches to mental health, current definitions of mental health share two characteristics. To begin, mental health is examined from a biopsychosocial perspective, which takes into account biological, psychological, and social variables. Second, mental health refers to a state of being free of mental illness. The World Health Organization, for example, defines mental health as “a condition of well-being in which every individual fulfills his or her own potential, can cope with the usual demands of life, can work successfully and fruitfully, and can contribute to her or his community” (World Health Organization, 2018). This concept aided significant progress in mental health research and practice by broadening the definition of mental health beyond the absence of mental illness to include the presence of positive characteristics (Torano et. al., 2020)

In the Philippines, many institutions are still not equipped to address mental health issues. Hence, there is a gap in the existing literature that shows comprehensive knowledge about mental health initiatives. This gap urged the researchers to investigate mental well-being, particularly from the perspective of academic employees. Mental health is truly one of the timely topics of the 21st century both at a national and global level. However, this doesn't always necessarily mean that it is correctly and meaningfully understood. It is quite the opposite as apparent to numerous engagements I have had in the past 4 years about this topic here in the country and abroad. In 2016 (updated in July 2017), Magtubo reported some elucidation about the status of mental health in the Philippines by the numbers. Firstly, mental health illnesses are the third most common form of morbidity for Filipinos. That is around 1.4 million people with identified disabilities showed that mental disability accounts for 14 percent of all disabilities. In this number, one in five people suffers from a mental health problem. In terms of governmental response, only 5% of the total budget of the Department of

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Health is allocated for mental health. With a population of over 100 million, there are only 700 psychiatrists and a thousand psychiatric nurses.

Between 17 to 20 percent of Filipino adult experience psychiatric disorders, while 10 to 15 percent of Filipino children, aged 5 to 15, suffer from mental health problems. In the NSO (now PSA) study, 88 cases of mental health problems were reported for every 100,000 Filipinos. According to the latest numbers from the new Philippine Health Information System on Mental Health (PHIS-MH), schizophrenia is the top mental health problem in the Philippines, affecting 42 percent of the study cohort. Most of them were male. Other mental health disorders in the list are depression, anxiety disorder, schizoaffective disorder, acute and transient disorder, and stimulant-related disorder. This survey included 2,562 patients in 14 participating public and private hospitals from May 2014 to May 2016. The PHIS-MH was conducted to collect data on mental health in the Philippines as a tool to put together a mental healthcare database in the country. During the typhoon Yolanda calamity in 2013, 800,000 Filipinos suffered from depression, anxiety disorder, and post-traumatic stress disorder. Overall, the most common mental health disorder in the country are schizophrenia (1% of the total population mainly from 22-44 age group), substance abuse disorder (96.74% were methamphetamine hydrochloride, 24.94% were marijuana, and 1.11% were cocaine), post-traumatic stress disorder (roughly recurring yearly due to natural calamities), and depression (mainly due to poor socioeconomic status) which is the leading cause of suicide. Suicide is another creeping problem in the Philippines. In 2012, 2,558 Filipinos committed suicide, and of the number, 2,009 were males.

Fairly recently, the Philippine Mental Health Law (R.A. 11036), after its long and winding battles in the houses and senate, was finally enacted in June 2018. It is an act "establishing a national mental health policy for the purpose of enhancing the delivery of integrated mental health services, promoting and protecting the rights of persons utilizing psychiatric, neurologic and psychosocial health services". There are four components of the Mental Health Law: it secures the rights and welfare of mental health professionals and persons with mental needs; it provides mental health services in hospitals and barangay; aims for an improved mental health facility; and to integrate mental health education in schools and workplaces. Lastly, through the Mental Health Law, PhilHealth coverage for mental health diseases has been expanded to outpatient checkups and medicines. Indeed, through this legislation, mental health in the Philippines is having a bright future for all the Filipinos.

Not all countries across the globe have legislative enactment of mental health in their legal system. In fact, in the Southeast Asian region, only the Philippines has, thus far, a law specifically for the uplift of its citizens' mental health. Though it is not entirely a requirement to legislate on this cause, doing so could curb various issues and challenges that relate to people's mental health. Here is a rundown of the global cases and statistics about mental health and related conditions: mental illness is the most neglected health problem in the developing world (Banis, 2019). Based on the World Health Organization (WHO) data, Ritchie & Roser (2018) reported the following: they predicted that by 2030, mental disorders will account for 13% of the total global burden of diseases; around 1-in-6 people globally (15-20 percent) have one or more mental or substance use disorders; the largest number of people had an anxiety disorder, estimated at around 4 percent of the population. Further, mental health disorders are more common in women. Education & employment are strongly linked to mental health. The prevalence of mental health disorders has not significantly increased in the last 26 years. Global statistics on mental health are poorly defined, measured, and understood (Ritchie, 2019). Truly, issues in mental health are still a global concern and much work to advocate for it is most definitely needed. Until it becomes an active part of everyone's support and embedded in our collective consciousness, mental health will remain to be an elusive psychological, social, cultural, and political issue.

Given this information, this study aims to explore the wellbeing in the academe through the National University's academic employees as a post COVID-19 psychosocial response for the promotion of mental health. The researchers utilized a quantitative research approach using a questionnaire: a 50-item Mental Health Questionnaire (Masanda, 2020) with an internal reliability index of 0.88 designed to measure wellbeing (in 10 dimensions) among adult professionals using a 7-point Likert scale. A total of 167 employees across the 9 campuses of the National University Philippines participated in this study through online survey. Data were analyzed using descriptive statistics and t-test to assess significant differences.

RESULTS AND DISCUSSION

This paper generates novel information regarding the experiences of the academic and support personnel of the National University Philippines in relevance to their psychological or mental health. The results provide deeper understanding on the different factors that may have affected the psychological well-being of academic and non-academic employees alike inside the university.

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These results can assist employees in gaining further understanding of their own experiences about their work engagement which affects their mental health status.

Table 1. Frequency of the participants per area of functioning of the mental health spectrum.

Scores	Percentage	Verbal Interpretations
1.00 – 2.70	1%	<i>Poor</i> Diminished sense of wellbeing and that your mental health, in general, might be suffering
2.71 – 5.25	20%	<i>Fair</i> Reasonable sense of wellbeing and your overall mental health is properly functioning
5.26 – 7.00	79%	<i>Good</i> Worthy sense of wellbeing and your mental health in total is thriving and enable you to function fully and optimally.

Based on table 1, many NU Philippines employees experience a *good* level of mental health and are functional. This indicates that they feel a variety of good feelings, including joy, happiness, love, and fulfillment. They also feel as though their lives have meaning and purpose. On the other hand, they can feel unpleasant emotions like grief, rage, and worry, but they also know how to control them. They do not allow these feelings to rule them or direct their actions.

In terms of relational capacities, they have solid, wholesome connections with other people. Their friends and family make them feel loved and supported. While at the same time, they are conscious of their own feelings, ideas, and actions. They can recognize how their emotions and thoughts influence their actions. On a general sense, they have the capacity to overcome obstacles and overcome failures. They refuse to let adversity define them. Both their physical and emotional wellbeing are taken care of. They seem to consume wholesome foods, get enough rest, and engage in regular exercise. In totality, they are active in their relationships, interests, and jobs. They believe that they are changing the world.

Table 2. Summary of scores of the participants per domain of the mental health spectrum.

Domains	Mean	SD	Verbal Interpretation
Uses life skills	5.79	0.89	High
Being comfortable with other people	5.79	0.81	High
Meeting the demands of everyday life	5.54	0.94	High
Healthy expression of emotions	5.48	0.85	High
General optimism	5.97	0.82	High
Feeling good about oneself	5.91	0.86	High
Uses "I message"	5.14	0.68	High Average
Adaptability	5.48	1.01	High
Assertiveness	5.50	0.78	High
Being a team player	5.82	0.77	High
Overall Mental Health	5.64	0.84	High

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In a more specific terms, table 2 shows that they are aware of their strengths and areas for improvement. Before selecting a choice, they consider the advantages and disadvantages of several possibilities. When faced with a task, they persevere. They are resourceful and relentless in their search for answers. They can perceive things from several angles and generate fresh concepts. They are kind and considerate of others and they have faith in themselves and are optimistic about the future. They are empathetic and eager to lend a hand while being able to maintain their own wants and set limits. They have effective coping mechanisms in place to handle trying circumstances and can set priorities for their work and adhere to deadlines.

Table 3. Summary of the scores of the participants in terms of area of work in the mental health spectrum.

Participants	Mean	SD	Verbal Interpretation
Academic Support Personnel	5.55	0.92	High
Faculty Members	5.71	0.55	High

Table 3 presents the level of well-being in the mental health spectrum between the teaching and non-teaching personnel of the National University Philippines. It shows that the Faculty Members ($M = 5.7, S = .55$) of the National University Philippines have a higher score in the mental health questionnaires than the Academic Support Personnel ($M = 5.5, D = .92$). Similarly, the Faculty Members have lower variances in terms of their responses in the mental health questionnaire. However, both set of personnel shows a good, functioning, and effective sense of well-being. As it suggests, teaching and non-teaching personnel performs their jobs with a “high” level of well-being.

Table 4. Test of difference of the participants’ scores in terms of area of work in the mental health spectrum.

T-Test: Two-Sample assuming unequal variances		
	<i>Academic Support Personnel</i>	<i>Faculty Members</i>
Mean	5.545217391	5.713636364
Variance	0.846662451	0.302358562
Observations	23	44
Hypothesized Mean Difference	0	
Df	30	
t Stat	-0.805812145	
P(T<=t) two-tail	0.426692618	
t Critical two-tail	2.042272456	

The results indicate that the Mental Health Scores of Academic Support Personnel and Faculty Members of the National University Philippines had no significant difference with the p-value level of .43. This means that the level of wellbeing of both personnel are not different from one another. In a more specific terms of their mental health in the work setting, both they have an ability to receive, assimilate, understand, and regulate one’s own emotions and those of others. They have the capacity to manage and repair of the emotions that arise in the work context, as well as an understanding of social situations at the workplace of these professionals.

Mental health among many sectors has become a growing concern. With the adverse effect of different social factors and the Covid-19 pandemic, many institutions are faced with various mental health problems that affect their employees (Barona et.al., 2020). Despite the increasing concern for mental health problems among academicians and even students, and the lack of an institutionalized comprehensive mental health program as a response to address such issues, both personnel tend to be more satisfied in their sphere of work as can be reflected from these results.

Other factors that could further affect employees’ mental health as can be inferred from the results of the study include task management, working time, services available, personal conflict, job security, and healthcare provision. These psychosocial factors are conceived as the conditions present in work situations related to the organization of work, the environment, the type of position, and the tasks to be carried out, which all affect the development of both work and mental health (Musilek, 2019). These factors therefore seem to facilitate the quality of working life and personal development of the personnel.

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As a future trend in this line of study, this paper emphasizes that research must not only be the evaluation and management of the psychosocial risks, but also the application and development of policies of good organizational practices to avoid the appearance of burnout and the costs it brings with it. Any intervention must be supported by a theoretical foundation and scientific evidence. Hence, it is highly recommended that the National University Philippines craft and design a comprehensive mental health program contextualized within the needs of the employees. The said program must include an informative module preventing burnout syndrome and encouraging the development of professional and personal skills and competences of both academic and support personnel.

REFERENCES

- 1) Barona, E. G., Molina, M. G., Gomez, A. G., Manso, J.M., & Baamonde, M.E. (2020). Quality of working life, psychosocial factors, burnout syndrome and emotional intelligence. *Int. J. Environ. Res. Public Health*, 17(24), 9550; <https://doi.org/10.3390/ijerph17249550>
- 2) Banis, D. (2019). *Mental illness as the most neglected disease in third-world countries*. <https://www.forbes.com/sites/davidebanis/2019/01/24/mental-illness-is-the-most-neglected-health-problem-in-the-developing-world/#f377ebb1db41>
- 3) Chan, C. M. H., Ng, S. L., In, S., Wee, L. H., & Siau, C. S. (2021). Predictors of Psychological Distress and Mental Health Resource Utilization among Employees in Malaysia. *International Journal of Environmental Research and Public Health*, 18(1), 314. <https://doi.org/10.3390/ijerph18010314>
- 4) Hackett A, Strickland K (2018) *Using the framework approach to analyse qualitative data: a worked example*. Nurse Researcher. doi:10.7748/nr.2018.e1580
- 5) Masanda, A. B. (2020). *Mental health – same world, different view: A practical guide towards a flourishing wellbeing*. Rizal: Jenher Publishing House, Inc.
- 6) Magtubo, C.A. (2016, updated July 2017). *Mental health in the Philippines: By the numbers*. <https://today.mims.com/mental-health-in-the-philippines--by-the-numbers>
- 7) Musilek, J. (2019). The top 7 workplace factors that impact employee health. <https://www.greatplacetowork.com/resources/blog/the-top-7-workplace-factors-that-impact-employee-health>
- 8) Palma-Vasquez, C., Carrasco, D., & Hernando-Rodriguez, J. C. (2021). Mental Health of Teachers Who Have Teleworked Due to COVID-19. *European Journal of Investigation in Health, Psychology and Education*, 11(2), 515–528. <https://doi.org/10.3390/ejihpe11020037>
- 9) Ritchie, H. (2019). *5 facts about global mental health*. <https://www.weforum.org/agenda/2018/06/global-mental-health-five-key-insights-which-emerge-from-the-data>
- 10) Ratanasiripong, P., China, T., Ratanasiripong, N. T., & Toyama, S. (2020). Resiliency and mental health of school teachers in Okinawa. *Journal of Health Research*, 35(6), 470–481. <https://doi.org/10.1108/jhr-11-2019-0248>
- 11) Rath, T. & Harter, J. (2010). *Your career well-being and your identity*. <https://news.gallup.com/businessjournal/127034/career-wellbeing-identity.aspx>
- 12) Ritchie, H. & Roser, M. (2018). *Mental health*. <https://ourworldindata.org/mental-health>
- 13) Shami, R., Tareh, M., & Taran, H. (2017). Identifying the relationship among teacher's mental health and emotional intelligence and their burnout. *Independent Journal of Management & Production*, 8(1), 124–143. <https://doi.org/10.14807/ijmp.v8i1.513>
- 14) Torrano, D. H., Ibrayeba, L., Sparks, J. Lim, N., Clementi, A., Almukambetova, A., Nurtayev, Y., & Muratkyzy A. (2020). Mental health and well-being of university students: a bibliometric mapping of the literature. *Front Psychology*, 11:1226. doi: 10.3389/fpsyg.2020.0122
- 15) World Health Organization. (2018). *Mental health: Strengthening our response*. <https://www.who.int/en/news-room/fact-sheets/detail/mental-health-strengthening-our-response>



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Coefficient Estimate for a Subclass of Close-to-Convex Functions with Respect To Symmetric and Conjugate Points Connected With the Q–Borel Distribution



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ABSTRACT: The main purpose of this paper is to introduce a new subclass of close-to-convex functions in the open unit disc \mathbb{U} , denoted by $\kappa^{\alpha, \tau, q}(A, B)$ with respect to symmetric and conjugate points by applying a q -analogue of the familiar Borel distribution (BD), which is a subclass of all functions that are analytic, univalent and normalized by the conditions $f(0) = 0$ and $f'(0) = 1$. We find estimates $|a_2|$, $|a_3|$, $|a_4|$ and $|a_5|$ for Taylor-Maclaurin coefficients of the functions in the subclass introduced, and a brief discussion is also given to the pertinent relationship between these classes and the famous Fekete- Szegő theorem for $|a_3 - \mu a_2^2|$ and $|a_2 a_4 - a_3^2|$. Also, we deduce various corollaries and consequences of the main results when $q \rightarrow 1^-$. We find the sufficient condition for a function $f(z)$ to be in the class $\kappa_S^{\alpha, \tau, q}(A, B)$ and $\kappa_C^{\alpha, \tau, q}(A, B)$.

KEYWORDS-Analytic functions; Univalent functions; Coefficient estimates; Symmetric points; Conjugate points.

1. INTRODUCTION

Let \mathcal{A} be the class of functions f which are analytic, univalent and normalized with $f(0) = 0$ and $f'(0) = 1$, the function f is given by

$$f(z) = z + \sum_{j=2}^{\infty} a_j z^j, \quad z \in \mathbb{U}, \tag{1.1}$$

where

$$\mathbb{U} = \{z \in \mathbb{C} : |z| < 1\},$$

is the unit disc. Also, the function $g \in \mathcal{A}$ is given by

$$g(z) = z + \sum_{j=2}^{\infty} b_j z^j, \quad z \in \mathbb{U}. \tag{1.2}$$

Therefore, the functions $f(z)$ and $g(z)$ have a convolution (or Hadamard product), which is given by

$$f(z) * g(z) = (f * g)(z) = z + \sum_{j=2}^{\infty} a_j b_j z^j, \quad z \in \mathbb{U}. \tag{1.3}$$

Consider Ω to be the family of functions $w(z)$ which are analytic in \mathbb{U} and defined as follows $\Omega = \{w \in \mathcal{A} : w(0) = 0 \text{ and } |w(z)| < 1, z \in \mathbb{U}\}$. $\tag{1.4}$

Assume that $f(z), g(z) \in \mathcal{A}$, we say that f is subordinate to g (written $f(z) \prec g(z)$) if there exists a Schwarz function $w(z)$, analytic such that

$$f(z) = g(w(z)) \quad (z \in \mathbb{U}).$$

In particular, if the function $g(z)$ is univalent in \mathbb{U} , then the subordinate is equivalent to (see [2, 13])

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$$f(0) = g(0) \text{ and } f(\mathcal{U}) \subset g(\mathcal{U}). \quad (1.5)$$

Definition 1. [10] For A and B are arbitrarily fixed numbers and that $(-1 \leq B < A \leq 1)$, denote the family by $P[A, B]$ containing functions of the form

$$P(z) = 1 + \sum_{j=1}^{\infty} p_j z^j. \quad (1.6)$$

is analytic in \mathcal{U} and then

$$P(z) < \frac{1 + Az}{1 + Bz} \text{ or } P(z) = \frac{1 + Aw(z)}{1 + Bw(z)}, (z \in \mathcal{U}) \quad (1.7)$$

holds.

In the year 1973, Janowski [10] introduced the following subclass of starlike functions:

$$S^*(A, B) := \left\{ f : f \in \mathcal{A} \text{ and } \frac{zf'(z)}{f(z)} < \frac{1 + Az}{1 + Bz} \right\},$$

for $(-1 \leq B < A \leq 1; z \in \mathcal{U})$.

On the other hand, in 1959, Sakaguchi [19] introduced the class of starlike functions with respect to symmetric points as follows:

$$S_s^* := \left\{ f : f \in \mathcal{A} \text{ and } \Re \left(\frac{zf'(z)}{f(z) - f(-z)} \right) > 0; z \in \mathcal{U} \right\}.$$

Goel and Mehrotra [8] introduced the subclass $S_s^*(A, B)$ of class S_s^* as follows:

$$S_s^*(A, B) := \left\{ f : f \in \mathcal{A} \text{ and } \frac{2zf'(z)}{f(z) - f(-z)} < \frac{1 + Az}{1 + Bz} \right\}$$

for $(-1 \leq B < A \leq 1; z \in \mathcal{U})$.

El-Ashwah and Thomas [4] introduced the class of starlike functions with respect to conjugate points as follows:

$$S_c^* := \left\{ f : f \in \mathcal{A} \text{ and } \Re \left(\frac{zf'(z)}{f(z) + \overline{f(\bar{z})}} \right) > 0; z \in \mathcal{U} \right\}.$$

Many authors introduced the analogue definitions by extension as follows (see [3]):

$$S_c^*(A, B) := \left\{ f : f \in \mathcal{A} \text{ and } \frac{2zf'(z)}{f(z) + \overline{f(\bar{z})}} < \frac{1 + Az}{1 + Bz}; z \in \mathcal{U} \right\}.$$

Since $S_c^*(A, B)$ is the subclass of starlike functions with respect to conjugate points. More results can be found in [21, 22, 23] on starlike functions with respect to symmetric and conjugate points. In 1952, Kaplan [12] introduced the class of close-to-convex functions as follows

$$\kappa := \left\{ f : f \in \mathcal{A} \text{ and } \Re \left(\frac{zf'(z)}{g(z)} \right) > 0; z \in \mathcal{U} \right\}.$$

Let $\kappa_s(A, B)$ be the class of close-to-convex functions with respect to symmetric point (see [11])

$$\kappa_s(A, B) := \left\{ f : f \in \mathcal{A} \text{ and } \frac{2zf'(z)}{g(z) - g(-z)} < \frac{1 + Az}{1 + Bz}; (-1 \leq B < A \leq 1; z \in \mathcal{U}) \right\}, \quad (1.8)$$

where $g(z) = z + \sum_{j=2}^{\infty} b_j z^j \in S_s^*(A, B)$. (1.9)

Let $\kappa_c(A, B)$ be the class of close-to-convex functions with respect to conjugate point (see [27]) when $\alpha = 0$

$$\kappa_c(A, B) := \left\{ f : f \in \mathcal{A} \text{ and } \frac{2zf'(z)}{g(z) + \overline{g(\bar{z})}} < \frac{1 + Az}{1 + Bz}; (-1 \leq B < A \leq 1; z \in \mathcal{U}) \right\},$$

(1.10)

where $g(z) = z + \sum_{j=2}^{\infty} b_j z^j \in S_c^*(A, B)$. (1.11)

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Huo Tang and Guan-Tie Deng [27] introduced new subclasses of close-to-convex and quasiconvex functions with respect to symmetric and conjugate points. Such probability distributions as the Logarithmic, the Binomial, the Poisson, the Pascal, and other distributions have recently appeared in different contexts in the Geometric Function Theory of Complex Analysis mainly from a theoretical viewpoint (see [1, 5, 15, 17]). Recently, Wanas and Khuttar [28] have presented the Borel distribution (BD) whose probability mass function is given as follows:

$$\text{Prob}\{x = \rho\} = \frac{(\rho\tau)^{\rho-1} e^{-\rho\tau}}{\rho!} \quad (\rho = 1, 2, 3, \dots).$$

Recall that if a discrete random variable x takes on the values $1, 2, 3, \dots$ with the following probabilities, it is said to have a Borel distribution:

$$\frac{e^{-\tau}}{1!}, \frac{2\tau e^{-2\tau}}{2!}, \frac{9\tau^2 e^{-3\tau}}{3!}, \dots \quad (1.12)$$

respectively, where τ is the parameter involved.

Wanas and Khuttar [28] also introduced the following series $\mu(\tau; z)$ whose coefficients are probabilities of the Borel distribution (BD):

$$\begin{aligned} \mu(\tau, z) &:= z + \sum_{j=2}^{\infty} \frac{[\tau(j-1)]^{j-2} e^{-\tau(j-1)}}{(j-1)!} z^j, \\ &:= z + \sum_{j=2}^{\infty} \varphi_j(\tau) z^j \quad (0 < \tau \leq 1), \end{aligned}$$

where, for convenience,

$$\varphi_j(\tau) := \frac{[\tau(j-1)]^{j-2} e^{-\tau(j-1)}}{(j-1)!}.$$

We now recall the following linear operator $\mathcal{Q}(\tau; z)$ for functions $f: \mathcal{A} \rightarrow \mathcal{A}$ (see [6, 14, 25]): as follows:

$$\begin{aligned} \mathcal{Q}(\tau; z)f(z) &= \mu(\tau; z) * f(z) \\ &= z + \sum_{j=2}^{\infty} \frac{[\tau(j-1)]^{j-2} e^{-\tau(j-1)}}{(j-1)!} a_j z^j \quad (0 < \tau \leq 1). \end{aligned} \quad (1.13)$$

We now recall several concepts and notations of the classical q -calculus, which is primarily inspired by the work of Srivastava [24], who employed a variety of operators of q -calculus and fractional q -calculus. First, the q -Pochhammer symbol $(\tau; q)_n$ is defined, for $\tau, q \in \mathbb{C}$ and $n \in \mathbb{N}_0 := \mathbb{N} \cup \{0\}$, by

$$(\tau; q)_n = \begin{cases} 1 & (n = 0) \\ (1 - \tau)(1 - \tau q) \dots (1 - \tau q^{n-1}) & (n \in \mathbb{N}) \end{cases} \quad (1.14)$$

and

$$(\tau; q)_{\infty} = \prod_{j=0}^{\infty} (1 - \tau q^j) \quad (|q| < 1).$$

According to the q -gamma function $\Gamma_q(z)$ defined by (see [7])

$$\Gamma_q(z) = (1 - q)^{1-z} \frac{(q; q)_{\infty}}{(q^z; q)_{\infty}} \quad (|q| < 1; z \in \mathbb{C}),$$

it is easily seen from (1.14) that

$$(q^{\tau}; q)_n = \frac{(1 - q)^n \Gamma_q(\tau + n)}{\Gamma_q(\tau)} \quad (n \in \mathbb{N}_0)$$

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The q -gamma function $\Gamma_q(z)$ is known to satisfy the following recurrence relation:

$$\Gamma_q(z+1) = [z]_q \Gamma_q(z),$$

where $[r]_q$ denotes the basic (or q -) number defined as follows:

$$[r]_q = \begin{cases} \frac{1-q^r}{1-q} & (r \in \mathbb{C}) \\ 1 + \sum_{j=1}^{n-1} q^j & (n \in \mathbb{N}) \end{cases}$$

(1.15) Using the definition (1.15), the q -factorial $[n]_q!$ is given by

$$[n]_q! := \begin{cases} 1 & (n = 0) \\ \prod_{j=1}^n [j]_q & (n \in \mathbb{N}) \end{cases}$$

For $\tau \in \mathbb{C}$, we shall also make use of the following notation for the basic (or q -) Pochhammer symbol defined above in (1.14):

$$(q^\tau; q)_n = \begin{cases} 1 & (n = 0) \\ (1-q^\tau)(1-q^{\tau+1}) \dots (1-q^{\tau+n-1}) & (n \in \mathbb{N}) \end{cases}$$

and, for convenience, we write

$$[\tau]_{q,n} := \begin{cases} 1 & (n = 0) \\ \frac{(q^\tau; q)_n}{(1-q)^n} = \prod_{j=1}^n [\tau+j-1]_q & (n \in \mathbb{N}). \end{cases}$$

(1.16)

in terms of the q -numbers $[r]_q$ defined by (1.15). Clearly, from the definition (1.16), it is easy to see for the familiar Pochhammer symbol $(\tau)_n$ that

$$\lim_{q \rightarrow 1^-} \{[\tau]_{q,n}\} = \lim_{q \rightarrow 1^-} \left\{ \frac{(q^\tau; q)_n}{(1-q)^n} \right\} = (\tau)_n$$

and, for the classical (Euler's) gamma function $\Gamma(z)$, we have

$$\lim_{q \rightarrow 1^-} \{\Gamma_q(z)\} = \Gamma(z).$$

For $0 < q < 1$ and the function $Q(\tau; z)f(z)$ given by (1.13), when we apply the q -derivative operator D_q defined by (see [9] and [18])

$$D_q(f(z)) := \begin{cases} \frac{f(z) - f(qz)}{1-q} & (0 < q < 1) \\ f'(z) & (q \rightarrow 1^-), \end{cases}$$

we get

$$\begin{aligned} D_q(Q(\tau; z)f(z)) &:= \frac{Q(\tau; z)f(z) - Q(\tau; z)f(qz)}{(1-q)z} \\ &= 1 + \sum_{j=2}^{\infty} [j]_q \frac{[\tau(j-1)]^{j-2} e^{-\tau(j-1)}}{(j-1)!} a_j z^{j-1} \quad (0 < \tau \leq 1; z \in \mathbb{U}), \end{aligned}$$

where the function $f(z)$ is given by (1.1).

Definition 2. [26] For $\alpha > -1$ and $0 < q < 1$, the linear operator $Q_\tau^{\alpha,q}$ for functions $f: \mathcal{A} \rightarrow \mathcal{A}$ is defined as follows:

$$Q_\tau^{\alpha,q} f(z) * \mathcal{N}_{q,\alpha+1}(z) = z D_q(Q(\tau; z)f(z)) \quad (z \in \mathbb{U}),$$

where the function $\mathcal{N}_{q,\alpha+1}$ is given by

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$$\mathcal{N}_{q,\alpha+1}(z) := z + \sum_{j=2}^{\infty} \frac{[\alpha + 1]_{q^{j-1}}}{[j - 1]_q!} z^j \quad (z \in \mathbb{U}).$$

A simple computation shows that

$$\begin{aligned} \mathcal{Q}_\tau^{\alpha,q} f(z) &:= z + \sum_{j=2}^{\infty} \frac{[j]_q! [\tau(j - 1)]^{j-2} e^{-\tau(j-1)}}{[\alpha + 1]_{q^{j-1}} (j - 1)!} a_j z^j \\ &= z + \sum_{j=2}^{\infty} \delta_j a_j z^j \quad (0 < \tau < 1; \alpha > -1; 0 < q < 1; z \in \mathbb{U}), \end{aligned}$$

(1.17)

where

$$\delta_j = \frac{[j]_q! [\tau(j - 1)]^{j-2} e^{-\tau(j-1)}}{[\alpha + 1]_{q^{j-1}} (j - 1)!}. \quad (1.18)$$

We also note that

$$\delta_2 = \frac{[2]_q! e^{-\tau}}{[\alpha + 1]_{q,1}} \text{ and } \delta_3 = \frac{[3]_q! \tau e^{-2\tau}}{[\alpha + 1]_{q,2}}. \quad (1.19)$$

From the equation (1.17), we can easily verify that each of the following relations holds true for all $f \in \mathcal{A}$:

$$[\alpha + 1]_q \mathcal{Q}_\tau^{\alpha,q} f(z) = [\alpha]_q \mathcal{Q}_\tau^{\alpha+1,q} f(z) + q^\alpha z D_q \left(\mathcal{Q}_\tau^{\alpha+1,q} f(z) \right), z \in \mathbb{U}$$

and

$$\begin{aligned} \mathcal{R}_\tau^\alpha f(z) &:= \lim_{q \rightarrow 1^-} \{ \mathcal{Q}_\tau^{\alpha,q} f(z) \} = z + \sum_{j=2}^{\infty} \frac{j [\tau(j - 1)]^{j-2} e^{-\tau(j-1)}}{(\alpha + 1)_{j-1}} a_j z^j \\ &= z + \sum_{j=2}^{\infty} \Omega_j a_j z^j \quad (z \in \mathbb{U}), \end{aligned}$$

where

$$\Omega_j = \frac{j [\tau(j-1)]^{j-2} e^{-\tau(j-1)}}{(\alpha+1)_{j-1}}. \quad (1.20)$$

Definition 3. A function $f \in \mathcal{A}$ is said to be in the class $\kappa_s^{\alpha,\tau,q}(A, B)$ if and only if

$$\left(\frac{2z \left(\mathcal{Q}_\tau^{\alpha,q} f(z) \right)'}{\mathcal{Q}_\tau^{\alpha,q} g(z) - \mathcal{Q}_\tau^{\alpha,q} g(-z)} \right)' < \frac{1 + Az}{1 + Bz} \quad (1.21)$$

$(-1 \leq B < A \leq 1; 0 < \tau \leq 1; \alpha > -1; 0 < q < 1)$.

Upon letting $q \rightarrow 1^-$ in the class $\kappa_s^{\alpha,\tau,q}(A, B)$, we have

$$\lim_{q \rightarrow 1^-} \{ \kappa_s^{\alpha,\tau,q}(A, B) \} = \mathcal{G}_s^{\alpha,\tau}(A, B),$$

where

$$\mathcal{G}_s^{\alpha,\tau}(A, B) := \left\{ f: f \in \mathcal{A} \text{ and } \frac{2z \left(\mathcal{R}_\tau^\alpha f(z) \right)'}{\mathcal{R}_\tau^\alpha g(z) - \mathcal{R}_\tau^\alpha g(-z)} < \frac{1 + Az}{1 + Bz} \right\}$$

(1.22)

for $(-1 \leq B < A \leq 1; 0 < \tau \leq 1; \alpha > -1)$.

Definition 4. A function $f \in \mathcal{A}$ is said to be in the class $\kappa_c^{\alpha,\tau,q}(A, B)$ if and only if

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$$\left(\frac{2z \left(Q_{\tau}^{\alpha,q} f(z) \right)'}{Q_{\tau}^{\alpha,q} g(z) + Q_{\tau}^{\alpha,q} g(\bar{z})} \right) < \frac{1 + Az}{1 + Bz} \tag{1.23}$$

$(-1 \leq B < A \leq 1; 0 < \tau \leq 1; \alpha > -1; 0 < q < 1)$, if we let $q \rightarrow 1^-$ in the class $\kappa_c^{\alpha,\tau,q}(A, B)$, we have

$$\lim_{q \rightarrow 1^-} \{ \kappa_c^{\alpha,\tau,q}(A, B) \} = \mathcal{G}_c^{\alpha,\tau}(A, B),$$

where

$$\mathcal{G}_c^{\alpha,\tau}(A, B) := \left\{ f: f \in \mathcal{A} \text{ and } \frac{2z \left(\mathcal{R}_{\tau}^{\alpha} f(z) \right)'}{\mathcal{R}_{\tau}^{\alpha} g(z) + \mathcal{R}_{\tau}^{\alpha} g(\bar{z})} < \frac{1 + Az}{1 + Bz} \right\}$$

(1.24)

for $(-1 \leq B < A \leq 1; 0 < \tau \leq 1; \alpha > -1)$.

2. SOME PRELIMINARY LEMMAS

The following lemmas will be needed to prove our results.

Lemma 1. (see [8], Lemma 2) If $P(z)$ is given by

$$P(z) = 1 + p_1 z + p_2 z^2 + p_3 z^3 + \dots \in P[A, B],$$

then

$$|p_n| \leq A - B \quad (n \in \mathbb{N}, -1 \leq B < A \leq 1).$$

(2.1)

For the coefficient inequalities of the classes $M_s(\alpha, A, B)$ and $M_c(\alpha, A, B)$ is given by (see [20])

Lemma 2. ([20], Theorem 3.1) Let $g(z) = z + \sum_{j=2}^{\infty} b_j z^j \in M_s(\alpha, A, B)$. Then for $n \geq 1, 0 \leq \alpha \leq 1$

$$|b_{2n}| \leq \frac{(A - B)}{n! 2^n (1 + (2n - 1)\alpha)} \prod_{j=1}^{n-1} (A - B + 2j),$$

and

$$|b_{2n+1}| \leq \frac{(A - B)}{n! 2^n (1 + 2n\alpha)} \prod_{j=1}^{n-1} (A - B + 2j).$$

Lemma 3. ([20], Theorem 3.2) Let $g(z) = z + \sum_{j=2}^{\infty} b_j z^j \in M_c(\alpha, A, B)$. Then for $n \geq 1, 0 \leq \alpha \leq 1$

$$|b_{2n}| \leq \frac{(A - B)}{(2n - 1)! (1 + (2n - 1)\alpha)} \prod_{j=1}^{2n-2} (A - B + j),$$

and

$$|b_{2n+1}| \leq \frac{(A - B)}{(2n)! (1 + 2n\alpha)} \prod_{j=1}^{2n-1} (A - B + j).$$

Note: Using the techniques used by A.T. Oladipo [16], we prove the next result below.

3. MAIN RESULT

In this section we give the coefficient inequalities for classes $\kappa_s^{\alpha,\tau,q}(A, B)$ and $\kappa_c^{\alpha,\tau,q}(A, B)$.

Theorem 1. Let $f(z) \in \kappa_s^{\alpha,\tau,q}(A, B)$. Then, for all $n \geq 1$,

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$$\begin{aligned}
 |a_2| &\leq \frac{(A - B)}{2\delta_2}, \\
 |a_3| &\leq \frac{(A - B)(2 + \delta_3)}{3! \delta_3}, \\
 |a_4| &\leq \frac{(A - B)[3(2 + \delta_3(A - B))]}{4! \delta_4}
 \end{aligned}
 \tag{3.1}$$

and

$$|a_5| \leq \frac{(A - B)[4(2 + \delta_3(A - B)) + \delta_5(A - B + 2)]}{40\delta_5}$$

Proof. Since $g(z) \in S_s^+(A, B)$, then we have from Lemma 2 when $\alpha = 0$

$$|b_2| \leq \frac{A - B}{2}, \quad |b_3| \leq \frac{A - B}{2}
 \tag{3.2}$$

$$|b_4| \leq \frac{(A-B)(A-B+2)}{8}, \quad |b_5| \leq \frac{(A-B)(A-B+2)}{8}$$

Since $f(z) \in \kappa_s^{\alpha, \tau, q}(A, B)$, it follows from (1.21) by using Equation (1.6)

$$\left(2z(Q_\tau^{\alpha, q} f(z))'\right) = (Q_\tau^{\alpha, q} g(z) - Q_\tau^{\alpha, q} g(-z)) \left(1 + \sum_{j=1}^{\infty} p_j z^j\right) \quad (0 < \tau \leq 1; \alpha > -1; 0 < q < 1).
 \tag{3.3}$$

It follows that

$$\begin{aligned}
 &z + 2\delta_2 a_2 z^2 + 3\delta_3 a_3 z^3 + 4\delta_4 a_4 z^4 + 5\delta_5 a_5 z^5 + \dots + 2n\delta_{2n} a_{2n} z^{2n} + (2n + 1)\delta_{2n+1} a_{2n+1} z^{2n+1} + \dots \\
 &= (z + \delta_3 b_3 z^3 + \delta_5 b_5 z^5 + \dots + \delta_{2n-1} b_{2n-1} z^{2n-1} + \delta_{2n+1} b_{2n+1} z^{2n+1} + \dots)(1 + p_1 z + p_2 z^2 \\
 &+ p_3 z^3 + p_4 z^4 + \dots).
 \end{aligned}$$

Equating the coefficients of like powers of z , we have

$$\begin{aligned}
 2\delta_2 a_2 &= p_1, \\
 \delta_3(3a_3 - b_3) &= p_2, \\
 4\delta_4 a_4 &= \delta_3 b_3 p_1 + p_3, \\
 \delta_5(5a_5 - b_5) &= \delta_3 b_3 p_2 + p_4.
 \end{aligned}
 \tag{3.4}$$

By applying (3.2) and followed by Lemma 1, we get (3.1) from (3.4). This completes the proof. Letting $q \rightarrow 1^-$ in Theorem 1, we obtain the following corollary.

Corollary 1. Let $f(z) \in \mathcal{G}_s^{\alpha, \tau}(A, B)$. Then, for all $n \geq 1$,

$$\begin{aligned}
 |a_2| &\leq \frac{(A - B)}{2! \Omega_2}, \\
 |a_3| &\leq \frac{(A - B)(2 + \Omega_3)}{3! \Omega_3}, \\
 |a_4| &\leq \frac{(A - B)[3(2 + \Omega_3(A - B))]}{4! \Omega_4},
 \end{aligned}
 \tag{3.5}$$

and

$$|a_5| \leq \frac{(A - B)[4(2 + \Omega_3(A - B)) + \Omega_5(A - B + 2)]}{40\Omega_5},$$

where $\Omega_j, \forall(j = 2, 3, 4, 5)$ are given by (1.20).

Theorem 2. Let $f(z) \in \kappa_c^{\alpha, \tau, q}(A, B)$. Then, for all

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$$\begin{aligned}
 |a_2| &\leq \frac{(A-B)(\delta_2+1)}{2!\delta_2} \\
 |a_3| &\leq \frac{(A-B)[2+2\delta_2(A-B)+3\delta_3(A-B+1)]}{3!\delta_3}, \\
 |a_4| &\leq \frac{(A-B)[6+6\delta_2(A-B)+3\delta_3(A-B)(A-B+1)+\delta_4(A-B+1)(A-B+2)]}{4!\delta_4},
 \end{aligned}$$

$n \geq 1$,
and (3.6)

$$|a_5| \leq \frac{(A-B)}{5!\delta_5} [24+24\delta_2(A-B)+12\delta_3(A-B)(A-B+1)+4\delta_4(A-B)(A-B+1)(A-B+2) + \delta_5(A-B+1)(A-B+2)(A-B+3)]$$

Proof. Since $g(z) \in S_c^*(A, B)$, then we have from Lemma 3 when $\alpha = 0$

$$\begin{aligned}
 |b_2| &\leq (A-B), |b_3| \leq \frac{(A-B)(A-B+1)}{2}, \\
 |b_4| &\leq \frac{(A-B)[(A-B+1)(A-B+2)]}{6}, \\
 |b_5| &\leq \frac{(A-B)[(A-B+1)(A-B+2)(A-B+3)]}{24}.
 \end{aligned} \tag{3.7}$$

Since $f(z) \in \kappa_c^{\alpha, \tau, q}(A, B)$, it follows from (1.23) by using Equation (1.6)

$$\begin{aligned}
 (2z(Q_\tau^{\alpha, q} f(z)))' &= (Q_\tau^{\alpha, q} g(z) + Q_\tau^{\alpha, q} \overline{g(\bar{z})}) \left(1 + \sum_{j=1}^{\infty} p_j z^j \right) \\
 (0 < \tau \leq 1; \alpha > -1; 0 < q < 1).
 \end{aligned}$$

(3.8)
It follows that

$$\begin{aligned}
 z + 2\delta_2 a_2 z^2 + 3\delta_3 a_3 z^3 + 4\delta_4 a_4 z^4 + 5\delta_5 a_5 z^5 + \dots + 2n\delta_{2n} a_{2n} z^{2n} + (2n+1)\delta_{2n+1} a_{2n+1} z^{2n+1} + \dots \\
 = (z + \delta_2 b_2 z^2 + \delta_3 b_3 z^3 + \delta_4 b_4 z^4 + \delta_5 b_5 z^5 + \dots + \delta_{2n} b_{2n} z^{2n} + \delta_{2n+1} b_{2n+1} z^{2n+1}) \\
 \cdot (1 + p_1 z + p_2 z^2 + p_3 z^3 + p_4 z^4 + \dots).
 \end{aligned}$$

Equating the coefficients of like powers of z , we have

$$\begin{aligned}
 \delta_2(2a_2 - b_2) &= p_1 \\
 \delta_3(3a_3 - b_3) &= \delta_2 b_2 p_1 + p_2 \\
 \delta_4(4a_4 - b_4) &= \delta_3 b_3 p_1 + \delta_2 b_2 p_2 + p_3, \\
 \delta_5(5a_5 - b_5) &= \delta_4 b_4 p_1 + \delta_3 b_3 p_2 + \delta_2 b_2 p_3 + p_4.
 \end{aligned} \tag{3.9}$$

By applying (3.7) and followed by Lemma 1, we get (3.6) from (3.9). This completes the proof.

Letting $q \rightarrow 1^-$ in Theorem 2, we obtain the following corollary.

Corollary 2. Let $f(z) \in \mathcal{G}_c^{\alpha, \tau}(A, B)$. Then, for all $n > 1$,

Coefficient Estimate for a Subclass of Close-to-Convex Functions with Respect To Symmetric and Conjugate Points Connected With the Q-Borel Distribution

$$\begin{aligned}
 |a_2| &\leq \frac{(A-B)(\Omega_2+1)}{2!\Omega_2} \\
 |a_3| &\leq \frac{(A-B)[2+2\Omega_2(A-B)+3\Omega_3(A-B+1)]}{3!\Omega_3}, \\
 |a_4| &\leq \frac{(A-B)[6+6\Omega_2(A-B)+3\Omega_3(A-B)(A-B+1)+\Omega_4(A-B+1)(A-B+2)]}{4!\Omega_4}, \text{ and} \\
 |a_5| &\leq \frac{(A-B)}{5!\Omega_5} [(24+24\Omega_2(A-B)+12\Omega_3(A-B)(A-B+1)+4\Omega_4(A-B)(A-B+1)(A-B+2) \\
 &\quad +\Omega_5(A-B+1)(A-B+2)(A-B+3)].
 \end{aligned}
 \tag{3.10}$$

where $\Omega_j, \forall (j = 2,3,4,5)$ are given by (1.20). Our next result is to briefly look at the connection of our classes to the classical Fekete-Szegő Theorem.

Theorem 3. Let $f(z) \in \kappa_s^{\alpha, \tau, q}(A, B)$. Then,

$$|a_3 - \mu a_2^2| \leq \frac{(A-B)[4\delta_2^2 + 2\delta_3\delta_2^2 - 3\mu\delta_3(A-B)]}{12\delta_3\delta_2^2} \mu \leq 0,
 \tag{3.11}$$

and

$$|a_2 a_4 - a_3^2| \leq (A-B)^2 \left\{ \frac{9\delta_3^2(\delta_3(A-B)+2) - 4\delta_2\delta_4(2+\delta_3)^2}{144\delta_2\delta_3^2\delta_4} \right\}.
 \tag{3.12}$$

Proof. Also, the proof could be obtained from Theorem 1.

Letting $q \rightarrow 1^-$ in Theorem 3, we get the next corollary.

Corollary 3. Let $f(z) \in \mathcal{G}_s^{\alpha, \tau}(A, B)$. Then,

$$|a_3 - \mu a_2^2| \leq \frac{(A-B)[4\Omega_2^2 + 2\Omega_3\Omega_2^2 - 3\mu\Omega_3(A-B)]}{12\Omega_3\Omega_2^2},
 \tag{3.13}$$

and

$$|a_2 a_4 - a_3^2| \leq (A-B)^2 \left\{ \frac{9\Omega_3^2(\Omega_3(A-B)+2) - 4\Omega_2\Omega_4(2+\Omega_3)^2}{144\Omega_2\Omega_3^2\Omega_4} \right\}.
 \tag{3.14}$$

Theorem 4. Let $f(z) \in \kappa_c^{\alpha, \tau, q}(A, B)$. Then, for $\mu \leq 0$,

$$|a_3 - \mu a_2^2| \leq \frac{(A-B)[4\delta_2^2[2+2\delta_2(A-B)+3\delta_3(A-B+1)]-6\mu\delta_3(A-B)(\delta_2+1)^2]}{24\delta_3\delta_2^2},
 \tag{3.15}$$

and

$$|a_2 a_4 - a_3^2| \leq \frac{(A-B)^2}{144\delta_2\delta_3^2\delta_4} \{ 3\delta_3^2(\delta_2+1)[6+6\delta_2(A-B)+3\delta_3(A-B)(A-B+1)+\delta_4(A-B+1)(A-B+2)] - 4\delta_2\delta_4[2+2\delta_2(A-B)+3\delta_3(A-B+1)]^2 \}.
 \tag{3.16}$$

Proof. Also, the proof could be obtained from Theorem 2.

Letting $q \rightarrow 1^-$ in Theorem 4, we get the next corollary.

Corollary 4. Let $f(z) \in \mathcal{G}_c^{\alpha, \tau}(A, B)$. Then,

Coefficient Estimate for a Subclass of Close-to-Convex Functions with Respect To Symmetric and Conjugate Points Connected With the Q-Borel Distribution

$$|a_3 - \mu a_2^2| \leq \frac{(A - B)[4\Omega_2^2[2 + 2\Omega_2(A - B) + 3\Omega_3(A - B + 1)] - 6\mu\Omega_3(A - B)(\Omega_2 + 1)^2]}{24\Omega_3\Omega_2^2},$$

(3.17)

and

$$|a_2 a_4 - a_3^2| \leq \frac{(A - B)^2}{144\delta_2\delta_3^2\delta_4} \{3\Omega_3^2(\Omega_2 + 1)[6 + 6\Omega_2(A - B) + 3\Omega_3(A - B)(A - B + 1) + \Omega_4(A - B + 1)(A - B + 2)] - 4\Omega_2\Omega_4[2 + 2\Omega_2(A - B) + 3\Omega_3(A - B + 1)]^2\}.$$

(3.18)

In the finally result is on sufficient condition for a function $f(z)$ to be in $\kappa_s^{\alpha, \tau, q}(A, B)$.

Theorem 5. Let the function $f(z)$ defined by (1.1) and let

$$\sum_{j=2}^{\infty} \delta_j \{|(2ja_j - (1 - (-1)^j)b_j)| - |(1 - (-1)^j)Ab_j - 2jBa_j|\} \leq 2(A - B)$$

(3.19)

holds, then $f(z)$ belong to $\kappa_s^{\alpha, \tau, q}(A, B)$.

Proof. Assume that the inequality (1.21) holds. Then we get for $z \in \mathbb{U}$.

$$\left| \sum_{j=2}^{\infty} 2j\delta_j a_j z^j - \sum_{j=2}^{\infty} (1 - (-1)^j)b_j \delta_j z^j \right| = \left| \sum_{j=2}^{\infty} (1 - (-1)^j)Ab_j \delta_j z^j - \sum_{j=2}^{\infty} 2jBa_j \delta_j z^j \right| + 2|(A - B)z|$$

$$\left| \sum_{j=2}^{\infty} (2ja_j - (1 - (-1)^j)b_j)\delta_j z^j \right| = \left| \sum_{j=2}^{\infty} ((1 - (-1)^j)Ab_j - 2jBa_j)\delta_j z^j \right| + |2(A - B)z|$$

\leq

$$\sum_{j=2}^{\infty} \delta_j |(2ja_j - (1 - (-1)^j)b_j)| r^j = \sum_{j=2}^{\infty} \delta_j \left| ((1 - (-1)^j)Ab_j - 2jBa_j) \right| r^j + 2(A - B)r, \quad (0 < r < 1).$$

Now, letting $r \rightarrow 1$, therefore, we obtain

$$\sum_{j=2}^{\infty} \delta_j \{|(2ja_j - (1 - (-1)^j)b_j)| - |(1 - (-1)^j)Ab_j - 2jBa_j|\} \leq 2(A - B).$$

Therefore, it follows that

$$\left| \frac{2z(Q_{\tau}^{\alpha, q} f(z))' - (Q_{\tau}^{\alpha, q} g(z) - Q_{\tau}^{\alpha, q} g(-z))}{A(Q_{\tau}^{\alpha, q} g(z) - Q_{\tau}^{\alpha, q} g(-z)) - B(2z(Q_{\tau}^{\alpha, q} f(z))')} \right| < 1, z \in \mathbb{U}.$$

(3.20)

$$|w(z)| = \left| \frac{2z(Q_{\tau}^{\alpha, q} f(z))' - (Q_{\tau}^{\alpha, q} g(z) - Q_{\tau}^{\alpha, q} g(-z))}{A(Q_{\tau}^{\alpha, q} g(z) - Q_{\tau}^{\alpha, q} g(-z)) - B(2z(Q_{\tau}^{\alpha, q} f(z))')} \right| < 1, z \in \mathbb{U}.$$

Assuming

(3.21)

Then $w(0) = 0, w(z)$ is analytic in $|z| < 1$ and $|w(z)| < 1$. Therefore, $f(z) \in \kappa_s^{\alpha, \tau, q}(A, B)$.

Theorem 6. Let the function $f(z)$ defined by (1.1) and let

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$$\sum_{j=2}^{\infty} \delta_j \{ |(ja_j - b_j)| - |Ab_j - Ba_j| \} \leq (A - B) \tag{3.22}$$

holds, then $f(z)$ belong to $\kappa_c^{\alpha, \tau, q}(A, B)$.

Proof. Assume that the inequality (1.23) holds. Then we get for $z \in \mathbb{U}$.

$$\left| \sum_{j=2}^{\infty} j\delta_j a_j z^j - \sum_{j=2}^{\infty} b_j \delta_j z^j \right| = \left| \sum_{j=2}^{\infty} Ab_j \delta_j z^j - \sum_{j=2}^{\infty} jBa_j \delta_j z^j \right| + |(A - B)z|$$

$$\left| \sum_{j=2}^{\infty} (ja_j - b_j) \delta_j z^j \right| = \left| \sum_{j=2}^{\infty} (Ab_j - jBa_j) \delta_j z^j \right| + |(A - B)z|$$

$$\leq$$

$$\sum_{j=2}^{\infty} \delta_j |(ja_j - b_j)| r^j = \sum_{j=2}^{\infty} \delta_j |(Ab_j - jBa_j)| r^j + (A - B)r, \quad (0 < r < 1).$$

Now, letting $r \rightarrow 1$, therefore, we obtain

$$\sum_{j=2}^{\infty} \delta_j \{ |(ja_j - b_j)| - |Ab_j - jBa_j| \} \leq (A - B).$$

Therefore, it follows that

$$\left| \frac{2z(Q_{\tau}^{\alpha, q} f(z))' - (Q_{\tau}^{\alpha, q} g(z) + Q_{\tau}^{\alpha, q} \overline{g(\bar{z})})}{A(Q_{\tau}^{\alpha, q} g(z) + Q_{\tau}^{\alpha, q} \overline{g(\bar{z})}) - B(2z(Q_{\tau}^{\alpha, q} f(z))')} \right| < 1, z \in \mathbb{U}. \tag{3.23}$$

Assuming

$$|w(z)| = \left| \frac{2z(Q_{\tau}^{\alpha, q} f(z))' - (Q_{\tau}^{\alpha, q} g(z) + Q_{\tau}^{\alpha, q} \overline{g(\bar{z})})}{A(Q_{\tau}^{\alpha, q} g(z) + Q_{\tau}^{\alpha, q} \overline{g(\bar{z})}) - B(2z(Q_{\tau}^{\alpha, q} f(z))')} \right| < 1, z \in \mathbb{U}. \tag{3.24}$$

Then $w(0) = 0, w(z)$ is analytic in $|z| < 1$ and $|w(z)| < 1$. Therefore, $f(z) \in \kappa_c^{\alpha, \tau, q}(A, B)$.

REFERENCES

- 1) Altinkaya, S. and Yalçın, S. (2017), ‘Poisson distribution series for certain subclasses of starlike functions with negative coefficients’, *Annals of Oradea University Mathematics Fascicula* 24(2), 5–8.
- 2) Bulboacă, T. (2005), *Differential subordinations and superordinations: Recent results*, House of Scientific Book Publications: Cluj-Napoca, Romania.
- 3) Dahhar, S. and Janteng, A. (2009), A subclass of starlike functions with respect to conjugate points, in ‘*Int. Math. Forum*’, Vol. 4, Citeseer, pp. 1373– 1377.
- 4) El-Ashwah, R. M. and Thomas, D. K. (1987), ‘Some subclasses of close-toconvex functions’, *J. Ramanujan Math. Soc* 2, 86–100.
- 5) El-Deeb, S. M., Bulboacă, T. and Dziok, J. (2019), ‘Pascal distribution series connected with certain subclasses of univalent functions’, *Kyungpook Mathematical Journal* 59(2), 301–314.
- 6) El-Deeb, S., Murugusundaramoorthy, G. and Alburaihan, A. (2021), ‘BiBazilevic functions based on the Mittag-Leffler-type Borel distribution associated with Legendre polynomials’, *J. Math. Comput. Sci* 24, 235–245.
- 7) Gasper, G. and Rahman, M. (1990), ‘Basic hypergeometric series’, *Encyclopedia of Mathematics, and its Applications*.

“Article Title”

- 8) Goel, R. M. and Mehrook, B. S. (1982), ‘A subclass of starlike functions with respect to symmetric points’, *Tamkang J. math.* 13, 11–24.
- 9) Jackson, F. H. (1910), ‘On q -definite integrals’, *Quart. J. Pure Appl. Math* 41(15), 193–203.
- 10) Janowski, W. (1973), ‘Some extremal problems for certain families of analytic functions I’, 3(28), 297–326.
- 11) Janteng, A. and Halim, S. A. (2009), ‘Coefficient estimate for a subclass of close-to-convex functions with respect to symmetric points’, *Int. J. Math. Analysis* 3(7), 309–313.
- 12) Kaplan, W. (1952), ‘Close-to-convex schlicht functions.’, *Michigan Mathematical Journal* 1(2), 169–185.
- 13) Miller, S. S. and Mocanu, P. T. (2000), *Differential subordinations: Theory and Applications*, Vol. 225, Series on Monographs and Textbooks in Pure and Applied Mathematics.
- 14) Murugusundaramoorthy, G. and El-Deeb, S. M. (2022), ‘Second Hankel determinant for a class of analytic functions of the Mittag-Leffler-type Borel distribution related with Legendre polynomials’, *Soc. J. Appl. Engrg. Math.*
- 15) Nazeer, W., Mehmood, Q., Kang, S. M. and Haq, A. U. (2019), ‘An application of Binomial distribution series on certain analytic functions’, *J. Comput. Anal. Appl* 26(1), 11–17.
- 16) Oladipo, A. (2012), ‘New subclasses of analytic functions with respect to other points’, *International Journal of Pure and Applied Mathematics* 75(1), 1–12.
- 17) Porwal, S. and Kumar, M. (2016), ‘A unified study on starlike and convex functions associated with Poisson distribution series’, *Afrika Matematika* 27, 1021–1027.
- 18) Risha, M. A., Annaby, M., Mansour, Z. and Ismail, M. E. (2007), ‘Linear q -difference equations’, *Zeitschrift für Analysis und ihre Anwendungen* 26(4), 481–494.
- 19) Sakaguchi, K. (1959), ‘On a certain univalent mapping’, *Journal of the Mathematical Society of Japan* 11(1), 72–75.
- 20) Selvaraj, C. and Vasanthi, N. (2011), ‘Subclasses of analytic functions with respect to symmetric and conjugate points’, *Tamkang Journal of Mathematics* 42(1), 87–94.
- 21) Sokol, J. (1990), ‘Some remarks on the class of functions starlike with respect to symmetric points’, *Folia Scient. Univ. Tech. Resoviensis* 73, 79–89.
- 22) Sokol, J. (1991), ‘I. function starlike with respect to conjugate points’, *Zeszyty Nauk. Politech. Rzeszowskiej Mat. Fiz* 12, 53–64.
- 23) Sokol, J., Szpila, A. and Szpila, M. (1991), ‘On some subclass of starlike functions with respect to symmetric points’, *Zeszyty Nauk. Politech. Rzeszowskiej Mat. Fiz* 12, 65–73.
- 24) Srivastava, H. M. (2020), ‘Operators of basic (or q -) calculus and fractional q -calculus and their applications in geometric function theory of complex analysis’, *Iranian Journal of Science and Technology, Transactions A: Science* 44(1), 327–344.
- 25) Srivastava, H. M. and El-Deeb, S. M. (2021), ‘Fuzzy differential subordinations based upon the Mittag-Leffler type Borel distribution’, *Symmetry* 13(6), 1023.
- 26) Srivastava, H. and El-Deeb, S. M. (2022), ‘Subclasses of analytic functions with respect to symmetric and conjugate points connected with the q -Borel distribution’, *Filomat* 36(16), 5521–5538.
- 27) Tang, H. and Deng, G.-T. (2013), ‘New subclasses of analytic functions with respect to symmetric and conjugate points’, *Journal of complex analysis*.
- 28) Wanas, A. K. and Khuttar, J. A. (2020), ‘Applications of Borel distribution series on analytic functions’, *Earthline Journal of Mathematical Sciences* 4(1), 71–82.



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Organization, Customs, and Social Activities: The Case of Holy Week



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ABSTRACT: Holy Week in Los Fresnos, La Perla, Veracruz, Mexico, goes beyond the religious aspect. This small town with fewer than a thousand inhabitants exhibit exemplary organization as it has collaborated with another town for over two decades. These traditions are passed down from generation to generation, adapting and improving over time. The study is based on participant observation, photographs, and notes, as well as data provided by the elderly members of the community. This demonstrates that Holy Week involves social, economic, and individual practices within a specific context, not limited solely to the religious aspect.

KEYWORDS-Cultural activity, organization, customs, collective economy, religious practice.

I. INTRODUCTION

For some people, it represents an Easter holiday, while for others, it is a period devoted to upholding religious traditions that have been perpetuated across numerous years and generations, particularly within the Catholic faith. In Mexico, as reported by the National Institute of Statistics and Geography (INEGI), 77.7% of the population identifies as Catholic [1]. This statistic is particularly relevant in the high mountain regions, where each community engages in activities related to Holy Week. These activities involve the participation and organization of community members who dedicate several weeks to preparing for the annual traditional customs. These customs see the involvement of people across all age groups, including adults, children, and youth.

Los Fresnos is a community situated in the high mountain region of Veracruz, within the municipality of La Perla. Its location near Pico de Orizaba, Mexico's tallest volcano, is of notable significance to the surrounding areas, a fact underscored by Morales et al. (2023)[2]. A key aspect of Los Fresnos is its economic structure, which primarily revolves around remittances and the production and marketing of foliage. The latter plays a crucial role in regional markets and extends its influence to cities such as Puebla, State of Mexico, and Mexico City, as elaborated in the studies by Morales and Fabre (2021)[3]. These economic activities are not merely financial drivers; they also significantly influence the social and cultural fabric of the community.

In the municipality of La Perla, numerous communities engage in Holy Week activities. However, this specific study focuses on the community of Los Fresnos. Observations and participations were conducted here, beginning from Ash Wednesday, which marked the commencement of Lent in 2022 on March 2. On this day, individuals received ashes on their foreheads or heads, a practice consistently observed each year in accordance with the dates set by the Catholic Church, headquartered in Vatican City, Italy. Following this, a group of community members initiated the planning of the events, also inviting others to contribute in various capacities. Leading up to Holy Week, every Friday, a small Via Crucis (Way of the Cross) was conducted. Depending on the weather, this ritual was held either in the church or started from the main street and culminated at the church.

While the essence of these events is rooted in religious observance, they also encompass significant economic and social dimensions. Beyond the purely religious activities, some individuals seize the opportunity to engage in commerce, selling items such as snacks, drinks, fruits, ice creams, and various other refreshments. Additionally, these events serve as a social catalyst, drawing individuals who, despite no longer residing in the area, return to participate in these activities with their families. This

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aspect underscores the social relevance of these gatherings. The research presented in this article will delve into the multifaceted nature of Holy Week activities, exploring them within diverse contexts.

Beginning with the work of Ponciano-Castellanos (2019)[4], a distinction is drawn between the roles of men and women in these activities. This research, while primarily concentrated on the Stations of the Cross, reveals that most tasks associated with Holy Week are traditionally undertaken by men, who also predominantly serve as organizers. Women, though typically involved in roles deemed exclusively for them, are gradually making inroads into these activities. Their increasing participation is notably evident in roles such as runners, a topic that will be further explored in this study. Additionally, while Ponciano-Castellanos' (2019)[4] research is centered on Guatemala, it presents certain parallels with the current study, highlighting similarities in the observance of Holy Week despite the geographical and national differences between the two regions.

Aguilera Calderón (2015)[5] suggests the exploration of activities in Santa María Acapulco, a community within the municipality of Santa Catarina, situated in the southern part of San Luis Potosí. This area shares demographic similarities with Los Fresnos and parallels in terms of geographical space and the nature of its activities. The author highlights the various practices undertaken by the residents to observe Holy Week, also referred to as *Semana Santa*. Mirroring the focus of this study, the activities in Santa María Acapulco commence on Ash Wednesday. Subsequently, every Friday leading up to Good Friday, the last of these days, the community engages in the Stations of the Cross. Furthermore, the research reveals that each region or town has its unique set of activities, underscoring the distinctiveness inherent to each locality.

Incorporating insights from additional research on Holy Week activities, Mancha-Castro (2019)[6] delves into the significance of the practices observed by the inhabitants of Huelva. Echoing earlier studies, Mancha-Castro emphasizes that Holy Week represents a "festive religious ritual where the connection of people with the Christian-Catholic divinity is manifested through iconic rites and acts" (Mancha-Castro, 2019, p. 3) [6]. Concurrently, during these religious events, both the church and the town hall of Huelva collaborate to facilitate the procession through the city's streets. Moreover, the observance of Holy Week transcends the religious domain, intertwining with economic and political aspects. As examined in the reviewed studies, the residents who commemorate the passion of Jesus do so in a manner that reflects the customs and traditions specific to their own context.

Byba (2018) [7] offers an analytical perspective on the term "Holy Week" and its connotations in the Spanish language. The study delineates key aspects, noting that "the imagery of the Easter festival is embedded in its cognitive structure, encompassing a range of cognitive markers based on possessive, attributive, comparative, objective, subjective patterns, as well as those of interiority and process." Furthermore, the manuscript highlights alternative expressions such as "week major," "week big," and "week of passion," treating them as synonymous with Holy Week.

In the specific context of this research, the terminology used by people is understood and recognized, although the conceptualization of Holy Week varies. The term's meaning is contingent on the context in which it is employed, yet there are commonalities, such as the alignment of activities with the dates prescribed by the Catholic Church. This research acknowledges that while the term "Holy Week" may vary in its usage, the underlying themes and observances maintain a degree of uniformity across different contexts.

Sánchez Guzmán and Fernández Paradas (2020) [8] conducted a comprehensive analysis of Holy Week in 18th-century Valladolid, Spain, utilizing resources such as historical newspapers and existing paintings related to the event. Their study aimed to depict how this religious activity was observed, considering the higher prevalence of Catholicism 400 years ago, both in Spain and in other countries influenced by the Catholic faith. In a related vein, Rivera Krakowska (2005)[9] focuses on the significance of Holy Week in Santa María Tonantzintla, located in the state of Puebla. Her research underscores the community's deep involvement in the Holy Week festivities, particularly in the dramatic representations that span from the prayer in the olive garden to the crucifixion. This study highlights the community's commitment to perpetuating these annual religious activities, showcasing the integral role of communal participation in maintaining these longstanding traditions.

In conclusion, it is essential to examine how the residents of Mexico City, particularly in the Iztapalapa delegation, observe Holy Week. The representation of the Passion of Christ in this region involves extensive organization, engaging thousands of participants in various roles and necessitating elaborate stage setups for key events, notably Palm Sunday and the period from Thursday to Sunday. Notably, Friday stands out as the day with the most intensive activities and work, a characteristic shared with the studies previously discussed and this research. Partida Tayzán (2005)[10] delves into the origins of the Iztapalapa staging, tracing its inception to 1833, marking 189 years of continuous observance. Initially, this ritual was conceived by the local population as a means to stabilize the world amidst a cholera epidemic. This historical perspective provides a deeper understanding of the cultural and societal significance of Holy Week in Iztapalapa, illustrating how these traditions have evolved and been sustained over nearly two centuries.

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II. DEVELOPMENT

Participant observation was employed as a key component of the research methodology, encompassing not just the observation of activities performed by each participant but also active involvement in these activities. As articulated by Pellicer et al. (2013)[11], the approach necessitates a dual role: "On one hand, you must look and act as a participant; and on the other, as an observer. To achieve this dual experience, the participant observer in the city must engage simultaneously as a member of it and as a 'stranger' to it" (p. 128). To fulfill this dual role effectively, participation extended beyond the specific days of Holy Week. It began from the initial meeting where the organizing committee convened community members to draft a work plan. This plan involved soliciting support and compiling a list of requirements ranging from flowers for decoration to labor for setting up crosses and ensuring their proper installation. This immersive approach provided a comprehensive perspective, allowing for a deeper understanding of the community's involvement and the intricate details of organizing such significant events.

This year, the initial meeting took place in January, providing a three-month lead time for preparations. Subsequently, both observation and participation commenced on Ash Wednesday and continued every Friday, leading up to the detailed events of Holy Week, which are elaborated upon later in the study. Sánchez Serrano (2013)[12] underscores the value of participant observation, stating that it "allows the collection of the most numerous, most direct, richest, most profound, and complex information" (p. 96). This method offers insights that surpass those obtained through interviews, where certain details might be overlooked or omitted. Moreover, participant observation provides a unique vantage point for understanding the organizational structure and the historical inheritance of roles over the years. Unlike mere observation, this method enables a deeper engagement with the community, allowing the researcher to experience firsthand the nuances of communication, decision-making, and tradition that shape these events. This approach is instrumental in capturing the essence of the community's practices and the intricate dynamics involved in the preparation and execution of Holy Week activities.

S.J. Taylor and R. Bogdan (1984)[13], Martínez (2007) [14], and Ardèvol et al. (2003)[15] also highlight the effectiveness of participant observation in revealing intricate details. For this particular research, the use of photographs and notes taken during the observation process greatly facilitated the documentation and understanding of the activities' significance for the community.

Some tasks required extensive late-night work to ensure that the final preparations for the next day's events, such as the Friday procession, were completed without any issues. This was particularly evident in the case of a group of florists who worked on the floral arrangements. When there was ample space and fewer people in the church, their task was made more manageable. A similar situation was observed in the preparation of the monument for Thursday and the placement of palms in the church and the starting point of the procession on Palm Sunday. These observations provided a deeper insight into the community's dedication and the meticulous efforts behind the scenes. Understanding the significance of these activities and the commitment of the community members was crucial in capturing the essence of the Holy Week celebrations and the cultural and religious importance they hold for the population.

The contribution of the older adult population was invaluable in this research, as these individuals, having lived in the community for over 60 years, provided a historical perspective on the changes and developments over time. People who possessed photographs or had served as event organizers offered crucial insights. Key information, such as the inauguration of the church and the identities of the main event organizers, is widely known within the community.

To further understand the activities from the participants' viewpoints, the approach of this research was deemed highly relevant. It recognizes that the involvement in these activities extends beyond mere religious obligation. The organization and execution of tasks represent a collective effort, fostering community unity to meet specific criteria within the given context. Additionally, these events present an opportunity for economic benefit for some families, while also emphasizing the importance of shared experiences and the active participation of youth and children. This multifaceted approach underscores that the observance of Holy Week is not only a religious practice but also a cultural and social phenomenon, deeply embedded in the community's fabric. It highlights the interplay of tradition, community bonding, economic aspects, and intergenerational participation, painting a comprehensive picture of the significance of these events in the lives of the community members.

Palm Sunday

The commencement of Holy Week activities begins on Palm Sunday, where community members congregate at a location known as the hermitage. This site serves as the setting for the blessing of palms, which are adorned with various flowers. The size of each palm varies according to individual or family preference. Additionally, other plants like bougainvillea (*Bougainvillea*), chamomile (*Chamaemelum nobile*), laurel (*Laurus nobilis*), rue (*Ruta*), rosemary (*Salvia rosmarinus*), and olive tree (*Olea europaea*) are also brought for blessing, all of which are cultivated within the community.

The timing of this gathering is typically dependent on the priest, usually scheduled around noon. Consequently, attendees are advised to arrive about half an hour earlier. The ceremony begins with the blessing of the palms and plants, followed by a

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procession to the church. This procession, covering a distance of approximately 600 meters, is led by an image carried in front, accompanied by the priest. Throughout the journey, participants sing hymns until they reach the church, where a mass is celebrated, marking the conclusion of the day's activities. This ritual not only signifies the start of Holy Week but also embodies the community's deep-rooted religious and cultural traditions.

Prior to delving into the events of the subsequent days, it is important to highlight the formation of lines by individuals embarking on the pilgrimage. These participants, carrying decorated palms in their arms, represent a diverse cross-section of the community, encompassing men, women, young people, and children, transcending age and social status. On this occasion, the formation is segregated by gender, with separate lines for females and males. In instances where one gender outnumbers the other, the lines are organized by height, from tallest to shortest. The individuals in these lines are distinguished not only by their participation in the procession but also by their attire and specific roles. They don traditional purple dresses and are adorned with a golden cord tied around their waist. Notably, these participants undertake the pilgrimage barefoot. This attire and the act of walking barefoot are symbolic, reflecting a deeper spiritual or ritualistic significance. The procession is led by these individuals, who precede both the religious image and the priest. This practice, beginning on Palm Sunday, sets the tone for the solemnity and reverence that characterize the Holy Week observances, highlighting the community's commitment to upholding these traditions.

From an economic perspective, starting on Palm Sunday, vendors selling food and drinks set up their stalls approximately 80 meters from the church. This arrangement also includes designated areas for vehicle parking to avoid any traffic disruptions, especially during processions and other activities that attract large crowds. These temporary establishments not only cater to the immediate needs of the participants post-procession or activity but also offer a more varied menu on the subsequent days of Holy Week. This provision is particularly beneficial for those who are unable to dine at home during the festivities. While food stalls and snack vendors are a common sight on regular Sundays, the scale and variety during Holy Week are notably more extensive. This period sees a significant increase in such temporary establishments, reflecting the heightened activity and the influx of participants in the area. This aspect of Holy Week not only adds to the festive atmosphere but also contributes to the local economy, providing an opportunity for vendors to cater to the increased demand.



Figure 1. Palm Sunday procession.

Own elaboration

Monday, Tuesday and Wednesday

During these days leading up to the main events of Holy Week - Thursday, Friday, Saturday, and Sunday - the community engages in meticulous preparations. One key aspect of this preparation involves the residents sweeping the streets. This task is particularly important to ensure the safety of those who participate in the barefoot runs, covering a distance of about 5 kilometers across two communities, with Los Fresnos hosting the most significant activities. In addition to street cleaning, families contribute to the festive atmosphere by placing purple and white decorations along both sides of the street. These arrangements, either handmade or purchased, are not only decorative but also hold symbolic value, representing offerings for the festivities. This practice is deeply ingrained in the community's tradition and is seen as a significant contribution to preserving these customs for future generations. Furthermore, a collective effort is made to clear any foliage and remove obstacles that might impede the processions. In cases where construction materials or other obstructions are found along the pilgrimage routes, residents are

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requested to relocate these materials to ensure smooth and unobstructed passage. These communal activities underscore the residents' commitment to maintaining the sanctity and order of the Holy Week celebrations, reflecting a shared sense of responsibility and reverence for these time-honored traditions.



Figure 2. Preparation for Friday.

Own elaboration

Holy Thursday

On the afternoon of this day, community members gather at the church in Los Fresnos to partake in the "Foot Washing" mass, a significant ritual in the Holy Week observances. During this ceremony, children aged between 7 and 12 years enact the roles of the apostles. In the Catholic tradition, there are 12 apostles, and these children, representing them, are attired in purple dresses with golden cords, and like the apostles, they approach the altar barefoot. In a parallel display, the individuals who will participate in the run the following day dress similarly to the children portraying the apostles. They form lines along the sides of the church, with both genders represented equally in these lines. This inclusivity marks a significant shift from the tradition of the past five years, where only men participated in the run. The recent involvement of women in this activity is a notable development, suggesting a trend towards greater gender parity in future observances. This evolution in the participation of women highlights the dynamic nature of cultural and religious practices within the community. It reflects a growing recognition of the importance of inclusivity and the changing roles and representations within these deeply rooted traditions. The adaptation of these practices over time illustrates the community's ability to balance respect for tradition with contemporary social progress.

On this particular day, the solemnity of the occasion is accentuated by the visual elements within the church. A long purple cloth drapes the main altar, and as the "Gloria" hymn is sung, the organizers simultaneously cover the other church images with purple cloths. This act may coincide with the ringing of the church bells, creating a profound auditory experience. However, as the hymn concludes, a noticeable silence ensues, and the subsequent hymns are performed a cappella. The atmosphere is further enriched by the sound of the rattle, accompanying a modest procession within the church. Additionally, a small altar adorned in yellow and white, embellished with flowers of the same colors, is set up exclusively for this day. This altar serves as a focal point for a representation akin to the prayer in the olive garden. Following the mass, the apostles, runners, and members of religious groups engage in prayer, enveloping the space in a reverent silence. This quietude persists even as a group of people, tasked with arranging the religious images, gathers in the courtyard. The meticulous attention to ritual and symbolism on this day reflects the deep spiritual connection of the community to these observances. The use of colors, sounds, and silence, along with the specific arrangements within the church, all contribute to creating a reflective and solemn atmosphere, befitting the significance of the events being commemorated.

Another event of great significance to the residents of the community is the blessing of bread, a ritual that commemorates the Last Supper. At the conclusion of the mass, the priest performs a blessing over the bread, which is then distributed among the community members. This ritual, like the previously mentioned activities, involves a dedicated group of organizers. These organizers approach certain residents to donate bread for the blessing, a custom that has become increasingly ingrained in the community's practices in recent years. However, it is noteworthy that in 2020, this and other activities were not conducted due to the outbreak of the SARS-CoV-2 virus. The pandemic led to the closure of numerous businesses and the cancellation of events involving gatherings, as a measure to prevent the spread of the virus. This interruption raises the question: What activities are typically carried out for Easter in this community? The cessation of these traditions in 2020 underscores the impact of global events on local practices and highlights the adaptability and resilience of communities in the face of

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unprecedented challenges. The pandemic not only disrupted economic and social life but also deeply affected cultural and religious observances, prompting communities to reconsider and adapt their traditional practices.

In 2021, the Holy Week activities in Los Fresnos resumed, adhering to the traditional format observed in the years prior to the pandemic, while incorporating the safety measures recommended by the Ministry of Health. This approach marked a return to the community's cherished practices, albeit with necessary adjustments for public health. In 2022, this trend continued, with even greater participation from the residents, indicating a gradual return to the community's usual vibrancy and involvement in these events. Focusing on the specific activities of Holy Week in Los Fresnos, a notable aspect is the preparation that takes place in the church. On the eve of the procession, community members dedicate themselves to organizing and creating floral arrangements for the religious images that will be featured in the next day's procession, scheduled for 10 in the morning. This preparation process is meticulous, with attention paid to every detail, from the attire to the positioning of the figures of Mary and Jesus. Such care ensures that these representations can be carried smoothly during the procession. This painstaking effort in preparing the images for the procession is a testament to the community's profound reverence for these sacred symbols. It also highlights the significance of these traditions in maintaining the cultural and spiritual identity of Los Fresnos. The community's commitment to these practices, evident in their dedication to both the aesthetic and logistical aspects of the procession, reflects a deep connection to their heritage and a collective desire to preserve these rituals for future generations.



Figure 3. Thursday's activities.
Own elaboration

Holy Friday

The eagerly anticipated day for which the community has been preparing has finally arrived. From the early hours, the organizers are busy ensuring that everything is set for the procession. They oversee the arrangement of the religious images, the lineup of runners and apostles, and the young candle bearers who carry candles and a cross draped with a piece of purple cloth for the person in the middle. One of the key tasks of the day involves positioning the 15 crosses that represent the Stations of the Cross, each marked with its respective name and station number. The placement of these crosses, spaced at intervals that have become customary over time, is a responsibility of the families associated with each station. These families not only decorate their designated areas but also provide water for the runners, a thoughtful gesture considering the day's typically high temperatures. Although a temperature of around 30 degrees Celsius might seem moderate, it is notably warmer than the usual 18 to 20 degrees Celsius experienced in the community. This temperature difference adds an extra layer of challenge to the day's activities, highlighting the dedication and resilience of the participants in upholding this cherished tradition.

Moreover, the physical conditions of the community present significant challenges for those running or walking barefoot. The roads are surfaced with a material known as chapopote, which becomes particularly problematic in the heat, especially in the middle of the road. The rest of the road is characterized by horizontal cracks, posing a risk of stumbling and causing injuries such as lost toenails to the runners. Despite these harsh conditions, participants engage in this ritual year after year, motivated by a sense of tradition and continuity with their parents' and grandparents' participation. This activity necessitates the runners' presence at 9 in the morning, even though the Stations of the Cross procession does not commence until 10 in the morning. This early gathering is crucial for preparing the incense used in the ceremony. A bonfire, fueled by charcoal, is lit, and once the coals have absorbed sufficient heat, they are transferred to a censer. This censer is then used to incense the images and crosses at each station. This aspect of the ritual, though physically demanding, is imbued with deep symbolic significance and is a testament to the community's enduring commitment to preserving their cultural and religious heritage.

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Upon completing the preparation of the censer, participants proceed to change into their ceremonial attire, donning the purple dress and golden cord, and importantly, they remove their shoes. They then line up, ready to lead the procession, continuously swinging the censer to ensure it remains lit, as its flame is crucial for achieving their objective. The formation of the line is based on height, from tallest to shortest, with individuals positioning themselves accordingly, irrespective of gender. Once the line is properly organized and all the runners are in place, the procession awaits the arrival of the porters, additional runners, those carrying candles, and the general public. Following the runners are the ciriales, a group of three individuals, who are distinguished by their white dresses and cords. Unlike the runners, the ciriales wear shoes. Next in the procession are the 12 apostles, six on each side of the street. Their attire mirrors that of the runners, including the small cross they carry, and they too participate barefoot. This meticulous organization and adherence to traditional dress codes and procession order reflect the deep-rooted cultural and religious significance of the event. The participation of community members in various roles, each with its unique symbolism and significance, illustrates the collective effort and dedication involved in preserving these longstanding traditions.

It is important to note that while children are eager to participate in the representation, they are never forced to do so by their guardians or the organizer. However, the person responsible for them during the Via Crucis and processions is always vigilant, equipped with bandages for any incidents that might occur along the way and ensuring the children stay hydrated throughout the event. Having a designated caretaker is crucial, even though the parents also keep a close watch on their children. Following the children in the procession is the representative image of Jesus, adorned in a purple dress with intricate purple details. This image is also decorated with flowers and foliage, reflecting the community's dedication to this activity. The effort and commitment to this aspect of the procession are paramount, as the design of the adornment is unique each year, never repeating, showcasing the florists' creativity and skill. Beside the image of Jesus, community members who wish to help carry it during the procession take their place. Following them, the general public joins in, and from this point, two lines are formed to allow a path in the center. This organization not only facilitates the smooth movement of the procession but also symbolizes the collective involvement and unity of the community in this deeply significant religious event.

Regarding the procession's organization, the central space of the route is specifically reserved for the runners. This arrangement allows them to break away from the crowd and run with their censers, ensuring their unimpeded movement. Additionally, about halfway through the procession, some participants start singing, while others use horns to ensure that their voices are heard by all. Prior to the commencement of the procession, certain individuals don red flannels. This is a signal to drivers, indicating the approach of the procession and advising them to either pull over or, if necessary, to proceed with caution. This is particularly important in case of emergencies where drivers might need to pass through quickly. To further manage traffic and ensure safety, drivers are informed about the procession's location along the route, allowing them to opt for alternate paths if needed. These logistical considerations are crucial for maintaining order and safety during the procession. They reflect the community's awareness and responsiveness to potential challenges, ensuring that the religious observance proceeds smoothly without disrupting the local traffic flow. This balance between tradition and practicality is a testament to the community's ability to adapt and organize large-scale events effectively.

Once some aspects of the Stations of the Cross have been detailed, and everything is in order. The procession of the image representing the Virgin Mary leaves, said image wears a black dress with some details, it is necessary to mention that year after year her dress changes just like the image represented by Jesus. The respective people who carry are found, 4 people are used, changed depending on whether there are more people who want to carry or tiredness of the participants. This procession begins the journey first and goes towards an opposite path, here people emphasize that women are the ones who accompany this journey. Although it is not mandatory, however, you can see how the majority of women choose to go with this procession, there is also the participation of some ladies who sing while they make the journey until they meet the representative image of Jesus, and There are also people who indicate the pertinent signs to drivers. They begin the journey first because the distance they will walk is greater than that of the other procession, with the exception that it does not make stops at the Stations of the Cross, at least not until the 4th station. Once they are at the point known as the hermitage, the organizers notify each other for the other procession to leave.

In relation to said procession, it has greater participation, although people are gradually integrating into it. Since some usually wait for it at home while others prefer to be there from the exit to the entrance. Before the meeting of both processions, the one that integrates the representative image of Jesus and the other participants previously mentioned. At the beginning of this procession, the runners are given the start, starting with the smallest ones with little difference in start time. This factor depends on the number of participants. If there is greater participation, the start time is smaller. But if there is less participation, the starting time between the runners is longer. Likewise, a person from one row leaves when the organizer gives the indication and then a person from the other row. The runners also have a person who gives them directions.

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Before initiating their role in the procession, the runners place a small amount of incense, approximately less than a tablespoon, into the censer. This action produces a distinctive aroma and smoke, which is a key element of the ritual. This process of incensing is repeated each time the runners encounter a significant gathering of people along the procession route. The first to be incensed are the Christ figure covered in the purple canvas, followed by the representative image of Jesus and the wooden cross. During this act of incensing, the runners demonstrate reverence by kneeling, bowing their heads, and making the sign of the cross before continuing their journey. This solemn gesture is an expression of devotion and respect for the religious symbols. The same ritual is performed when the runners reach the procession carrying the representative image of Mary. Upon reaching this point, they proceed to incense the image before moving ahead to continue their participation in the procession. Additionally, this act of incensing and showing reverence is replicated at each of the 15 stations along the route. This repeated action of incensing at various points and stations throughout the procession not only adds a sensory dimension to the observance but also symbolizes the runners' continuous homage and veneration as they navigate the procession route. It reflects the deep spiritual significance of these rituals within the community's Holy Week celebrations.

In addition to the previously mentioned elements of the procession, the role of the wooden cross, carried by a group of men from the community, warrants special mention. This cross is crafted by the residents themselves, who select a suitable tree for its construction. In keeping with the community's commitment to environmental sustainability, particularly given their focus on planting foliage, a new tree is planted to replace the one used for the cross. This practice ensures the replenishment of trees, vital for the local ecosystem. The cross, weighing approximately 90 kilograms, presents a significant physical challenge to those who bear it. The carriers rotate shifts frequently, and while they are accustomed to the weight, it does not diminish the inherent discomfort and strain of carrying such a heavy object. This shared burden is emblematic of the community's spirit of cooperation and mutual support. The carriers of the cross, along with those who carry the images and those who sing, all contribute to the collective effort required to sustain these activities over several hours. This aspect of the procession – the communal carrying of the cross – is not only a physical manifestation of devotion but also a powerful symbol of the community's unity and strength. It reflects the deep sense of solidarity and shared purpose that underpins these religious observances, as the community comes together to honor their traditions and beliefs.

The organization of the procession involves a meticulous system of coordination, where participants are given badges to identify their roles within the team, particularly those responsible for overseeing the runners. These runners, due to the physical demands of their participation, are prone to mishaps, necessitating close monitoring. To ensure safety and smooth operation, supervisory rounds are conducted on motorcycles, and there is active involvement from civil protection services and municipal police. As the procession progresses, it makes stops at three stations, pausing for approximately 10 minutes at each. These breaks also provide opportunities for changing the carriers of the cross. A pivotal moment in the procession occurs when the two separate processions converge. This juncture holds significant meaning for the community, as it marks a point of increased participation. The procession of women, which includes the candles, apostles, the image of Jesus, and the cross, waits for the right moment to merge with the main procession. Once joined, they continue together, though they are not at the end of the line; the general public follows behind them. From this point, the combined procession makes stops at the remaining stations before ultimately arriving at the church. This collective journey, marked by shared rituals and moments of pause, embodies the communal spirit and devotion of the inhabitants. The procession, in its entirety, is not just a religious observance but also a profound expression of community solidarity and cultural identity.

To mark the conclusion of the day's first tour, the organizers express their gratitude to the community for facilitating the Via Crucis, a tradition that has been upheld since the beginning of Lent. Typically, this day's celebration includes a ritual where people kiss the cross. However, in light of COVID-19 precautions, modifications were made to this practice. Instead of kissing the cross, participants were encouraged to simply make a reverential gesture towards it, thereby minimizing the risk of virus transmission. To expedite the process and prevent crowding within the church, three crosses are strategically placed: two on the sides and one in the center. This arrangement allows the activity to be completed more efficiently and safely. Following this event, the congregation disperses, with the general public expected to return at 8 pm for the next significant event of the day. For the runners and other collaborators involved in preparing for the upcoming procession, known as the Procession of Silence, their presence is required an hour earlier. This additional time is necessary to ensure that all preparations are in place for the solemn and reflective nature of this particular procession. The adaptation of traditional practices in response to health concerns, and the continued commitment to these observances, underscores the community's resilience and dedication to maintaining their cultural and religious heritage, even in challenging times.

The final event of the day is the Procession of Silence, as previously mentioned. This solemn procession involves carrying a representation of Jesus' coffin, with a strong emphasis on maintaining silence throughout. The organization of this nocturnal procession is carefully planned, considering the unique challenges it presents. The procession is led by the runners, who pair up

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for safety reasons, given the lack of public lighting at night. The distance between each pair is kept minimal, and overall participation in this procession tends to be lower than during the day. The risks are heightened during the night, as poor visibility increases the likelihood of accidents, and there is also the potential danger of attacks from canines. In anticipation of these risks, residents are requested to secure their pets for the duration of the procession, estimated to be at least 3 hours. Once the runners have their censers lit, individuals carrying candles begin to integrate into the procession. The Procession of Silence, with its unique challenges and solemnity, stands as a poignant representation of the community's devotion and respect for the traditions of Holy Week. The adaptation of the procession to ensure safety in the nighttime setting reflects the community's commitment to preserving these practices while being mindful of practical considerations.

As the Procession of Silence continues, a participant dressed similarly to the candle bearers carries a tray bearing three nails and a crown of thorns, symbolizing the crucifixion of Jesus. Following this individual, the apostles join the procession. Once everything is in place, the central image of the procession, carried by eight men due to its considerable weight, makes its appearance. Accompanying this image are individuals positioned along the sides, ready to assist in carrying it throughout the journey. Adding to the solemn atmosphere, a participant with a noisemaker plays it continuously along the route. The general population follows, participating in the procession with reverence and silence. To ensure safety and order, two loops are formed along the sides of the procession, creating a central space. This space is crucial as it allows the runners, with their lit censers, to pass through the procession without causing any harm to the other participants. This careful organization of the Procession of Silence, with its symbolic elements and thoughtful arrangement, reflects the community's deep respect for the tradition. The inclusion of various roles and the strategic formation of the procession demonstrate the community's commitment to maintaining the solemnity and safety of this significant religious observance.

In addition to the image of Jesus, the Procession of Silence also features the image of Mary, with community members volunteering to help carry it. To enhance safety and visibility during the procession, especially in poorly lit areas, participants are encouraged to bring lamps or candles. This precaution helps prevent accidents such as slipping or tripping in the dark.

Historically, there was a practice of burning tires along certain sections of the procession route that were particularly dark and devoid of houses. However, this practice has been discontinued due to growing environmental awareness. This change was influenced by the church, schools, and other organizations that highlighted the environmental damage caused by tire burning. It's noteworthy that this practice was not unique to this community but was also common in other areas lacking public lighting and observing Holy Week activities. In the present day, to ensure safety in these darker sections of the route, some individuals are assigned to guard these areas. Additionally, the organizers conduct patrols on motorcycles to ensure everything proceeds smoothly and safely. This evolution in the community's approach to managing the procession reflects a growing consciousness about environmental stewardship and a commitment to adapting traditions in a responsible manner. The community's ability to balance the reverence of their religious observances with practical and environmental considerations exemplifies a dynamic and thoughtful approach to cultural and religious celebrations.

Upon reaching the church at the end of the Procession of Silence, the runners play a crucial role in ensuring that all participants are accounted for, notifying the organizers of anyone who may be missing so that they can be safely retrieved. Meanwhile, the gathered congregation engages in prayers, marking the conclusion of the evening's activities. After the prayers, the general population disperses and heads home. However, the organizers remain at the church for a while longer, as their responsibilities for the day are not yet complete, and they need to prepare for the upcoming activities scheduled for the next day. Despite the relatively small population of the communities involved in these religious activities, there is a notable level of participation from the residents. Additionally, the presence of people from outside the community contributes to a larger turnout, as observed by the locals. Holy Week in these communities is more than just a series of religious observances; it is a time for social interaction and community bonding. Unlike regular Sunday masses, Holy Week activities offer a unique space for communal engagement, as evidenced by the active participation of entire families. This period serves not only as a religious observance but also as a vital cultural and social event, fostering a sense of unity and togetherness among the community members.

Concluding with the description of the activities according to Friday below, some images are shown in Figure 4 that represent the routes that were previously mentioned.

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Figure 4. Viacrucis. Own elaboration

Saturday of Glory

On this particular day, the community congregates at the church at 10 in the morning to participate in the procession dedicated to Mary. The runners, apostles, and ciriales, however, arrive an hour earlier to prepare. This preparation includes changing into their respective attire and, for the runners, lighting their censers. Once ready, the runners form two lines, followed by the candles and apostles. Notably, in this procession, the apostles do not carry their crosses, and only 11 members of this group participate, with the possibility of the remaining member joining as a runner. The image of Mary, carried by women and accompanied by other female volunteers, is then integrated into the procession. With the formation complete, the procession commences, with the threads released to create a space for the runners to pass through. The route is the same as the previous day, but this procession differs in that it does not include stops, and the runners' reverence is directed solely towards the image of the Virgin Mary. As a result, this procession is completed in a shorter time compared to the one held the day before. This day's activities highlight the community's devotion to different aspects of the Holy Week narrative, with specific reverence given to the figure of Mary. The organization and participation in this procession, much like the others, reflect the community's deep-rooted religious traditions and the collective effort to uphold these practices year after year.

Following the procession, the community begins preparations for the Easter Vigil Mass. This preparation phase is marked by a collective effort in creating floral arrangements, where a group of community members, skilled in working with flowers and foliage, come together to foster an atmosphere of joy and celebration. This activity is inclusive, with children also participating alongside their parents, contributing to the communal spirit of the occasion. The tasks for preparing the church for the Easter Vigil are diverse and involve various members of the community. Some devote their time to cleaning the church, ensuring it is pristine for the important service. Others assist in procuring candles and carrying out other necessary preparations for the Easter celebration. These efforts are coordinated to align with the priest's schedule for the Mass. The timing of the Easter Vigil Mass, typically scheduled from 7 to 8:30 in the evening, is considerate of the community's daily routines. This scheduling allows community members to manage their day-to-day responsibilities, whether at home or in the fields, before gathering for the Easter celebration. The chosen time frame demonstrates the community's ability to balance religious observances with everyday life, ensuring broad participation in this significant event. The Easter Vigil Mass, with its themes of renewal and joy, serves as a culmination of the Holy Week observances, bringing the community together in a shared expression of their faith and cultural heritage.

As the designated time for the Easter Vigil approaches, the community congregates in the church, accompanied by the continuous sound of the rattle. This sound has been a substitute for the church bells since they were last rung on Thursday in Glory. The use of the noisemaker, a large instrument located at the top of the church bell tower, is a significant aspect of the Holy Week observances. Operating this noisemaker requires considerable effort, as it is played for extended periods and during various key moments of the week. The noisemaker is sounded to signal the beginning of the Stations of the Cross, throughout the Stations, for the call to the Friday afternoon celebration, and during the Procession of Silence. It is also used on Saturday morning during the procession with the Virgin Mary and finally to announce the celebration of Easter. Due to the demanding nature of this task, it typically involves the participation of several people, usually men, both adults and youths. Some of these participants have been involved in this activity since the first time Holy Week was observed in the community. This tradition of using the noisemaker,

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particularly in the absence of church bells, is not just a practical measure but also holds symbolic significance. It reflects the community's adaptability and commitment to maintaining the solemnity and continuity of their Holy Week traditions. The collective effort in operating the noisemaker underscores the communal spirit and the shared responsibility in upholding these cultural and religious practices.

As the community gathers for the Easter celebration, attendees are initially asked to remain in the atrium, except for those involved in a specific ritual involving a bonfire. Participants in this ritual bring buckets of various sizes filled with water and flowers to be blessed. After placing these buckets in a designated area, they are instructed to return to the atrium to partake in the initial activity of the celebration. This first activity involves lighting candles and tapers from the bonfire's flame. Each family participates in this ritual, symbolizing the spread of light and renewal. Following this, a small procession is formed, with the fire leading the way as the congregation moves into the church. If it is already dark, the church lights remain off, creating an atmosphere of solemnity and reflection. Those who have readings to perform do so with the aid of lamps, adding to the ambiance. During this service, the children who portrayed the apostles, dressed in purple, take their place in the first rows on the left side, each holding a candle. The ciriales, dressed in white, also participate, maintaining their role as they have throughout the Holy Week observances. This part of the Easter celebration, with its focus on light and renewal, is a poignant conclusion to the Holy Week observances. The use of light, both from the bonfire and the candles, in the darkness of the church, serves as a powerful symbol of hope and rebirth, central themes of the Easter celebration. The involvement of the entire community, from the youngest to the oldest, in these rituals, underscores the deep-rooted cultural and spiritual significance of these traditions in the community's life.

As the Easter Vigil unfolds, the runners carry only their candles. At the moment the priest proclaims the word of glory, a cascade of celebratory sounds and sights envelops the congregation: bells ring, rockets burst in the air, and rose petals – or petals of other flowers prepared by the community – begin to fall gracefully from the dome. Concurrently, the purple cloth veiling the altar images is slowly removed, all set against the backdrop of the resonant song of glory. The children who portrayed the apostles participate in this transformative moment by heading to the bell tower to change their garments to white, symbolizing a shift from solemnity to celebration. This change is mirrored in the atmosphere of the church, now adorned with an abundance of white flowers and various floral arrangements, creating a sense of joy and renewal. The ceremony continues with the blessing of the water, accompanied by hymns that resonate with the theme of the activity. As the celebration concludes, a sense of community fellowship is palpable. Some congregants gather at the stalls near the church to socialize, while others opt for gatherings in their homes. This concluding part of the Easter Vigil is a vivid testament to the joy and communal spirit that characterizes the celebration. The transformation of the church's ambiance, the change in the apostles' attire, and the communal activities reflect the themes of rebirth and renewal central to Easter. The congregation's participation in these rituals and their subsequent socializing underscore the importance of these traditions in fostering community bonds and cultural continuity.

Easter Sunday

The day following the Easter Vigil marks the Resurrection Procession, another significant event in the community's Holy Week observances. This procession typically takes place either at 10 in the morning or at noon. A notable change in this day's procession is the absence of the children who played the role of the apostles in the previous activities. Their essential participation in earlier events transitions to a different role on this day. Many of these children choose to participate as runners, already equipped with the necessary attire. The only additional requirement is a censer, which they obtain from others who participated in the earlier processions. For some previous participants, continuing in their role as runners is not feasible due to cuts or blisters on their feet, or because they need to return to work, especially if their employment is in a city. On the day of the Resurrection Procession, the runners don white dresses and cords and continue to participate barefoot. They arrive early, around 9 in the morning, to prepare the bonfire, an integral part of the procession's setup. This change in attire from purple to white symbolizes the transition from mourning to celebration, reflecting the joyous nature of the Resurrection Procession. The continued involvement of community members, adapting their roles to suit their circumstances, demonstrates the flexibility and commitment within the community to uphold these cherished traditions.

On the day of the Resurrection Procession, the route remains the same as in previous days, but there is a noticeable decrease in participation from the community, organizers, porters, and runners. The duration of this procession is notably shorter, lasting about one and a half hours, compared to the lengthier processions of Friday and Saturday. While the activities of the Resurrection Procession are similar across the region, each community has its unique aspects that set its observance apart from others. These particularities are a source of pride and distinction. The involvement of children and young people is especially noteworthy, as their enthusiasm and willingness to participate in the Holy Week activities suggest that these traditions will be sustained for many years to come. According to the residents, and as evidenced by a date inscribed on one of the church walls,

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the building has been in use since June 2001. However, the first recorded instance of religious activities being held there dates back to 2002. This marks 20 years of the inhabitants faithfully conducting these activities, aligning with the guidelines of the Catholic Church. The community's approach to organizing and involving everyone in various capacities is a testament to their commitment to these traditions. This collective effort ensures that each year's observance is a reflection of their shared faith and cultural heritage, fostering a strong sense of community and continuity.



Figure 5. Runners on Easter Sunday. Own elaboration

The historical context of the Holy Week observances reveals a significant evolution in the participation patterns of the residents of Los Fresnos and Tejocote. In the past, these communities participated in the Holy Week activities primarily in the municipality of La Perla. This participation required traveling distances ranging from 3 to 5 kilometers, a considerable effort considering the lack of transportation options and challenging road conditions at the time. However, in more recent years, improvements in infrastructure and accessibility have made it more viable for residents to travel between these communities. The reduced distance and enhanced transportation options, irrespective of the mode of transport used, have facilitated easier participation in the Holy Week activities. Additionally, the demographic changes over the decades have also played a role. In the 1980s and 1990s, the population of these communities was smaller than it is today. With the growth in population, there has been a corresponding increase in local participation in the Holy Week events. This shift has reduced the reliance on traveling to La Perla for observances, allowing for a more localized and community-centric celebration. These developments reflect not only the changing logistical and demographic dynamics but also the adaptability of the communities in maintaining and nurturing their religious and cultural practices. The evolution in participation underscores a deeper commitment to preserving these traditions within the local context, ensuring their continuity and relevance for future generations.

Second Sunday of Easter

Concluding the discussion of the activities in Los Fresnos, it's evident that the religious observances are not only a matter of faith but also require significant organization, manpower, and financial resources. The preparation for these events is an extensive process that demands foresight and coordination. Moreover, these activities have an economic dimension. The gathering of numerous people in a common area during Holy Week creates opportunities for local families engaged in food and beverage businesses, thereby generating income and supporting the local economy. The final event in the Holy Week calendar is the procession of the Lord of Mercy. For this procession, the community assembles at the church at 7:00 a.m. Consequently, the runners are asked to be present by 6:00 a.m. According to their feedback, this early morning schedule is preferable. The cooler temperatures and the optimal condition of the roads at this time make participation more comfortable. Additionally, after a week of rest, any injuries or discomfort in their feet from running in the previous processions have had time to heal, allowing them to participate more effectively. This blend of religious devotion, community organization, and economic activity highlights the multifaceted nature of Holy Week in Los Fresnos. It's a time that not only reinforces spiritual beliefs but also strengthens community bonds, supports local businesses, and showcases the resilience and adaptability of the community members.

The organization of the procession for the Lord of Mercy is meticulously planned, with the runners positioned at the forefront. They are arranged by height and dressed in white garments with a white cord, each carrying a lit censer. While the participation of the runners is significant, it is notably less extensive than that observed on Good Friday. Following the runners are the candle bearers, and then comes the incensed image, revered by the runners as they pass. Bringing up the rear of the procession is the general public, who join in as the procession advances. As the procession reaches the church, more people join, drawn by the commencement of the mass at 9:30 in the morning, a customary practice in the community and a point of convergence for both communities. Upon completion of the procession, the organizers express their gratitude for the collaboration of each participant. They also look forward to making improvements in the next Holy Week, optimistic about the future of these traditions. This optimism is fueled by the involvement of children and young people, who are increasingly participating in these customs.

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Their engagement is a promising sign that these practices will be sustained and cherished for decades to come, ensuring the continuity of these deeply rooted cultural and religious observances.

III. DISCUSSION

The religious events in this community, while centered around spiritual observances, encompass a broader spectrum that includes economic and social dimensions. A key economic aspect is the cultivation of flowers used in the floral arrangements for the church and religious images on various days. This cultivation not only supports the local economy but also plays a crucial role in the beautification of the religious ceremonies. Additionally, individuals skilled in creating floral arrangements often share their knowledge with the younger generation and others interested in contributing. This transfer of skills not only ensures the continuity of this important aspect of the celebrations but also fosters a sense of community and shared heritage. The food and beverage vendors also benefit economically from these events. The influx of participants and visitors during Holy Week provides them with a significant source of income, contributing to the overall economic health of the community. Above all, the social aspect of these events is paramount. The community's organization of these activities promotes not just coexistence but also collaborative work towards a common goal: maintaining and enhancing the community's well-being. The active participation of children and young people is particularly noteworthy. Their involvement not only allows them to showcase and develop their skills but also ensures that these cherished traditions will be passed down to future generations, preserving the community's cultural and religious identity.

IV. CONCLUSIONS

The method of participant observation was instrumental in capturing the essence of the Holy Week activities conducted by members of the two participating communities, as well as individuals from other cities or communities with family ties to the town. This approach enabled a detailed and immersive documentation of the events, beginning from the initial organizational meetings. While the observational work commenced with these preliminary gatherings, the focus of the documentation intensified during the Holy Week itself, a period marked by a higher density of activities and community involvement. The schedule of events was typically outlined on a card, detailing the timings and nature of each activity. However, it was observed that people often arrived earlier than the scheduled times. This early arrival was particularly notable in the case of the processions, where runners were advised to be present an hour in advance. Being there before the official start allowed for a comprehensive observation of the runners and their preparations, adding depth to the overall understanding of the community's practices. This method of participant observation not only provided a chronological account of the events but also offered insights into the community's dedication and the meticulous preparations that underpin these significant cultural and religious observances. The involvement of the observer in the community's rhythm of life during this period was crucial in capturing the nuances and the spirit of the Holy Week celebrations.

While the Holy Week celebrations in the community are a collective effort, it was observed that the more demanding tasks often fell to a select few. After the conclusion of each day's activities, most people returned home, leaving behind those with specific responsibilities or those who chose to stay voluntarily. This often resulted in a small group, typically around 10 people and mostly men, working to complete the necessary tasks. Looking to the future, there is an expectation that the community's population will grow over the next 5 to 10 years. This projection is supported by the active involvement of young people and children in the events. Their participation is a promising indicator that these traditions will be sustained for many decades to come, despite the community having only recently established a dedicated space for these observances. The significance of these events extends beyond the performance of religious rituals. They represent a way for the community to organize and unite around a shared purpose, drawing on practices and knowledge passed down from relatives or learned from other contexts sharing the same faith. This aspect of the celebrations highlights the role of Holy Week as a means of preserving cultural heritage and fostering a sense of community identity and continuity. The involvement of younger generations ensures that these traditions will not only endure but also evolve, reflecting the changing dynamics of the community.

In concluding this study, it's important to acknowledge the inherent limitations of the participant-observation method employed, particularly given the diversity of groups and activities involved in the Holy Week celebrations. While participant observation offers a comprehensive view of the events, it is not always feasible to actively participate in every aspect due to the specific knowledge and skills required for certain tasks. For instance, playing the noisemaker, a task that necessitates the ability to climb the tower and the physical strength to operate the instrument, was beyond the scope of direct participation. Similarly, the creation of floral arrangements, which requires artistic talent and expertise to craft unique designs that differ from previous years, was another area where observation was more appropriate than participation. Additionally, the simultaneous occurrence of various activities in different locations posed a challenge. It was not possible to witness all events from a single vantage point.

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However, this limitation was somewhat mitigated by engaging in discussions with community members. These conversations provided valuable insights into the events, their significance, and the reasons behind the specific ways in which they were conducted. This research, therefore, relied on a combination of direct observation, participation where feasible, and discussions with participants to gain a holistic understanding of the Holy Week observances. While certain aspects could only be observed, these observations, complemented by interactions with the community, offered a rich and nuanced perspective of the cultural and religious practices of the community.

This work took several years to carry out, as it was observed in 2019, in 2020 there were no events because the pandemic forced people to stay in their homes. Without carrying out activities that will lead to the conglomeration of people. For 2021 the activities were only with the participation of some people, in 2022 the activities were carried out as usual. It was considered that the 2019 observations were not sufficient, since some activities are carried out at the same time and it was not possible to be in all places or at all times, such as processions that separate, while some people play the noisemaker, for example. However, it was important to carry out participant observation in the three years mentioned. Which allowed us to know some details that would not be possible to see in a single year.

DECLARATION OF INTERESTS STATEMENT

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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REFERENCES

- 1) Inegi.org.mx (2020). En México somos 126 014 024 habitantes: censo de población y vivienda 2020. Disponible en: <https://en.www.inegi.org.mx/app/saladeprensa/noticia.html?id=6237>
- 2) Morales-Alarcon, G. J., Sandoval-Hernandez, M. A., Filobello-Nino, U. A., and Vazquez-Leal, H. 2023 National Protected Areas in Mexico: The Case of Pico De Orizaba. *International Journal of Multidisciplinary Research and Analysis*. <https://doi.org/10.47191/ijmra/v6-i7-24>
- 3) Morales-Alarcón, G. J., and Fabre-Platas, D. A. 2021 Follaje: producción y comercialización ante la nueva normalidad. *Interconectando Saberes*, (12), 151-164. <https://doi.org/10.25009/is.v0i12.2714>
- 4) Ponciano-Castellanos, K. 2019 Mi lugar es con María, no con Jesús. *Relaciones espaciales y construcción de género durante la Semana Santa en Guatemala*. *Península*, 14(2),121-153. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1870-57662019000200121&lng=es&tlng=es.
- 5) Aguilera-Calderón, R. 2015 La Fiesta de Semana Santa entre los xi'ui (pames) de Santa María Acapulco. De lo material a lo inmaterial. *Revista De El Colegio De San Luis*, 5(10), 134–155. <https://doi.org/10.21696/rcsl5102015429>
- 6) Mancha-Castro, J. C. 2020 La dramatización de una ciudad. Significaciones rituales urbanas de la Semana Santa de Huelva. *Disparidades*. *Revista De Antropología*, 75(1), e013. <https://doi.org/10.3989/dra.2020.013>
- 7) Byba M. 2019. El concepto de la Semana Santa: análisis cognitivo, lingüístico y cultural. *Círculo de Lingüística Aplicada a la Comunicación*, 77, 159-170. <https://doi.org/10.5209/CLAC.63281>
- 8) Sánchez-Guzmán, R. and Fernández-Paradas, A. R. 2020 De la crónica al periodismo, fuentes para el constructor de la semana santa ilustrada. [From the chronicle toto journalism, sources for the construction of the illustrated holy week]. *Vivat Academia*. *Revista de Comunicación*, 150, 1- 24. doi: <http://doi.org/10.15178/va.2020.150.1-24>
- 9) Rivera-Krakovska, O. 2005 Notas sobre la fiesta y la representación teatral en la Semana Santa de Santa María de Tonantzintla. *América sin Nombre*, 0(8), 75-85. <https://doi.org/10.14198/AMESN2006.8.10>
- 10) Partida Tayzán, A. 2005 La teatralidad actual de la Pasión en Iztapalapa. *América Sin Nombre*, (8), 68. <https://doi.org/10.14198/amesn2006.8.09>
- 11) Pellicer, I., Vivas-Elias, P., and Rojas, J. 2013 La observación participante y la deriva: dos técnicas móviles para el análisis de la ciudad contemporánea. El caso de Barcelona. *EURE*, 39(116),119-139. <https://www.redalyc.org/articulo.oa?id=19625670005>
- 12) Sánchez-Serrano, R. 2013 La observación participante como escenario y configuración de la diversidad de significados. *Observar, Escuchar y Comprender. Sobre La Tradición Cualitativa En La Investigación Social*, (May 2017), 93–123. Retrieved from <http://www.jstor.org/stable/j.ctt16f8cd1.7>
- 13) Taylor, S. J .and Bodgan, R. 1984 La observación participante en el campo. *Introducción a los métodos cualitativos de investigación*. La búsqueda de significados. Barcelona: Paidós Ibérica.

Organization, Customs, and Social Activities: The Case of Holy Week

- 14) Martínez R., L. A. (2007) La observación y el diario de campo en la definición de un tema de investigación. *Revista Perfiles Libertadores*, 4(80), 73–80.
- 15) Ardèvol, E., Bertrán, M., Callén, B., & Pérez, C. (2003). Etnografía virtualizada: la observación participante y la entrevista semiestructurada en línea. *Athenea Digital. Revista de Pensamiento e Investigación Social*, (3), 72-92.



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The Concept of Unlawful Act with the Strict Liability Model in Consumer Dispute Resolution in Indonesia



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ABSTRACT: Law Number 8 of 1999 concerning Consumer Protection regulates legal efforts to resolve consumer disputes through the courts. The lawsuit for damages is based on an unlawful act. The problem is how the concept of unlawful acts is a strict liability model for demanding compensation. The research method used is normative legal research. The results of this study explain that legal remedies through the concept of unlawful acts with this absolute liability model are by interpreting Article 19 paragraphs (1) and (3) of Law Number 8 of 1999. The concept of an unlawful act with a strict liability model is a plaintiff's obligation to prove the existence of a loss without having to prove a mistake. The recommendation is that the Government and the DPR immediately revise Law Number 8 of 1999 by strictly regulating unlawful acts as a legal norm in the law.

KEYWORDS: unlawful act, strict liability, consumer protection, compensation.

I. INTRODUCTION

Protection for consumers is a guarantee that consumers should get for every product purchased from producers or business actors. When consumers obtain goods or services, they always want quality goods or services, but in real life they sometimes do not always get goods or services that match their wishes, so this results in losses (Diyatmika et al., 2020). As consumers, of course they want to get the best service from business actors, although often the actions of producers or business actors actually harm consumers. For example, hidden defects in purchased goods, incorrect information, unsatisfactory service that consumers often experience, as well as poor online transactions, even though they have paid according to the price to obtain a good or service.

The current era of globalization with free trade means that trade liberalization provides an opportunity for countries to specialize in the production of goods and services, so that they can produce these goods cheaply (Dariah, 2005). Thus, many kinds of goods or services have emerged which are marketed to consumers in Indonesia, either through promotions, advertisements or direct offers of goods. This means that if you are not careful in choosing the desired product or service, consumers will only be harmed and become objects of exploitation from irresponsible business actors. Currently, without realizing it, consumers take the goods or services they consume for granted, resulting in various forms of errors and violations of consumer rights and this is disturbing and detrimental to society (Bustomi, 2018). If we look at the reality of what happened, there are several cases that can be considered detrimental to consumers, including the actions of business actors, whether intentional or due to negligence, which have serious and widespread impacts, so that the losses suffered by consumers can be massive. Material loss or threat of danger to consumers' lives caused by product imperfections. Some producers are less aware of their responsibility to protect consumers and ensure the safety and security of consumers in consuming the products they produce. Consumers who are victims are generally lower classes people, they have no other choice, so they are forced to consume or use goods or services with very minimal quality and safety. One day, this condition causes them to experience danger that could threaten their health and safety (Bustomi, 2018).

Consumers actually have rights that must be fulfilled by business actors, such as the right to protection in consuming or using goods or services, and the right to correct information about the condition of goods and services. Many consumers do not understand legal protection rights, because consumers have rights as buyers of goods and services (Atikah, 2020). Here there is a need to protect consumer rights, because according to the lazies faire paradigm, consumers and business actors are considered to have an equal position in the principle of freedom of contract (Sutedi, 2008). Likewise, it is stated in the principle of consumer protection, known as *caveat vendor*, that business actors and consumers are two equal parties (Sutedi, 2008) In reality, in practice this is not the case, the position of consumers in general is weaker when compared to business actors.

Consumers who feel disadvantaged do not know the steps that must be taken to demand fulfillment of their rights, so that fulfillment in the form of demands for compensation does not meet consumer expectations. Losses in the form of material losses

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or losses involving the consumer, such as illness, disability, or even death of the consumer. This claim for compensation has actually been stipulated in Law Number 8 of 1999 concerning Consumer Protection, especially in Article 19 paragraph (1) which explains that, "Business actors are responsible for providing compensation for damage, pollution and/or consumer losses due to consuming goods and/or services produced or traded". Because there is a demand for compensation which means there is a dispute, meaning a dispute over compensation. This dispute needs to be resolved, namely resolving the dispute between business actors or producers and consumers. Consumer Protection Law Number 8 of 1999 provides two legal remedies to resolve consumer disputes and at the same time protect consumers, namely dispute resolution through court and dispute resolution outside of court. This is regulated in Article 45 paragraph (1) which reads: "Every consumer who suffers losses can sue business actors through institutions tasked with resolving disputes between consumers and business actors or through courts within the general court."

The study in this paper is a consumer protection dispute that is resolved through the courts which refers to general (civil) court provisions, namely civil procedures or civil procedural procedures regulated in HIR/RBg. In general, civil proceedings in consumer protection disputes in court can take the form of ordinary individual lawsuits, simple lawsuits, class actions or lawsuits filed by consumer protection institutions, both government and non-governmental organizations. In a lawsuit or claim for compensation, it is aimed at an unlawful act, namely an act which according to the law has been violated (*onrechtmatigedaad*) with a claim for compensation. This provision is regulated in Article 1365 of the Civil Code. Consumers who feel they have been harmed as a result of consuming or using products produced by producers can sue for compensation through Article 1365 of the Civil Code. Article 1365 of the Civil Code states that, "every unlawful act that causes loss to another person requires that the person, because of his/her fault in causing the loss, compensate for the loss" (Hukumonline.com, 2014).

Apart from using the concept of unlawful acts in Article 1365 of the Civil Code, claims for compensation can also use the concept of strict liability which was adopted from the Anglo Saxon legal system. The concept of strict liability is different from the concept of unlawful acts in Article 1365 of the Civil Code. The element that must be proven by the plaintiff is that there is only loss, namely actual loss caused by the infringer or business actor, while the elements in Article 1365 of the Civil Code are the existence of loss, fault and causality (Frisca, 2021).

The problem is formulated, namely what is the concept of strict liability as a model for unlawful acts in resolving consumer disputes, and what elements must be proven in consumer dispute cases that occur as a form of consumer protection.

II. RESEARCH METHODS

The research method used is normative legal research, namely regarding the application of normative legal provisions in action to each specific legal event that occurs in society (Muhammad, 2004). According to Philipus M. Hadjon and Tatiek Sri Djamiati (2005), normative juridical research or normative legal research is research aimed at finding and formulating legal arguments through analysis of the main problem. Likewise, Lili Rasjidi (2009) stated that "the original legal research method is the normative legal research method". Therefore, from an application point of view, this research is problem-focused research, that is, the problem studied is based on theory or looks at the relationship between theory and practice (Soekanto & Mamudji, 1994). The main problem is the concept of absolute liability as a model for unlawful acts in resolving consumer disputes. The basis of this normative legal research approach is the main raw material, and examines theoretical matters relating to legal principles, legal conceptions, legal views and doctrines, regulations and legal systems. The legal data used is both primary legal data and secondary legal data, both from statutory regulations, books, previous research results, papers and the internet (website) which are closely related to the research.

III. RESULTS AND DISCUSSION

1. Development of Civil Liability in the Concept of Unlawful Acts

A claim for compensation is a claim from a party who feels disadvantaged as a result of a civil action. The claim for compensation is of course the result of an act which according to the law is considered to violate the law which results in loss. The party who demands compensation also demands civil liability. The existence of a civil liability claim is deemed to have committed a civil unlawful act. Acts against the law in Indonesia are known because of the enactment of the Civil Code or *Burgerlijk Wetboek* (BW) which the Dutch brought to Indonesia. This unlawful act originates from the continental European legal system which is a legacy of Roman law. An unlawful act in Dutch is known as *onrechtmatigedaad*, in English it is the tort or underlawful act (Fuady, 2004). According to Wirjono Prodjodikoro (1984), it provides an understanding that breaking the law does not only have a positive meaning but also a negative meaning, which also includes people who by remaining silent can be said to be breaking the law, namely in the case of someone who according to the law must act. The provisions for unlawful acts or *onrechtmatigedaad* are contained in Article 1365 of the Civil Code. The provisions of Article 1365 of the Civil Code are the legal basis for a person to file a lawsuit against the law in court. Article 1365 of the Civil Code describes it as an unlawful act

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if a civil action results in loss to another person, thereby requiring the person who is at fault to compensate for the loss (Kusumahpraja, 2021).

In its development, the concept of unlawful acts (*onrechtmatigedaad*) was initially formulated narrowly, namely only limited to acts that directly contradict or violate written law. Due to the development of society, several cases of unlawful acts have reached a dead end when they are sued in court on the grounds that there is no law. Since 1812, *Hoge Raad* formulated unlawful acts in a broad sense which includes an act that is contrary to morality or norms that are considered inappropriate in social life in society. After the issuance of standard arrest on January 31, 1919 (Sodikin, 2018), So the definition of an unlawful act is not only an act that violates another person's rights or goes against the law, but also a violation of decency or societal norms of decency, both against oneself and against others. The definition of unlawful acts is interpreted broadly, due to the very complex development of social life. The definition of unlawful acts in this broad sense does not actually provide a clear and definite formulation of unlawful acts, but later this understanding was used as a reason to file a lawsuit in court and judges now interpret unlawful acts broadly. However, judges in their decisions in law enforcement must be implemented fairly, so that the judge's decisions are expected to fulfill a sense of justice as far as possible (Margono, 2019).

A lawsuit using Article 1365 of the Civil Code needs to fulfill several elements as an unlawful act, such as elements of fault (*schuld*), loss (*schad*), causal relationship (*causal verband*) and relativity (*relativiteit*) (Prodjodikoro, 1984). The claim for compensation submitted according to Article 1365 of the Civil Code, the plaintiff must prove the existence of several of these elements. In the concept of the Anglo Saxon system, acts against the law are known as fault based liability, namely liability that requires an element of fault (Sodikin, 2018). This is in line with the elements that must be fulfilled in Article 1365 of the Civil Code, but in the understanding of the Anglo Saxon legal system, the element of fault is the main element in claims for compensation. Therefore, in Indonesia, Article 1365 of the Civil Code states that every unlawful act which therefore causes harm to another person, requires the person whose fault caused the loss to compensate for the loss (Sodikin, 2018). Thus, by understanding fault based liability in the Anglo Saxon legal system, the perpetrator of an unlawful act is responsible for the losses he causes. Therefore, the action and loss can be taken into account as a requirement for the claim. So, in Indonesia according to Article 1365 of the Civil Code, the perpetrator of an unlawful act is only responsible for the losses he causes, if the errors and losses can be calculated. Here blame is used to imply that someone is responsible for a harmful outcome. The elements of loss and error are directly related, because a loss is caused by an error. However, according to Article 1365 of the Civil Code, there are still other elements that must be proven, namely the elements of causality and relativity.

To clarify the elements contained in Article 1365 of the Civil Code, acts against the law (fault based liability) in the Anglo Saxon legal system are known as traditional liability. In this concept of responsibility, the priority is fault. Civil fault or *schud* is also called *mens rea* which is the most important main object in determining whether someone is declared responsible or not. According to this traditional principle of liability, fault or *mens rea* is the obligation of the party who feels aggrieved, so they must be able to prove it. This is related to Article 163 HIR/183 RBg which is used in the Civil Procedure Law in Indonesia, which is an application of the Indonesian legal system which requires the party who feels disadvantaged to submit evidence to find fault with the party who committed the crime. Proving that there was a mistake is not easy, and will be very difficult because you must first prove that there is a causal relationship between the wrongdoing and the loss of the sufferer.

The heavy burden of proof in the form of errors in the development of science and technology has increased the burden of proof of elements of error when using the concept of unlawful acts. This is because it is a traditional liability and creates difficulties in predicting what will arise from a business or production activity whose risks are difficult to tolerate. Thus, the concept of unlawful acts as a concept for resolving civil disputes which requires the existence of an element of error in complex life in this era of technological progress is difficult to prove. Therefore, to anticipate the difficulty of proving the existence of an element of error, in Indonesia the concept of strict liability was developed which was adopted from the Anglo Saxon legal system. This is, even though Law Number 8 of 1999 concerning Consumer Protection does not explicitly regulate strict liability, but by interpreting Article 19 of Law Number 8 of 1999 concerning Consumer Protection, the concept of strict liability can be applied to civil lawsuits in the field of consumer protection.

As explained above, proving that there is a fault is not easy, because you must first prove that there is a causal relationship between the act, fault and loss. Here the plaintiff experienced difficulty in proving the causal relationship. The reality in practice is that there are differences in the applicable civil procedural law, because in accordance with the provisions of the applicable procedural law, the plaintiff must prove the element of causality. The need for proof by the plaintiff feels unfair, if the plaintiff has to prove the element of causality, because it is too difficult for them. Therefore, the concept of strict liability is a responsibility that does not prove the existence of an element of fault, but only proves the element of loss as the main element in the concept of a model of unlawful act. The element of loss is the main element in filing a lawsuit to claim compensation. This is where strict responsibility lies as a modern model of liability for unlawful acts. The element of loss is the

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legal basis for a lawsuit in court, and the element of fault is not the legal basis for filing a civil lawsuit in court. So, basically the concept of strict liability as a model of tort is an obligation of the plaintiff to the defendant who must prove the existence of a loss without having to prove the defendant's fault, if there has been actual loss to the plaintiff.

2. Consumer Protection and Business Actor Accountability

Law Number 8 of 1999 concerning Consumer Protection provides regulations regarding the rights and obligations between consumers and producers, which are regulated in Articles 4 to 7 of Law Number 8 of 1999. These rights and obligations are regulated so that consumers and producers have the same position. One of the most important aspects regarding the rights and obligations of the parties is the provision of clear and honest information regarding goods and services (Marpi, 2020). For consumers, rights are necessary, because a sense of security needs to be created for every human being with the right to fulfill their daily needs, so these rights need to be fulfilled and protected. Therefore, human rights to fulfill their daily needs are realized in their rights as consumers which are then guaranteed by law (Pratama, 2023).

There are rights and obligations between consumers and producers as business actors which are regulated in law to stop the imbalance between consumers and producers, because producers have capital power and are more organized and are also given ease in doing business by the government (Atsar & Apriani, 2019). The development of industry with easily available capital causes the production of goods and services to become increasingly complex. In addition, economic development and economic development, especially in the fields of industry and trade, have produced various goods and services that can be consumed by consumers. Likewise, globalization which supports free trade with advances in telecommunications and information technology has made it easier to transact goods and services across a country's territorial boundaries. The goods and services offered vary both from within the country and abroad. Such conditions are actually beneficial for consumers because consumers' needs for desired goods and services can be met, but because economic development and industrialization are very strong, consumers become weak.

This position shows that business actors and consumers are unbalanced so that consumers are in a weak position. In addition, consumers become objects of business activity for business actors to gain maximum profits by various sales promotion methods that will harm consumers. Another factor that is a weakness for consumers is that the level of consumer awareness of their rights is still low. This is due to low consumer education, resulting in ignorance of their rights as consumers or ignorance of the quality of the products they will buy. What often happens is that the conditions and conditions of consumers are weak compared to business actors. This causes consumers to often not sue business actors even though consumers have experienced losses due to the actions of business actors. This, coupled with the economic value experienced by consumers as a result of violations of their rights by relatively small business actors, means that consumers do not file lawsuits or demands against business actors (Panjaitan, 2021).

Law Number 8 of 1999 concerning Consumer Protection is the legal basis for consumers through legal action, namely a lawsuit for compensation. There is legal action through lawsuits in court with the hope that business actors will become aware of it. They try with the economic principle of getting the maximum possible profit with the minimum possible capital. This principle has the potential to harm consumers both directly and indirectly. Legal tools that protect consumers through lawsuits in court do not mean to kill the businesses of business actors or producers, but to encourage a healthy business climate in facing competition through the provision of quality goods and services.

Civil lawsuits using the concept of unlawful acts using the strict liability model actually have their legal basis in Article 19 paragraphs (1) and (3) of Law Number 8 of 1999 concerning Consumer Protection. Article 19 paragraph (1) states that "Business actors are responsible for providing compensation for damage, pollution and/or loss to consumers resulting from consuming goods and/or services produced or traded", and paragraph (3) states that "Providing Compensation is carried out within a period of 7 (seven) days after the transaction date". The sentence contained in Article 19 paragraph (1) is "business actors are responsible for providing compensation...". This paragraph is interpreted as regarding compensation for losses resulting from an unlawful act, so that every unlawful act brings harm to other people (*Elke onrechtmatige daad, waardoor aan een ander schade wordt toegebracht...*) (Widiyastuti, 2020) must provide compensation. The act of a business actor producing its production results which, according to Article 19 paragraph (1) of Law Number 8 of 1999, results in "damage, pollution and/or loss to consumers as a result of consuming the goods and/or services produced or traded" is an unlawful act, because other people who feel their rights have been violated. Therefore, every action that causes harm to another person must be compensated.

According to David Oughton, as quoted by Sari Murti, by interpreting unlawful acts as torts, and that torts have a role that is related to the problem of preventing economic losses (Widiyastuti, 2020). This is related to the problem of trading activities in goods and services which causes losses. Therefore, the concept of unlawful acts has a role in protecting economic interests, especially consumers, so the use of the provisions of this legal concept can be interpreted as achieving results efficiently. Consumer

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protection through Article 19 paragraph (1) of Law Number 8 of 1999 means that consumers as plaintiffs expect compensation and plaintiffs must also suffer losses. The purpose of Article 19 paragraph (1) of Law Number 8 of 1999 is compensation for losses, so that here the plaintiff (in this case the consumer) must suffer a loss, then the business actor (producer), whether they do or not, is the cause of the loss.

Furthermore, Article 19 paragraph (3) of Law Number 8 of 1999 states "there is provision of compensation which must be carried out within a grace period of seven days after the date of the transaction". Article 19 paragraph (3) is related to Article 2 of Law Number 8 of 1999 concerning the principles of consumer protection, namely the principles of benefit, justice, balance, security, consumer safety and legal certainty. The relationship between Article 19 paragraph (3) and Article 2 of Law Number 8 of 1999, explains that if the business actor is proven in court, immediately within seven days after the date of the transaction he is obliged to pay compensation. Paying immediate compensation is a fulfillment of the principles of benefit, justice, balance, security, safety and consumer legal certainty contained in Law Number 8 of 1999. Therefore, by adhering to the Anglo Saxon legal system, the responsibility of business actors in terms of products Liability according to the common law system or Anglo Saxon legal system does not require an element of fault. In such a legal construction, it is impossible to reverse prove the element of fault, because strict liability is referred to as liability without fault (Widiyastuti, 2020).

The development of this theory of responsibility is actually a reflection of the demands for a sense of justice expected by consumers. The complexity of problems and human behavior continues to change from time to time, so there is a need for legal theory to answer the challenges of the times to fulfill consumers' sense of justice. The legal doctrine of strict liability is the right answer to fulfill a sense of justice for consumers who demand their rights for the losses they experience from the products offered by producers. Strict liability is a legal doctrine that requires someone to be responsible for damage caused or caused by a product (Kemen LHRI, 2003). Thus, the legal doctrine requires that those responsible for business actors whose activities produce and market products that pose a danger to the health and lives of humans or consumers, are absolutely responsible for the losses incurred with the obligation to pay compensation directly and immediately when the health hazard occurs and consumers' lives.

3. Production of Business Actors Sued by Consumers

Business actors in producing goods and services can cause harm to consumers which can have dangerous impacts on human health and life. In general, the types of production activities of goods and services will always develop in accordance with developments in science and technology as well as developments in society in general. The thinking must be directed at formulating and creating criteria that can determine whether an individual activity in concrete includes activities that result in production which then endangers consumers. Therefore, it is necessary to determine the type of product consumed by consumers that poses a danger. The claim for compensation uses legal action with absolute responsibility. Judges can determine the forms of danger and criteria for a product that can be subject to the doctrine of absolute liability. The plaintiff does not need to prove whether or not there was civil error or negligence on the part of the defendant, what is important here is that the judge must decide that there has been a loss for the consumer as the plaintiff.

The author gives an example of a business or activity whose production results can be subject to the strict liability doctrine. *First*, financial technology or often called Fintech. Fintech is currently assisted by the internet, which has definitely encouraged the emergence of many startup companies in the financial sector in terms of online loans based on information technology (fintech) peer to peer lending or commonly called P2P Lending (Novinna, 2020). Technology-based fast loan fintech supervised by the Financial Services Authority. Business actors may be negligent in safeguarding consumers' personal data, thereby giving rise to legal problems in collecting debts from consumers. Illegal dissemination of consumer data carried out by debt collectors as third parties who carry out collections in an unlawful manner against consumers as customers who receive loans who fail to pay (default). This is of course that business actors have neglected to carry out their duties regarding their obligations to supervise and prevent abuse of authority (Novinna, 2020). Consumers as the injured party do not have to prove that there is an element of error committed by the business actor, but can sue the business actor.

Second, other cases, for example e-commerce cases which relate to on-line transactions. E-commerce is the impact of technological developments, so that transactions in e-commerce include through buying and selling offers and online buying and selling acceptance (Basri, 2019). Rapid developments in the field of telematics have caused existing positive law to lag behind and no longer be able to reach technological developments. Current laws and regulations are not yet able to protect consumers. Trading via e-commerce in the form of buying and selling does have several things that are generally agreed upon between buyers and sellers. However, it is not uncommon for sellers to cheat or buyers to cheat. Because consumers are the object of business for business actors to obtain maximum profits, they can commit fraud and ultimately harm consumers, because consumers have a weak bargaining position. Consumers cannot identify goods to be ordered via the internet, and also the information received is one-sidedly created by the seller, without the consumer verifying it. Consumers must first pay in full for the goods ordered, then

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the goods reach the consumer. If there is a loss on the part of the consumer, the consumer can sue the court as a result of the unlawful act committed by the business actor without having to prove whether or not there was an error. Consumers only prove that they have experienced losses.

Third, cases that occurred during the Covid-19 pandemic were cases of fake vaccines. Although this case is a criminal law case and is threatened under the Criminal Code, Law Number 8 of 1999 and Law Number 36 of 2009 concerning Health are civil law cases. This is because there are parties who feel disadvantaged, namely consumers or the public. There is a possibility that cases of fake vaccines that have occurred in the future could happen again, because there are business actors who do naughty things. There are people's rights that need to be protected in the event of fake vaccines. Law Number 8 of 1999, especially Article 4, provides consumer protection, namely the rights obtained from fake vaccine products. As consumers have the right to obtain comfort, security and safety in consuming goods and services; obtain correct, clear and honest information regarding the condition and guarantee of goods and services; and receive compensation, compensation and replacement, if the goods and services received are not in accordance with the agreement or are not as they should be (Geovanie & Dana, 2021). The principle of strict liability in consumer protection law is used to ensnare business actors, especially goods producers who market their products to the detriment of consumers. According to the principle of strict liability, producers are obliged to be responsible for losses suffered by consumers due to the use of the products they market. Compensation can be in the form of a refund or replacement of goods or services of the same or equivalent value or health care or providing compensation in accordance with statutory provisions (Geovanie & Dana, 2021).

Fourth, cases in the banking sector which result in losses experienced by customers as consumers. This happens because of limited consumer knowledge which causes people to suffer losses from placing funds or utilizing services at financial services institutions (banking). Banks as producers cannot simply seduce potential consumers with low interest rates, but in the end make business relationships between consumers and business actors become a matter of dispute (Laksono et al., 2022), because consumers suffer losses. There are several banking crimes that result in customers (consumers) being harmed, such as skimming (an act of stealing banking customers' data using a recording device as a medium, and this usually occurs on ATM machines and also EDCs); Phishing (an act of stealing customer information by searching for or hacking IDs and passwords, even breaking into banking customers' credit cards); Malware (the perpetrator enters data in the form of a virus into the customer's network by breaking into the data warehouse of the banking service provider, this action is rarely found because the perpetrator only needs to use a laptop/computer as a medium without the need for physical contact) (Laksono et al., 2022). The sophisticated technology used by criminal results in losses experienced by consumers. The strict liability doctrine can be used by consumers to determine fault rather than as a determining factor (Marcelliana et al., 2023). The rights of banking consumers are protected by the strict liability doctrine to claim compensation.

Fifth, another case is in the food sector, and food is a type of goods that is widely consumed by consumers. Regarding halal issues and whether or not the marketed food is suitable for consumption, consumers need to know the information. For example, the amount of food that is forbidden according to Islam may be very small, but with the progress and development of science and technology which has produced various processed food products by adding various additional ingredients whose halal is not clear, this can endanger the health of consumers (Putri Cahyani, 2021). Likewise with other types of food, including their shelf life, consumers need to know information about the food being distributed or marketed. If consumers feel that they have been harmed by the food products they have consumed, then the business actors are responsible, meaning they are obliged to bear everything that happens (Sakti et al., 2015). This is, almost all the characteristics of risks or responsibilities that depend on or include all the characteristics of actual rights and obligations such as losses, threats, crimes, costs or conditions that create a duty to carry out the law. Business actors are absolutely responsible for implementing the law.

Sixth, cases in the service sector, with various services produced by business actors, such as transportation services (both on-line and off-line), hotel services, expedition services, health services, transportation services, and others. Consumers who use services have rights as regulated in Law Number 8 of 1999. This means that if their wishes are not fulfilled when using the services provided by the business actor, the consumer demands compensation for the losses experienced in using the services provided by the business actor. Business actors providing services are activities to provide satisfaction to consumer desires. If the consumer has paid a certain amount of money, but the producer does not provide what the consumer wants. Claims for compensation can be submitted to court through a strict liability lawsuit. The manufacturer has violated the law because it does not provide services as specified in the law.

The existence of such cases means that business actors are absolutely responsible for the losses incurred with the obligation to pay compensation directly when the losses occur. Actions of business actors that cause losses to consumers, whether intentionally or negligently, can be prosecuted, and in accordance with Article 118 HIR, a lawsuit must be filed with a lawsuit letter to the district court in accordance with the authority of that court. In this case, the plaintiff does not need to prove that there is

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an element of fault by the defendant, but the plaintiff must prove that there is a causal relationship, namely the loss experienced by the plaintiff which is the result of the defendant's actions, namely producing goods or services that harm the plaintiff.

IV. CONCLUSION

The development of legal science has changed the concept of unlawful acts in Article 1365 of the Criminal Code with a strict liability model. The concept of tort with the strict liability model is a model of tort with a plaintiff's obligation to the defendant to prove the existence of a loss without having to prove the defendant's fault. Legal action through the concept of unlawful acts with a strict liability model is one of consumer protection, namely by interpreting Article 19 paragraphs (1) and (3) of Law Number 8 of 1999 concerning Consumer Protection. This is because in Article 19 paragraph (1) of Law Number 8 of 1999 there is the sentence "responsible for providing compensation", which means there is a concept of an unlawful act. Article 19 paragraph (3) of Law Number 8 of 1999 contains the sentence "the provision of compensation is carried out within a grace period of 7 (seven) days", which means that claims for compensation must be paid directly without having to prove the element of intent or negligence of an error. The interpretation of Article 19 paragraphs (1) and (3) of Law Number 8 of 1999 is as an effort to protect consumers.

REFERENCES

- 1) Apriani, R. & Abdul. A. (2019). *Buku Ajar Hukum Perlindungan Konsumen*. Deepublish Publisher.
- 2) Atikah, I. (2020). *Perlindungan Hak-Hak Konsumen Dalam Hukum Negara*. Media Madani.
- 3) Basri, H. (2019). Perlindungan hukum terhadap konsumen dalam melakukan transaksi e-commerce ditinjau dari Undang-Undang Perlindungan Konsumen Undang-Undang Nomor 8 Tahun 1999 (Studi Kasus Kerudungbyramana Bandung). *Pamulang Law Review*, 2(2), 131–140.
- 4) Bustomi, A. (2018). Tanggung Jawab Pelaku Usaha terhadap Kerugian Konsumen. *SOLUSI*, 16(2), 154–166. <https://doi.org/ersitas Palembang> <https://doi.org/10.36546/solusi.v16i2.125>
- 5) Dariah, A. R. (2005). Perdagangan Bebas : Idealisme Dan Realitas. *Mimbar*, 21(1), 115–126. <https://ejournal.unisba.ac.id/index.php/mimbar/article/view/167/pdf>
- 6) Diyatmika, K. P. S., Widiati, I. A. P., & Karma, N. M. S. (2020). Pertanggungjawaban dan Penyelesaian Sengketa Konsumen Berkaitan Dengan Perdagangan Parsel. *Jurnal Analogi Hukum*, 2(3), 393–398. <https://doi.org/10.22225/ah.2.3.2500.393-398>
- 7) Djamiati, T. S. and Philipus. M. H. (2005). *Argumentasi Hukum*. Gadjah Mada University Press.
- 8) Frisca. (2021). *Apakah Itu Perbuatan Melawan Hukum?* <https://lbhpengayoman.unpar.ac.id/apakah-itu-perbuatan-melawan-hukum/>.
- 9) Fuady, M. (2004). *Perbuatan Melawan Hukum Pendekatan Kontemporer*. Citra Aditya Bakti.
- 10) Greacy Geovanie, D., & Reza Arya Dana, K. B. (2021). Perlindungan Konsumen Terhadap Kasus Vaksin Palsu Dalam Perspektif Undang-Undang. *Jurnal Locus Delicti*, 2(1), 1–12. <https://doi.org/10.23887/jld.v2i1.454>.
- 11) Hukumonline.com. (2004). *Hakim: Pasal 1365 dan 1372 KUH Perdata Tidak Bisa Digabungkan*. <https://www.hukumonline.com/berita/a/hakimi-pasal-1365-dan-1372-kuh-perdata-tidak-bisa-digabungkan-hol10919/>.
- 12) Indonesia, K. L. H. R. (2003). *Pedoman Umum Penyusunan Gugatan Strict Liability Lingkungan Hidup*. Deputi Urusan Penegakan Hukum.
- 13) Kusumahpraja, R. K. (2021). *Tindakan Rekayasa Penyidik Sebagai Perbuatan Melawan Hukum Perdata (Ratio Decidendi Hakim Dalam Sebuah Perkara)* (R. Utami (ed.); 1st ed.). CV. Amerta Media.
- 14) Laksono, H. D., Prabowo, I. H., & Budhi, A. S. (2022). Optimalisasi Perlindungan Konsumen Perbankan Berdasarkan Uu No 8 Tahun 1999. *Prosiding HUBISINTEK*, 8, 636–641.
- 15) Mamudji, S. and Soekanto, S. (1994). *Penelitian Hukum Normatif—Suatu Tinjauan Singkat*. Raja Grafindo Persada.
- 16) Marcelliana, V., Adzani, N. N., Zahra, S. M., Massaid, H. N., Badriyyah, N., Benita, R., Sukarto, M., Fitriani, C. N., & Bayhaqi, T. A. R. (2023). Penerapan Perlindungan Konsumen Terhadap Nasabah Pt . Bank Syariah Indonesia. *Jurnal Publikasi Ilmu Hukum*, 1(2), 180–194. <https://doi.org/https://doi.org/10.59581/deposisi.v1i2.577>.
- 17) Margono. (2019). *Asas Keadilan, Kemanfaatan dan Kepastian Hukum Dalam Putusan Hakim*. Sinar Grafika.
- 18) Marpi, Y. (2020). *Perlindungan Hukum Terhadap Konsumen atas Keabsahan Kontrak Elektronik dalam Transaksi E-Commerce*. PT. Zona Media Mandiri.
- 19) Muhammad, A. (2004). *Hukum dan Penelitian Hukum*. Citra Aditya Bakti.
- 20) Novinna, V. (2020). "Perlindungan Konsumen dari Penyebarluasan Data Pribadi oleh Pihak Ketiga: Kasus Fintech Peer" To

The Concept of Unlawful Act with the Strict Liability Model in Consumer Dispute Resolution in Indonesia

Peer Lending. *Jurnal Magister Hukum Udayana (Udayana Master Law Journal)*, 9(1), 92–110. <https://doi.org/10.24843/JMHU.2020.v09.i01.p07>.

- 21) Panjaitan, H. (2021). *Hukum Perlindungan Konsumen, Reposisi dan Penguatan Kelembagaan Badan Penyelesaian Sengketa Konsumen Dalam Memberikan Perlindungan dan Menjamin Keseimbangan Dengan Pelaku Usaha*. Jala Permata Aksara.
- 22) Pratama, C. D. (2020). *Hak dan Kewajiban Konsumen*. Kompas.Com. <https://www.kompas.com/skola/read/2020/12/31/142912169/hak-dan-kewajiban-konsumen>.
- 23) Prodjodikoro, W. (1984). *Perbuatan Melanggar Hukum*. Sumur Bandung.
- 24) Putri Cahyani, G. (2021). *Analisis Kehalalan Produk Makanan Dalam Upaya Perlindungan Konsumen Bagi Umat Muslim Dalam Perspektif Ekonomi Islam (Studi Kasus Pasar Simpang NV Kabupaten Lampung Timur)*. Universitas Islam Negeri Raden Intan Lampung.
- 25) Rasjidi, L. & Lisa, R. (2009). *Monograf: Filsafat Ilmu, Metode Penelitian, Dan Karya Tulis Ilmiah Hukum*.
- 26) Sakti, M., Aryanti, D., & Yuli W, Y. (2015). Perlindungan konsumen terhadap beredarnya makanan yang tidak bersertifikat halal. *Jurnal Yuridis*, 2(1), 62–77. <https://doi.org/https://doi.org/10.35586/.v2i1.161>.
- 27) Sodikin. (2018). *Penegakan Hukum Lingkungan Menurut Undang-undang Nomor 32 Tahun 2009 tentang Perlindungan dan Pengelolaan Lingkungan Hidup*. In Media.
- 28) Sutedi, A. (2008). *Tanggung Jawab Produk Dalam Hukum Perlindungan Konsumen*. Ghalia Indonesia.
- 29) Widiyastuti, S. M. (2020). *Asas-Asas Pertanggungjawaban Perdata (Bagian Pertama)*. Cahaya Atma Pustaka.



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A Tracer Study of the 2019 Graduates of Bachelor of Science in Industrial Technology



Carina L. Vidania¹, Jeffrey S. Santos²

ABSTRACT: The success of any school in achieving its basic purposes is determined by the adequacy and quality, and relevance of the educational programs it provides.

The objective of this study was to determine the status of employment of the respondents; the length of time in looking for a job; their reason/s for the delay of employment or unemployment; the factors that facilitated in getting a job; and the level of their assessment on the quality and relevance of the education they obtained at ISU Ilagan Campus.

Most of the traced BS in Industrial Technology graduates batch 2019 started and completed their schooling within the prescribed period to finish the degree. However, some of them may have started out late or lagged behind their studies as indicated by the presence of significant number of respondents within the age range over the prescribed period of their course. Most of them were female and are still single. Most of them were took professional subjects for education and some of them were already LET passers.

Majority of the respondents claim that they were employed within the year of their graduation. However, No immediately vacancy were claimed as the top most reasons for the delay of the rest of the respondents' employment or had caused them unemployment.

The respondents identified as number one factor most contributory to their first employment was that they were educationally qualified. This implies that the employed respondents meet the minimum educational requirements of the hiring agencies. This indicates the relevance of the curriculum to job requirements. Most of the employed respondents were working in private firms but not yet permanent. It may indicate that this was not due to the inability of the respondents to meet the basic requirement, but it may be due to unavailability of permanent positions.

The job description of the respondents were an army, OFW, Product Specialist, Care Giver, Food and Beverage Services, Road Surveying, Tutoring, Cashier, Customer Service/Receptionist, Industrial Electrician, Machine Control Operator, SK Chairman, Teacher and Office Staff. The data indicates that majority of the respondents were in the field relative to their earned degree and there was a low prevalence of "misfits" and majority of the employed respondents were receiving salaries within the range above the minimum wage.

The employed respondents find communication skills, entrepreneurial skills; human or interpersonal skills; problem-solving skills, information technology skills; and microfinance skills very useful in their present job. Generally, they assessed as very useful in their present job the skills they acquire in college.

The respondents gave a remarkably favorable feedback on course content, faculty, as well as library, career guidance and scholarship as these were also found to be Excellent by the respondents. However, the program may want to level up from very good assessment to become excellent on Laboratories, physical plant, housing dormitories, alumni and job placement, Medical/Dental, Registration/Admission, Research services, Extension services and General administration and also to level up from good to become Very Good or excellent on Methods of Instruction. Nonetheless, the overall assessment of the respondents on the BS in Industrial Technology program was "Very Good".

INTRODUCTION

Higher education in our country is expected to significantly contribute to the development of a dynamic and self-sustaining economy, the pursuit of a better quality of life and the capacity to produce a burgeoning pool of skilled, versatile, technical, scientific, and managerial manpower that is internationally competitive (Amistad, 1999).

The success of any school in achieving its basic purposes is determined by the adequacy and quality, and relevance of the educational programs it provides. Although the words "relevance" and "quality", according to Aquino et al (1988) have been

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interpreted in various contexts and dimensions, there is a common agreement that, as applied to education, they reflect two important values made imperative by the fact that we have a dynamic culture fraught with complexity and challenge. It follows that the education system, along with other social systems in the Philippines society, can ill afford to be indifferent to, or oblivious of, such change. To restate one of the four national educational aims, the educational system must "respond effectively to changing needs and conditions of the nation through a system of educational planning and evaluation.

In this context, former students could provide vital feedback about their employability, the adequacy and relevance of their training in college in relation to the needs of their present job or prospective employment. This feedback from the graduates may guide the school in its pursuit to provide quality education that is relevant.

The Bachelor of Science in Industrial Technology program offered at the Isabela State University Ilagan Campus aims to equip future managers, supervisors with skills and efficiency needed to provide practical applications of theoretical knowledge in the different jobs in the industrial and technical world that could help in the socio-economic development of the country.

Objectives of the Study

This study has the following objectives:

1. To describe the profile of the respondents with respect to:
 - 1.1. sex
 - 1.2. age
 - 1.3. civil status
 - 1.4. graduate studies
 - 1.5. eligibilities
2. To determine the number of respondents who are employed, underemployed, self-employed, and unemployed?
3. To determine the waiting time before the respondents were employed?
4. To identify the reasons for the delay of employment or unemployment of the respondents?
5. To identify the factor most contributory to the first employment or present job of the respondents?
6. To determine the status of employment of the respondents with respect to:
 - 6.1. type of firm
 - 6.2. status of appointment
 - 6.3. job title
 - 6.4. monthly income
7. To determine the relevance of the college degree and educational training of the respondents to their present job?
8. To identify the skills acquired in college by the respondents which they find useful in their job.
9. To describe the level of assessment of the respondents on the BS InTecch program relative to:
 - 9.1. course content
 - 9.2. methods of Instruction
 - 9.3. faculty
 - 9.4. facilities
 - 9.4.1. library
 - 9.4.2. laboratories
 - 9.4.3. physical plant
 - 9.5. student Services
 - 9.5.1. career Guidance
 - 9.5.2. scholarship
 - 9.5.3. housing/dormitories
 - 9.5.4. alumni & job placement
 - 9.5.5. medical/dental
 - 9.5.6. registration/admission
 - 9.6. research services
 - 9.7. extension services
 - 9.8. general administration

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Conceptual Paradigm of the Study

The conceptual paradigm below shows the relationships of the variables in the study.

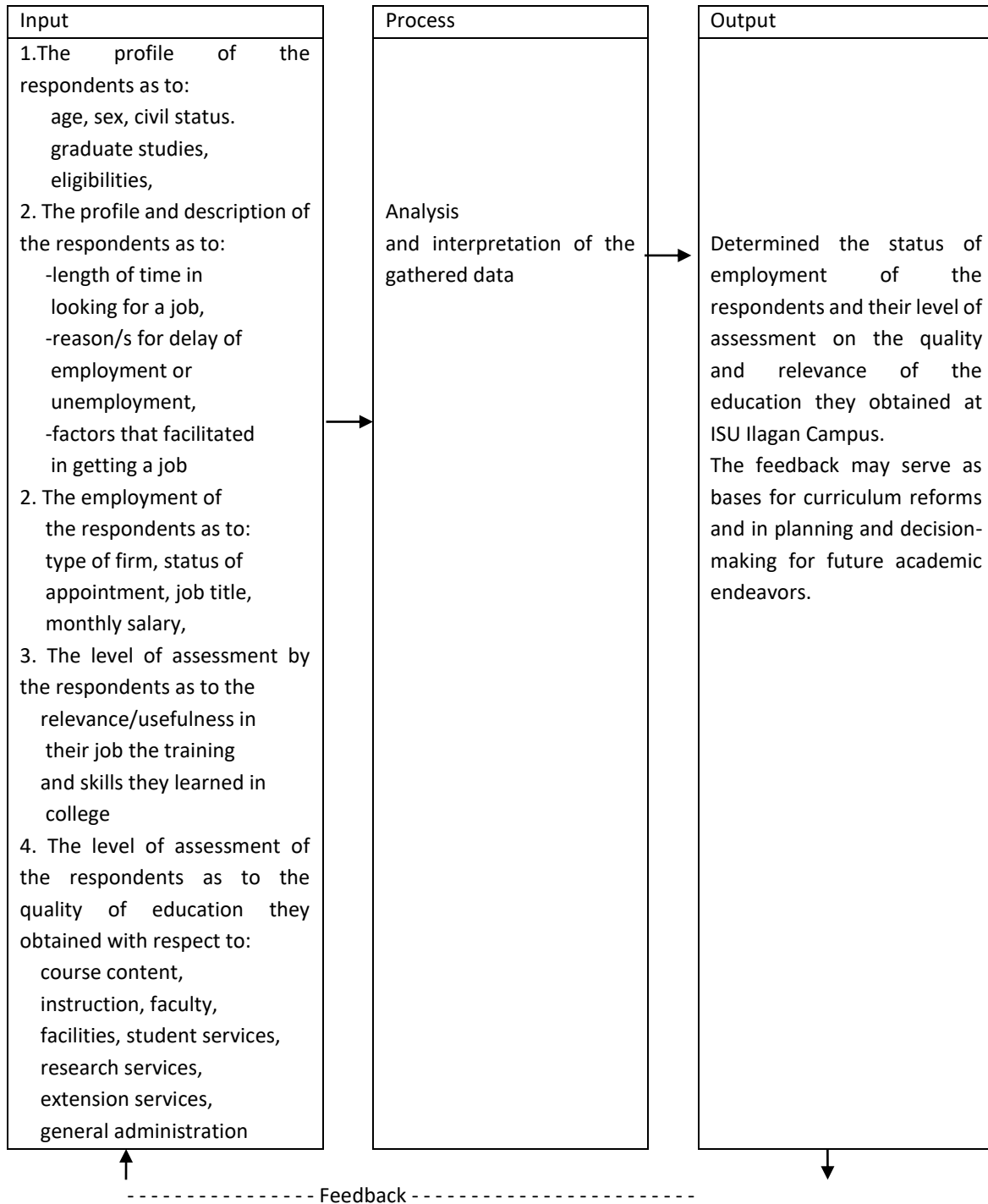


Figure 1. Conceptual Paradigm of the Study.

Scope and Delimitation of the Study

This Tracer Study was conducted to gather vital feedback about the quality and relevance of education obtained and employability of the graduates of Bachelor of Science in Industrial Technology (BS InTech) of the Isabela State University, Ilagan Campus. The respondents were the 214 graduates of School Year 2018-2019. The graduates were traced from the period January to June 2021. Two years period was said to be an ample time before tracing the graduates as by this time the graduates are expected to have been board passers and are already employed at least in a job fitting to the course they have taken.

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METHODOLOGY

The Research Method

The Researchers used the descriptive survey method. The data gathered reflected the traced status of the 214 Bachelor of Industrial Technology graduates of the Isabela State University, Ilagan Campus for the School Year 2018-2019. The descriptive method of research is oriented towards the description of the present status of a given phenomenon (Good and Scates (1972).

The data were gathered via Google Survey.

Respondents of the Study

The respondents of the study were the 214 graduates of Bachelor of Science in Industrial Technology from School Year 2018-2019 of the Isabela State University, Ilagan Campus, City of Ilagan, 3300 Isabela Philippines. The total number of graduates was taken as respondents (Appendix).

Locale of the Study

The Isabela State University, Ilagan Campus, Isabela 3300 Philippines where the respondents graduated is conveniently located at the center of Isabela.

Figure 2 shows the locations of ISU Ilagan and the ISU System as a whole in the map of Isabela.

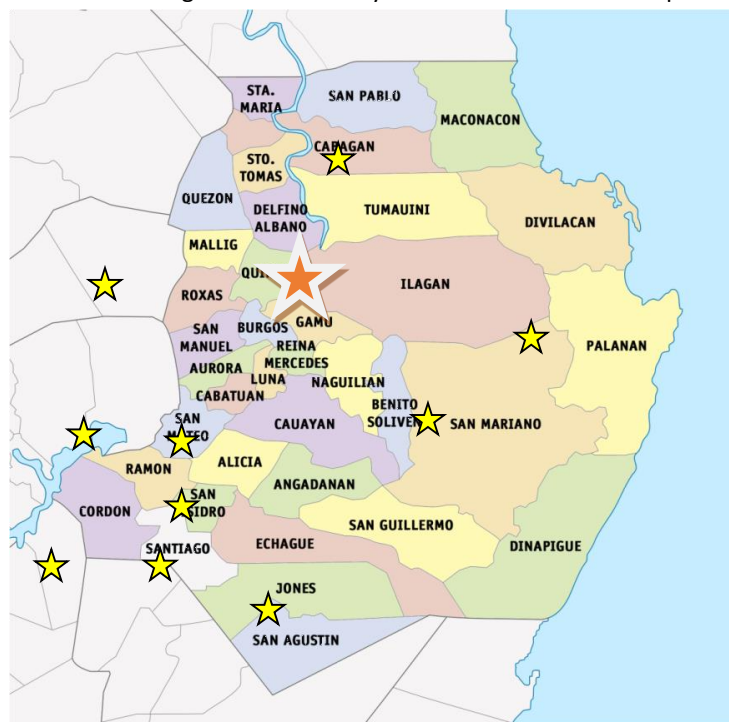


Figure 2. Location of ISU Ilagan Campus--with red star. Location of other campuses of the ISU System—yellow star.

Research Instruments

The primary instrument used in this study was the Google Survey questionnaire supplemented by interviews through the internet, phone calls, and documentary analysis.

The questionnaire used in this study was patterned after the CHED Graduate Tracer Study Instrument with some modification to suit the purpose of the present study.

The Five-point Scale was used to measure the indicators in the assessment of the respondents on the BS in Industrial Technology Program; and the Three-point Scale was used to measure the indicators on the usefulness of the skills acquired in their college to the present job of the respondents, corresponding to the following degree of intensity:

Description	Weighted Scale	Range
Excellent	5	4.20 – 5.00
Very Good	4	3.40 – 4.19
Good	3	2.60 – 3.39
Fair	2	1.80 – 2.59
Poor	1	1.0 - 1.79

Figure 3. Five-point Scale

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Description	Weighted Scale	Range
Very Useful	3	2.34 – 3.0
Useful	2	1.67 – 2.33
Not Useful	1	0.1 – 1.66

Figure 4. Three-point Scale

Collection of data

This study was proposed in a Research In-house Review. The Vice President for Research and Extension pronounced that Tracer Studies are no longer needed to be subjected to In-House Reviews since this is a CHED requirement and has to be annually conducted.

The Complete list of graduates was requested from the Office of the Registrar of the Campus. The Questionnaire of the study was uploaded in the internet. The respondents were reached either through the internet, home visits, or phone calls.

Statistical Treatment of the study

The profile of the respondents was presented in frequencies and percentages. The assessment on the BS in Industrial Technology program was presented using frequencies, percentages, and mean. The weighted mean and ranking were also used and the five-point and three-point scales were used to scale the level of the indicators of variables in the questionnaire.

RESULTS AND DISCUSSION

1. Profile of Respondents

1.1. Age

The data on the table below indicates that 3 or 1.51 percent of the respondents were ages 20-21; there were 64 or 32.32 percent were ages 22-23; there were 93 or 47 percent who were ages 24-25; there were 28 or 14.14 percent who were ages 26-27; 7 or 3.53 percent were ages 28-29; and 3 or 1.51 percent was within age ranges from 30-31. The data implies that most of the graduates from 3 years back to present were in the average age range of one who started and completed tertiary education within the prescribed period to finish the Bachelor of Science in Industrial Technology degree. However, a significant number of them rather started out late or lagged behind their schooling as indicated by the presence of 25 years olds and above. Nevertheless, the data also implies that the respondents were in the age range of one who is expected to be intellectually and emotionally ready to craft a career.

1.2. Sex

It could be seen on the table that there were 73 or 36.87 percent male respondents and 125 or 63.13 percent were female-respondents. Most of the respondents were female. This data confirms that the Industrial Technology is a female-dominated profession because there are 7 specialization offered; 3 for girls-trade (Food Technology, Cosmetology, Garments Technology), 3 for boys-trade (Automotive Technology, Electronics Technology, Electrical Technology) and 1 both for girls and boys (Drafting Technology) but still it was dominated by female enrollees.

1.3. Civil Status

The data show that 161 or 81.31 percent of the respondents were single; there were 34 or 17.17 percent were married; 2 or 1.01 percent were in live-in; and only 1 or 0.50 who respond rather not say. The data is giving the impression that the respondents managed to priorities their studies before getting into serious or more mature relationship. This data may also indicate that the respondents, having no added responsibility yet to raise a family, could focus more time in improving and establishing their career.

1.4. Graduate Studies

The data reveals that there was a lone respondent who was enrolled in higher education at the time of the survey. This indicates that most of the respondents were not into pursuing higher learning at the moment but some of them were enrolled in other schools to take professional education.

1.5. Eligibilities

It was gathered that 8 or 4.04 percent of the respondents who took for professional subjects for education and have already passed the Licensure Examination for Teacher. There were 43 or 21.71 percent of respondents who were holders and passed the National Competency II assessment. The data indicates that most of the respondents were a National Competency II holders.

Table 1 shows the frequency and percentage distribution of the indicators stated above that describes the profile of the respondents.

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Table 1. The Profile of respondents as to age, sex, civil status, graduate studies pursued, and eligibilities

Indicators	Frequency N=198	Percent
Age		
20-21	3	1.51
22-23	64	32.32
24-25	93	47
26-27	28	14.14
28-29	7	3.53
30-31	3	1.51
Sex		
Male	73	36.87
Female	125	63.13
Civil Status		
Single	161	81.31
Married	34	17.17
Live-in	2	1.01
Rather not say	1	0.50
Graduate Studies		
Masters Degree on-going(Education)	1	0.50
Eligibilities	(N=198 with 2 Or more eligibilities=51)	
Licensure Examination for Teacher	8	4.04
National Competency II	43	21.71

2. Number of Employed, Underemployed, Self- employed, and Unemployed Respondents.

The data indicates that out of the 198 respondents, 140 or 70.70 percent were employed and 40 or 20.20 percent were unemployed. Among the employed respondents 18 or 9.10 percent were identified as Self-Employed based from the data of the employed respondents has given out. There were no underemployed because all the respondents are still in the industry.

The data reveals that majority of the respondents were gainfully employed and there were few who were self-employed managing their own business. This indicates the relevance of the Program to job requirements.

Table 2 shows the frequency and percentage distribution of the indicators stated above.

Table 2. Number of Employed, Underemployed, Self-employed, and Unemployed Respondents

Indicators	Frequency N=198	Percent
Employed	140	70.70
Self-Employed	18	9.09
Unemployed	40	20.20

3. Lead Time Before the Respondents Were Employed.

The data shows that out of the 140 employed respondents, 95 or 67.86 percent were employed within the year after graduation; 37 or 26.43 percent within the second year; and 1 or 0.71 within the third year after graduation. This indicates that majority of the respondents were immediately got into jobs.

Table 3 shows the frequency and percentage distribution of the indicators stated above.

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Table 3. Lead Time Before the Respondents Were Employed

Indicators	Frequency N=140	Percent
Within the year after graduation	95	67.86
Within the second year after graduation	37	26.43
Within the third year after graduation	1	0.71

4. What is/are the Reason/s for the Delay of Employment or Unemployment of the Respondents?

The table shows that the number one reason of the respondents consider to have delayed their employment was because there was No immediate vacancy claim by 117 or 55.98 percent respondents; Rank 2 reason of 28 or 13.39 percent respondents was that Delay in taking/passing board exam; rank 3 reason of 11 or 5.26 percent respondents was that because of the Delay in the issuance of Other(outside) needed documents tie in Lack of Financial support for job hunting; Rank 4 reasons of 7 or 3.34 percent were Not Emotionally ready, because of the Delay in the issuance of school credentials, and because of Early marriage; on rank 5 as claimed by 5 or 2.39 percent respondents were in the Health reasons; rank 6 of 4 or 1.91 percent left as N/A; there were 3 or 1.44 percent both for Tight competition for a job and Available job is/are not in line with specialization as rank 7; Rank 8 for 1 or 0.48 percent for Studied again, Waiting for the result of exam, Early pregnant, Pandemic, Putting up a business rather than applying for a job and waiting for a quota.

Table 4 shows the frequency, percentage distribution, and rank of the reason/s for the delay of employment or unemployment of the respondents.

Table 4. Reason/s for the Delay of Employment or Unemployment of the Respondents

Indicators	Frequency N=209	Percent	Rank
Delay in taking/passing board exam	28	13.39	2
No immediate vacancy	117	55.98	1
Tight competition for a job	3	1.44	7
Not emotionally ready	7	3.34	4
Delay in the issuance of other(outside) needed documents	11	5.26	3
Delay in the issuance of school credentials	7	3.34	4
Early marriage	7	3.34	4
Health reasons	5	2.39	5
Studied again	1	0.48	
Lack of financial support for Job hunting	11	5.26	3
Waiting for the result of exam	1	0.48	8
Available job is/are not in line with specialization	3	1.46	7
Early pregnant	1	0.48	8
Pandemic	1	0.48	8
Putting up a business than applying for a job	1	0.48	8
Waiting for quota	1	0.48	8
N/A	4	1.91	6

5. Factor Most Contributory to the First Employment or Present Job of the respondents.

“Educational qualification” was the factor most considered by 39 or 20.53 percent of the respondents as contributory to their first employment. “Recommendation from relatives and friends” was ranked 2nd by 19 or 10 percent of the respondent. Ranked 3rd was “Personnel office of the company” by 7 or 3.68 percent of the respondents. “Former Employer/s” was ranked 4th

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by 5 or 2.63 percent of the respondents. Ranked 5th was “Job Fair/DOLE” and “Online Applications” by 4 or 2.11 of the respondents. “Media Advertisement” and “Electrician” was ranked 6th by 1 or 0.53 of the respondents.

The identified factor as most contributory to the first employment of the respondents may imply that the employed respondents meet the minimum educational requirements of the hiring agencies to qualify the respondents to the job they were applying for. This may also farther imply the relevance and non-relevance of the curriculum contents of the Program to job requirements.

Table 5 shows the frequency and percentage distribution of the factors contributory to the first employment or present job of the respondents.

Table 5. Factor Most Contributory to the First Employment of the Respondents

Indicators	Frequency N=190 (80 replies)	Percent	Rank
Educational qualification	39	20.53	1
Electrician	1	0.53	6
Former Employer/s	5	2.63	4
Advertisement	1	0.53	6
Recommendation from relatives/friends	19	10	2
Personnel office of the company	7	3.68	3
Job fair/DOLE	4	2.11	5
Online application ³	4	2.11	5

6. Status of Employment of the Respondents with Respect to:

- 6.1. Type of Firm
- 6.2. Status of Appointment
- 6.3. Job Description
- 6.4. Monthly Income

6.1. Type of Firm

The table shows that there were 40 or 28.57 percent respondents who work in the government and 106 or 75.71 percent were in private firms. The data indicates that most of the employed respondents are working in private firms, agencies or companies.

6.2. Status of Appointment

On the status of appointment of the respondents, there were 35 or 25 percent who were permanent; 79 or 56.43 percent were either casuals, contractual or job orders; 12 or 8.57 percent were temporary; and 17 or 12.14 were respond N/A. The data reveals that the status of employment of the respondents was mostly not permanent which indicates that they didn't have security of tenure.

The data on the Table above shows that majority of the respondents were not permanent in their status of employment. It implies that the status of employment of the respondents which was mostly not permanent was not due to the absence of the basic requirement which is eligibility but it may be due to unavailability of permanent positions. It may also indicate that it is highly competitive to get a permanent status in their places of work. Another indication may also be that the newly hired respondents were still gaining expertise in their field.

6.3. Job Title/Description

The data shows that 6 or 4.29 percent of the respondents were army; there were 4 or 2.86 percent of the employed respondents for each as Household Chores and Industrial Electrician. There was 1 or 0.71 percent respondents for each as Product Specialist, Care Giver, Food and Beverage Services, Road Surveying and Tutoring respectively; there were 13 or 9.29 percent respondents for cashier; there were 22 or 15.71 percent in Customer Service/Receptionist; there were 4 or 2.86 percent as an Industrial Electrician; 2 or 1.43 percent as Machine Control Operator and SK Chairman; 5 or 3.5 percent as Teacher; there were 29

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or 20.71 percent as an Office Staff; 8 or 5.71 percent answered N/A; and 49 or 35 percent left as a Blanks. The data indicates that majority of the respondents were fitted in their job and there was a low prevalence of “misfits”.

6.4. Monthly Income

The monthly income of 56 or 40 percent of the employed respondents was below Ph10,000.00; 54 or 38.57 percent were receiving salaries that ranges from Ph10,000.00-Ph14,999.00; there were 12 or 8.57 percent who were receiving salaries that ranges from Ph15,000.00-Ph19,999.00; there were 7 or 5 percent with salaries ranging from Ph20,000.00-Ph24,999.00; there were 4 or 2.86 percent with salaries ranging from Ph25,000.00-Ph29,999.00; there were 1 or 0.71 percent respond for each as received from Ph35,000.00 – Ph39,999.00 and Ph40,000.00 – Ph44,000.00 and 13 or 9.29 percent answered as N/A. This indicates that majority of the respondents were gainfully employed.

Table 6 shows the frequency and percentage distribution of the indicators stated above.

Table 6. The Status of Employment of the Respondents as to Type of Firm, Status of Appointment, Job Title, and Monthly Income.

Indicators	Frequency	Percent
Type of firm		
Government	40	28.57
Private	106	75.71
Status of Appointment		
Permanent	35	25
casual/contractual/job order	79	56.43
temporary	12	8.57
N/A	17	12.14
Job Title/Description		
Army	6	4.29
Household Chores	4	2.86
Product Specialist	1	0.71
Cashier	13	9.29
Care Giver	1	0.71
Customer Service/Receptionist	22	15.71
Food and Beverage Services	1	0.71
Industrial Electrician	4	2.86
Machine Control Operator	2	1.43
Road Surveying	1	0.71
SK Chairman	2	1.43
Teacher	5	3.5
Tutoring	1	0.71
Office Staff	29	20.71
N/A	8	5.71
Blanks	49	35
Monthly Income		
Below Ph10,000.00	56	40
Ph10,000.00 – Ph14,999.00	54	38.57
Ph15,000.00 – Ph19,999.00	12	8.57
Ph20,000.00 – Ph24,999.00	7	5
Ph25,000.00 – Ph29,999.00	4	2.86
Ph35,000.00 – Ph39,999.00	1	0.71
Ph40,000.00 – Ph44,000.00	1	0.71
N/A	13	9.29

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7. Relevance of the College Degree and Educational Training of the Respondents to Their Present Job.

The feedback indicates that 43 or 30.94 percent of the respondents find their degree and educational training “Very Relevant” to their present job; 71 or 51.08 percent of the respondents find it “Relevant”; 10 or 7.19 percent find it “Fairly Relevant”; and there was 15 or 10.79 percent respondent finds it “Not Relevant”. The data indicates that majority of the respondent find their college degree and educational training relevant to their present job. This may imply farther the relevance of the program to job requirements.

Table 7 shows the description of the employed respondents on the relevance of their college degree and educational training to their present job.

Table 7. Relevance of Respondents' College Degree and Educational Training to Their Present Job

Indicators	Frequency N=190 (139 who respond)	Percent
Very relevant	43	30.94
Relevant	71	51.08
Fairly relevant	10	7.19
Not relevant	15	10.79

8. Skills Acquired in College by the Respondents Which They Find Useful in Their Present Job.

Communication skills is the most useful skills they have acquired in their College which find very useful in their present job. The respondents ranked these as entrepreneurial skills; human or interpersonal skills; problem-solving skills, information technology skills; and microfinance skills. This implies that the employed respondents were able to acquire the indicated skills and find them very useful in their present job.

Table 8 shows the skills acquired in college by the respondents which they find useful in their present job.

Table 8. Skills Acquired in College by the Respondents Which They Find Useful in Their Present Job

Skills	Frequency	Rank
Communication	83	1
Entrepreneurial skills	4	3
Human relations	5	2
Leadership	4	3
Microfinance skills	1	5
Problem-solving	3	4
Information Technology	1	5

9. Level of assessment of the respondents on the BSE program relative to:

- 9.1. course content
- 9.2. methods of Instruction
- 9.3. faculty
- 9.4. facilities
 - 9.4.1. library
 - 9.4.2. laboratories
 - 9.4.3. physical plant
- 9.5. student Services
 - 9.5.1. career Guidance
 - 9.5.2. scholarship
 - 9.5.3. housing/dormitories

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9.5.4. alumni & job placement

9.5.5. medical/dental

9.5.6. registration/admission

9.5. research services

9.7. extension services

9.8. general administration

The BS in Industrial Technology Batch 2019 assessed the Program as "Excellent" on Course Content with weighted average mean of 4.58; Faculty (4.40); Library (4.29); Career Guidance (4.38); and Scholarship (4.53). The Following Services were assessed as "Very Good": Laboratories (4.01); Physical Plant (4.04); Housing Dormitories (3.77); Alumni & Job Placement (4); Medical/Dental (4); Registration/Admission (3.95); Research services (4.02); Extension services (4.09); and General administration. The rating for Methods of Instruction was "Good" with a weighted average mean of 3.30.

The overall weighted average mean (OWAM) of 4.10 was described as "Very Good".

Table 9. Level of Assessment of the Respondents on the BS in Indus Tech Program

Indicators	Weighted Average Mean	Description
9.1. course content	4.58	E
9.2. methods of Instruction	3.30	G
9.3. faculty	4.40	E
9.4. facilities		
9.4.1. library	4.29	E
9.4.2. laboratories	4.01	VG
9.4.3. physical plant	4.04	VG
9.5. student Services		
9.5.1. career Guidance	4.38	E
9.5.2. scholarship	4.53	E
9.5.3. housing/dormitories	3.77	VG
9.5.4. alumni & job placement	4	VG
9.5.5. medical/dental	4	VG
9.5.6. registration/admission	3.95	VG
9.6. research services	4.02	VG
9.7. extension services	4.09	VG
9.8. general administration	4.17	VG
OWAM	4.10	VG

Legend:

Descriptor	Numerical Scale	Range
Excellent	5	4.20 –
Very Good	4	5.00
Good	3	3.40 –
Good	2	4.19
Fair	1	2.60 –
Poor		3.39
		1.80 –
		2.59
		1.0 –
		1.79

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SUMMARY OF FINDINGS

Presented below are the findings of the study which were based from the data gathered and interpreted.

1. Profile of Respondents

1.1. Age

The data implies that most of the graduates from 4 years back to present were in the average age range of one who started and completed tertiary education within the prescribed period to finish the BS in Industrial Technology degree. However, a significant number of them rather started out late or lagged behind their schooling as indicated by the presence of 26 years olds and above. Nevertheless, the data also implies that the respondents were in the age range of one who is expected to be intellectually and emotionally ready to craft a career.

1.2. Sex

Most of the respondents were females. This data confirms that Industrial Technology is a female-dominated profession.

1.3. Civil Status

The impression that the respondents managed to priorities their studies before getting into serious or more mature relationship was evident as most of them were still single. This data may also indicate that the respondents, having no added responsibility yet to raise a family, could focus more time in improving and establishing their career.

1.4. Graduate Studies

There was a lone respondent who was enrolled in higher education at the time of the survey. This indicates that most of the respondents were not into pursuing higher learning at the moment but some of them were enrolled in other schools to take professional education.

1.5. Eligibilities

It was found out that most of the respondents were already licensed teacher and others were National Competency II Holders.

2. Number of Employed, Underemployed, Self-employed, and Unemployed Respondents.

The data indicates that out of the 198 respondents, 140 or 70.70 percent were employed and 40 or 20.20 percent were unemployed. Among the employed respondents 18 or 9.10 percent were identified as Self-Employed based from the data of the employed respondents has given out. There were no underemployed because all the respondents are still in the industry.

The data reveals that majority of the respondents were gainfully employed and there were few who were underemployed. This indicates the relevance of the Program to job requirements.

3. Lead Time Before the Respondents Were Employed.

The data shows that out of the 140 employed respondents, 95 or 67.86 percent were employed within the year after graduation; 37 or 26.43 percent within the second year; and 1 or 0.71 within the third year after graduation. This indicates that majority of the respondents were immediately got into jobs.

4. What is/are the Reason/s for the Delay of Employment or Unemployment of the Respondents?

The number one reason of the respondents consider to have delayed their employment was because there was No immediate vacancy claim by 117 or 55.98 percent respondents; Rank 2 reason of 28 or 13.39 percent respondents was that Delay in taking/passing board exam; rank 3 reason of 11 or 5.26 percent respondents was that because of the Delay in the issuance of Other(outside) needed documents tie in Lack of Financial support for job hunting; Rank 4 reasons of 7 or 3.34 percent were Not Emotionally ready, because of the Delay in the issuance of school credentials, and because of Early marriage; on rank 5 as claimed by 5 or 2.39 percent respondents were in the Health reasons; rank 6 of 4 or 1.91 percent left as N/A; there were 3 or 1.44 percent both for Tight competition for a job and Available job is/are not in line with specialization as rank 7; Rank 8 for 1 or 0.48 percent for Studied again, Waiting for the result of exam, Early pregnant, Pandemic, Putting up a business rather than applying for a job and waiting for a quota.

5. Factor Most Contributory to the First Employment or Present Job of the respondents.

Their educational qualification was the factor most considered by the respondents as contributory to their first employment. They also consider recommendation from relatives and friends, media advertisement, the job fair/DOLE and online application. Some of them were personnel office of the company and their former employer/s.

The identified number one factor as most contributory to the first employment of the respondents implies that the employed respondents meet the minimum educational requirements of the hiring agencies. This indicates the relevance of the curriculum to job requirements.

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6. Status of Employment of the Respondents with Respect to:

- 6.1. Type of Firm
- 6.2. Status of Appointment
- 6.3. Job Description
- 6.4. Monthly Income

6.1. Type of Firm

Most of the employed respondents were working in private firms, agencies or companies.

6.2. Status of Appointment

The data reveals that the status of employment of the respondents was mostly not permanent which indicates that they didn't have security of tenure.

Data shows that majority of the respondents were not permanent in their status of employment. It implies that the status of employment of the respondents which was mostly not permanent was not due to the absence of the basic requirement which is eligibility but it may be due to unavailability of permanent positions. It may also indicate that it is highly competitive to get a permanent status in their places of work. It may also be that the newly hired respondents were still gaining expertise in their field.

6.3. Job Title/Description

The job description of the respondents were army; Household Chores, Industrial Electrician, Product Specialist, Care Giver, Food and Beverage Services, Road Surveying, Tutoring, cashier, Customer Service/Receptionist, Industrial Electrician, Machine Control Operator, SK Chairman, Teacher, and Office Staff. The data indicates that majority of the respondents were fitted in their job and there was a low prevalence of "misfits".

6.4. Monthly Income

The monthly income of 56 respondents was below Ph10,000.00; 54 were receiving salaries that ranges from Ph10,000.00-Ph14,999.00; there were 12 who were receiving salaries that ranges from Ph15,000.00-Ph19,999.00; there were 7 with salaries ranging from Ph20,000.00-Ph24,999.00; there were 4 with salaries ranging from Ph25,000.00-Ph29,999.00; there was 1 with salaries ranging from Ph35,000.00-Ph39,999.00 and Ph40,000.00-Ph44,000.00. This indicates that majority of the respondents were gainfully employed.

7. Relevance of the College Degree and Educational Training of the Respondents to Their Present Job.

The feedback indicates that 43 or 30.94 percent of the respondents find their degree and educational training "Very Relevant" to their present job; 71 or 51.08 percent of the respondents find it "Relevant"; 10 or 7.19 percent find it "Fairly Relevant"; and there was 15 or 10.79 percent respondent finds it "Not Relevant". The data indicates that majority of the respondent find their college degree and educational training relevant to their present job. This may imply farther the relevance of the program to job requirements.

8. Skills Acquired in College by the Respondents Which They Find Useful in Their Present Job.

The employed respondents find communication skills and human or interpersonal skills very useful in their present job. The rest of the skills like entrepreneurial skills, information technology skills, problem-solving skills, and microfinance skills were also found to be useful by them. The skills indicated on the table are the skills that are expected to be fully developed in every student by the curriculum. There is an old adage: One could not give what one doesn't have. There may be two contentions here: Did the academe able to sufficiently equip its graduates with these skills? On the other hand, did the graduates done their part to sufficiently acquire these skills?

9. Level of assessment of the respondents on the BSEE program relative to:

- 9.1. course content
- 9.2. methods of Instruction
- 9.3. faculty
- 9.4. facilities
 - 9.4.1. library
 - 9.4.2. laboratories
 - 9.4.3. physical plant
- 9.5. student Services
 - 9.5.1. career Guidance

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9.5.2. scholarship

9.5.3. housing/dormitories

9.5.4. alumni & job placement

9.5.5. medical/dental

9.5.6. registration/admission

9.5. research services

9.7. extension services

9.8. general administration

The course content, faculty, library, career guidance and scholarship were given an "Excellent" assessment by the respondent. Laboratories, physical plant, housing dormitories, alumni and job placement, Medical/Dental, Registration/Admission, Research services, Extension services and General administration were given "Very Good" assessment by the respondents. Methods of Instruction were assessed as "Good".

The overall weighted average mean (OWAM) of 4.10 was described as "Very Good".

CONCLUSIONS

Most of the traced BS in Industrial Technology graduates batch 2019 started and completed their schooling within the prescribed period to finish the degree. However, some of them may have started out late or lagged behind their studies as indicated by the presence of significant number of respondents within the age range over the prescribed period of their course. Most of them were female and are still single. Most of them were took professional subjects for education and some of them were already LET passers.

Majority of the respondents claim that they were employed within the year of their graduation. What delays their employment or had caused their unemployment was because no immediate vacancy as the top most reasons of the respondents. This feedback from the respondents for the reasons of the delay of their employment.

The respondents identified as number one factor most contributory to their first employment was that they were educationally qualified. This implies that the employed respondents meet the minimum educational requirements of the hiring agencies. This indicates the relevance of the curriculum to job requirements. Most of the employed respondents were working in private firms.

Some of the respondents were board passers and they possessed other eligibilities. Eligibility is a basic requirement in getting a permanent position, especially in government firms. However, most of the respondents were not yet permanent. It may indicate that this was not due to the inability of the respondents to meet the basic requirement, but it may be due to unavailability of permanent positions. It may also indicate that it is highly competitive to get a permanent status of employment in their places of work. It may also be that the newly hired respondents were still gaining expertise in their field.

The job description of the respondents were an army, OFW, Product Specialist, Care Giver, Food and Beverage Services, Road Surveying, Tutoring, Cashier, Customer Service/Receptionist, Industrial Electrician, Machine Control Operator, SK Chairman, Teacher and Office Staff. The data indicates that majority of the respondents were in the field relative to their earned degree and there was a low prevalence of "misfits" and majority of the employed respondents were receiving salaries within the range above the minimum wage. This indicates that majority of the respondents were gainfully employed. The feedback also reveals that majority of the respondent find their college degree and educational training very relevant to their present job. This implies the relevance of the program to job requirements.

The employed respondents find communication skills, entrepreneurial skills; human or interpersonal skills; problem-solving skills, information technology skills; and microfinance skills very useful in their present job. Generally, they assessed as very useful in their present job the skills they acquire in college.

The overall assessment given by the respondents on the BS in Industrial Technology program was "Very Good".

RECOMMENDATIONS

1. The overall assessment of the respondents on the BS in Industrial Technology Program shows that the Program could still stand several improvement. The Program may want to take action on the feedback provided by the respondents.

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2. The Methods of Instruction which were assessed as "Good" by the respondents. The Program may want to have a critical look at itself and resolve to level up to "Very Good" or "Excellent" assessment by initiating necessary reforms.
3. The laboratories need immediate attention. The Program may want to conduct a more specific year-round self-evaluation as to the functionality and updating of its laboratories or initiate a comprehensive procurement plan prioritizing the needs in the laboratories for it to warrant a better assessment which would redound to more equipped graduates.
4. The school must provide more training workshops to hone the skills of the students before graduating from their course, hence, making them more prepared when it comes to job interviews.
5. School Administration must issue pertinent documents necessary for job application to avoid delays of employment or unemployment of the graduates.

REFERENCES

- 1) Abadilla, Jorge F. (1989). *Program effectiveness of Three Government Technicians Institutes in the Philippines*. Doctoral Dissertation, Technological University of the Philippines.
- 2) Amiscosa, Yolita S. (1984). "Teacher Competency". *The Cavite Journal of Education*. Volume I. October.
- 3) Amistad, Rodolfo M. (1999). *Issues and Trends in Higher Education: Philippine Scenario*. A report presented in Curriculum Development, PhD Summer Class. University of La Salette, Santiago City.
- 4) Aquino, Gaudencio V., Abellera, Rosalinda C., Hidalgo, Ligay C. (1988). *Principles of Teaching and Educational Technology*. Manila: National Book Store Inc.
- 5) Belen, Hermogenes F. (1971). *Essentials of Teaching Industrial and Related Subjects*. Manila: Colcol Publishing Co.
- 6) Boquirin, Telesforo N. (1975). *The Changing Role of Vocational Teacher Education in the New Society*. Keynote Address at Seminar Workshop on Vocational Teacher Education, Laoag City. INCAT.
- 7) Brandes, Barbara J. (1974) *Evaluation Within the Context of Program Development: Problems and Procedures in Effective Education*. Evaluating Education Programs and Procedures, Educational Technology Publications. Cliffs, New Jersey.
- 8) Commission on Higher Education (1995). *Philippine Higher Education in the 21st Century: Strategies for Excellence and Quality*. The task Force on Higher Education.
- 9) Doros, Emiliana R. (1993). *A Follow-up of the Graduate of the Philippine Air Force College of Aeronautics in Villamor Air Base*. Doctoral Dissertation. Manila. National teachers College.
- 10) Ebert, Wilhelm (1976). "World Teacher – Power". Today's Bulletin Nov. Dec.
- 11) Frias, Genera P. (1986). *A Follow-up of the Gregorio Araneta University Foundation Secretarial Graduates*. Doctoral Dissertation. Manila. National Teachers College.
- 12) Galarido, Isidro F. (1989). *The National Integration Study Grant Scholars: A Follow-up Study*. Doctoral Dissertation. Manila. National Teachers College.
- 13) Harrison, Raymond H. (1969). *Supervisory leadership*. New York: Reinhold.
- 14) Madausm, George F., Aiarsinn, Peter W., and Kellaghan, Thomas (1981). *School Effectiveness – A Reassessment of the Evidence*. New York: McGraw-Hill Book Co.
- 15) Maquiso, Melchizedek (1979). *The Philippine Education: What You Wanted to Know About It But Were too Shy To ask*. Manila: Philippine Education Co., Inc.
- 16) Minimum Wage Rates by Sector and Region, Philippines www.bles.dole.gov.ph/PUBLICATIONS/.../PDF/Tab24.pdf
- 17) Montessa, Isabelita (1985). *Productivity and Employability of Graduates of the Revised Standard Educational Program in the National Capital Region*. Doctoral Dissertation. Manila: Technological Institute of the Philippines.
- 18) Navarro, Rosita L., Cruz, Amelita A., Tovera, David G., and Lucido, Paz I. (1988). *Principles of teaching and Instructional Technology*. Quezon City: Katha Publishing Co., Inc.
- 19) Nollado, Jose N. (1993, Compiled and Edited by). *The Labor Code of the Philippines*. Manila: National Book Store, Inc.
- 20) Orlosky, Donald B. and Smith, Othaniel (1978). *Curriculum Development: Issues and insights*. Chicago: ngizal McNally College Publishing Company.
- 21) Pervaez, B. A. (1975). *Improving the Status of Technicians. Colombo Plan Colloquium on Inter-regional Technician Training*. Kuala Lumpur.
- 22) Pierce, A. J. (1980). *A Survey of Vocational Awareness and Use of Innovative Teaching Practice in the State of New York*. Doctoral Dissertation. The State University of New Jersey.
- 23) Pulido, Gloria (1971). *A Follow-up Study of the Graduates of Bachelor of Science in Mathematics of far Eastern University From SY 1989-1990 to SY 1994-1995*. Doctoral Dissertation. Manila: Far Eastern University.

A Tracer Study of the 2019 Graduates of Bachelor of Science in Industrial Technology

- 24) Sambu, Luzviminda C. (1983). *State Universities and Colleges' Bachelor of Science in Industrial Education: Its Impact to manpower Development in Region 02*. Doctoral Dissertation. Isabela State University.
- 25) Sutaria, Minda C. (1989). *Quality: Thrust of Education at All Levels in Philippine Education: Visions and Perspective*. Manila: National Book Store, Inc.
- 26) Taguinod, Margarito C. (1997). *A Follow-up Study of the Graduates of the College of Arts and Sciences in Cagayan State University: An Assessment*. Doctoral Dissertation. Cagayan Colleges of Tuguegarao.
- 27) Ten Year Development Plan: A Framework 1986-1985, Isabela State University.
- 28) Tumaliuan, Roxanna Q. (1995). *A Follow-up Study of the Graduates of the Secondary Science Program of the Isabela State University, Cabagan, Isabela From SY 1990-1994*. Doctoral Dissertation. St Paul University, Tuguegarao, Cagayan.
- 29) Webster's New World Dictionary of the American Language, 2nd Edition. William Collins Publishers, Inc., 1980.
- 30) Webster's 9th New Collegiate Dictionary. Springfield, Massachusetts, USA. Merriam-Webster Inc., 1983.



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Power Transfer Capability Enhancement of The Nigerian 330kV Transmission Network with SVC FACTS Controller



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ABSTRACT: The lack of installation of generation stations has affected the transmission system of the Nigerian power network as the load demand increases. This has led to increased power losses and power congestion on the lines which has affected the available transfer capacity (ATC) of the power system network. Due to these increasing issues, SVC FACTS controller was utilized in this paper to improve ATC. The ATC of the system without FACTS controller was obtained after modeling the system using the data obtained from NCC osogbo with NEPLAN software. The relationships between the cumulative distances and the ATC values for each line were obtained and the best polynomial order being the seventh order at R-square of 99.08% was optimized with genetic algorithm where the optimal ATC was 74.31MW at summative distance of 954.5km which was on line 8 (Benin TS to Oshogbo TS) with SVC FACTS implemented at Osogbo TS. The introduction of the compensator reduced the reactive power losses by 32%, real power losses by 36% and improved on the ATC by 18%.

KEYWORDS: FACTS, NEPLAN, power flow, power transfer capability, SVC

I. INTRODUCTION

The existing power system in Nigeria consist of generation stations, transmission stations and substations and distribution with majority of the generation plants being thermal and gas plants (Jiang, Chow, Edris, Fardanesh & Uzunovic, 2010; Das, Singh & Mishra, 2023; Awah, Okoro, Nkan & Okpo, 2022). The records from the national control center Osogbo through (PHCN, 2018) showed that some of the power generation plants are not functional either as a result of lack of maintenance or inability to implement protective measures with the occurrence of fault on the lines. This had led to reduction in the amount of power supply. Further findings made from the literature especially in (Sahraei-Ardakani & Blumsack, 2016; Sarraei-Ardakani & Hedman, 2017; Lyu, He, Tan, Lin, Luo & Yan, 2023), showed that the Nigerian transmission and distribution line currently witnesses power system congestion during transmission and distribution leading to the high rate of epileptic power supply and the inability to meet up with the ever increasing load demand in Nigeria. The major parameter utilized in testing the rate of power sent from the generation station and the amount received in the transmission stations was the available transfer capability (ATC) (Yang, Jiang, Han, Tan & Liu, 2023; Elgebaly, Taha, Azmy & El-Ghany, 2021). Some of the gas plants for power generation installed has not been able to generate electricity due to the absence of gas and at the process of meeting up the load demand (Ji, Gao, Zhou & Li, 2009; Nkan & Okpo, 2016; Oduleye, Nkan & Okpo, 2023; Okoro, Abunike, Akuru, Awah, Okpo, Nkan, Udenze, Innocent & Mbunwe, 2022), the power engineers tried to distribute power beyond the existing infrastructural capacity which has led to the collapse of some of the national grids (Jameson, Nkan & Okpo, 2024; Edifon, Nkan & Ben, 2016; Abunike, Umoh, Nkan & Okoro, 2021). To determine the ATC of the power system network, the power flow analysis especially the real power (in W) must be determined and then utilized in calculating the ATC. A low ATC implies a significant loss of power on the transmission network and affects the financial sustainability and social welfare of the affected country of state or state (Ji, Gao, Zhou & Li, 2009). The fundamental and most effective way of reducing power congestions and improving the ATC of the power system network has been the utilization of flexible AC transmission system (Takahashi, Hiraki, Iwamoto, Morita & Sakamoto, 2009; Mohan, Singh & Suresh, 2018). The use of FACTS ensures that a large amount of power generated would be transmitted and in doing so, reduces the power losses, improves the voltage profile and increases the power transfer capacity of the power transmission from the generation station to the load stations. The use of FACTS in improving the transmission of electricity from has been described to be a good alternative to installing new power plants which was known to be capital intensive (Shukl & Singh, 2023; Castilla, Velasco, Miret, Borrell & Guzman, 2022). In this paper, the power flow analysis and the ATC of the Nigerian 330kV transmission system was determined and a comparative analysis was carried out of the power system network for with and without the use

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of SVC FACTS. Prior to the placement of the FACTS, the power flow analysis was determined for the power system without FACTS and genetic algorithm optimization technique was deployed in determine the optimal location for installation of the SVC FACTS. The FACTS was implemented and simulated to determine the level of ATC improvement. The application utilized for the simulation of the power system network in this paper was NEPLAN and the data utilized was obtained from the national control center in Osogbo Osun state which was the central location for the control of the transmission power system network of Nigeria (PHCN, 2018).

II. REVIEW OF RELATED LITERATURE

(Wokoma, Osegi & Idachaba, 2019; Okpo & Nkan, 2016; Okpo, Nkan, Okoro & Akuru, 2021; Innocent, Nkan, Okpo & Okoro, 2021) predicted the voltage collapse point of the transmission system with quadratic line voltage stability index (q-LVSI) model and with machine learning modeling technique referred to as the AMI. These model were implemented on some of the buses of the Nigerian 330kV transmission system. To determine the performance of the model utilized, the author compared the outcome of the machining learning and q-LVSI technique to the GMDH time-series (Group Method of data Handling for time series model) which was a novel model developed by the author in the determination of the power transfer capability of the power system considered. (Airoboman, John, Araga, Abba-Aliyu & Aderibigbe, 2021; Ezeonye, Okpo, Nkan & Okoro, 2020; Innocent, Nkan, Okpo & Okoro, 2021) modeled the power system network of the Nigerian 330kV power system involving shiroro to jebba to Osogbo transmission system. The essence of the modeling and analysis was determined the stability in voltage and power with steady state and dynamic methods. The results by the author showed that the voltage was minimal at Jebba and osogbo stations for steady state outcome and the dynamic outcome showed that Osogbo and Jebba stations had the least reactive at varying fault scenarios. (Nkan, Okoro, Obi, Awah & Akuru, 2019; Nkan, Okoro, Awah & Akuru, 2019) used SVC and STATCOM separately in the transient stability improvement of the 48-bus network of the Nigerian 330kV power system network with the major area of concentration being the system response during the occurrence of a 3-phase fault. The power network was modeled in PSAT and the fault was introduced to the geregu substation (bus 33). The continual power analysis was performed in the power system network to obtain the optimal location for the installation of the FACTS and the location obtained which was the weakest bus was at bus 21. Hence, SVC and STASTCOMFACTS were installed and simulated one after another. The results obtained showed that the introduced of the FACTS devices were able to damp the high oscillations in the systems which was caused by the three phase fault. (Gu, Qiu, Shu, Zhang, Xiao & Chen, 2023; Nkan, Okoro, Awah & Akuru, 2019) established a circuit capacitive wireless power transfer (CPT) power system network and presented a primary side control strategy for the purpose of achieving a stable power output and ensure consistent high power transfer capability efficiency based on the parity time symmetric theory. The outcome of the results presented showed that the power transfer capability effect was more when the insertion depth of the system coupler array changes from 60 mm to 180mm with the proposed prototype of the CPT being stable at almost 25W with the transfer efficiency generated at 88% which the effectiveness of the chosen model design. (Lu, 2020; Nkan, Okpo & Okoro, 2020) utilized wireless power repeater for multiple loads applications and long distance transmission lines to ensure balance in power from the generation station to the load station. The repeaters performed as power relay that receives and transmits power and also ensures power availability to the load stations. The author focused on carrying out designs of the wireless repeater that would improve the power transfer capability of the power system network. (Wang, Zhou, Guo & Sun, 2022; Nkan, Okpo, Akuru & Okoro, 2020) proposed the utilization of deep learning models for the improvement of the total transfer capability of the power system network by clustering the operating systems into simpler spaces with a two stage cluster system and then utilized a deep learning model for the power transfer improvement. The variable sensibility of the deep learning model was controlled with first order control variable and quasi steady state system was utilized in determining the effects of the inputs to the deep learning model on the IEEE 39-bus network and the outcome of the study showed that the proposed method improved the total power transfer of the power system network. The authors in (Abramov & Peretz, 2020; Natalia, Nkan, Okoro & Obi, 2023) utilized an adaptive multi-loop controller system carry the power transfer capacity improvement of the capacitive wireless power transfer systems. The proposed controller comprises of continuous frequency tracking and the tuning of matching network with the aim of regulating the current and real power variables which were considered the main target to power transfer capability improvement. The resulted showed that the proposed system was effective in improving the power transfer of the power system when tested on a 5-bus network. (Luo, Hu, Munir, Zhu, Mai & He, 2022; Nkan, Okpo & Inyang, 2023) utilized a compensation design method in achieving a maximum amount of power transfer with voltage coupling constraints. The input and the output voltages of the power system were maintained at a 90° phase shift with the aid of derived compensation topologies. The result presented showed that the proposed design had a good performance in improving the level of power transfer in the power system network. The authors in (Nkan, Okpo & Okpura, 2023) proposed a sensitive based method in estimating the level of power improvement with the

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introduction of FACTS to the power system network and the impact of improved power transfer capability in the market via marginal cost determination. The reliability of utilizing FACTS in the power transfer improvement in the power system network was the major of the determination of the electricity distribution marginal cost and also the impedance adjustments it presents.

III. MATERIALS AND METHOD

The information for the 28-bus network of the Nigerian 330kV transmission system obtained is shown in Fig.1.

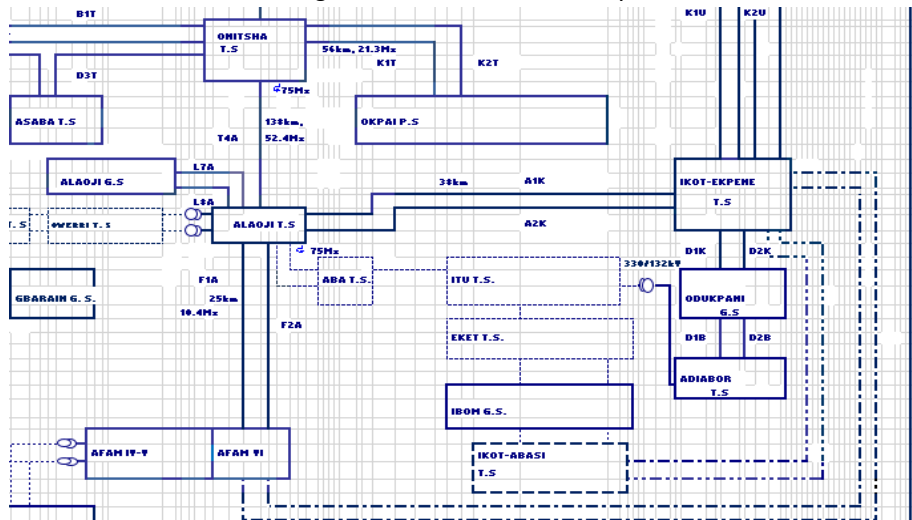


Fig.1. Nigerian 330kV transmission network

The network information provided in figure 1 were mainly situated in the southern region of Nigeria at voltage rating of 330kV. The network comprises of 28 buses with 36 transmission lines. The procedure for modeling the network in NEPLAN is summarized in the flow diagram shown in Fig.2.

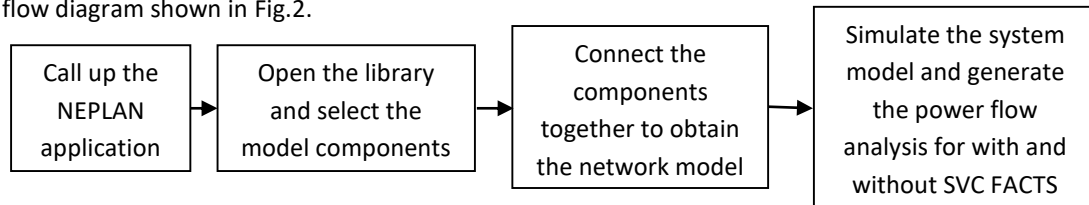


Fig.2. Block diagram of the pattern of modeling in NEPLAN

The NEPLAN had been installed in the desktop and called up. The system contains library for the modeling of the data shown in figure 1. The NEPLAN library was sectionalized to one port, two port, three port and four port model blocks. The main models blocks used for the assembling of the power system model were bus network, load line, bus and transmission line with symbol of load and generation stations. The NEPLAN model of the power system network is shown in Fig.3.

The bus station selected as the reference bus is Afam generation station. Choice of the station is due to the dynamic station with robust power generation capacity. The power system network was simulated to obtain the power flow analysis and the ATC of the network. Then a relation between the ATC and the summation of the distance of the transmission lines was generated with the linear model schematic shown in equation 1.

$$ATC = q_0 + q_1D + q_2D^2 + \dots + q_nD^n \tag{1}$$

where D represents the distance of the transmission line and $q_0 \dots q_n$ represents the coefficient of the polynomial model that is determined using least square method. The model order was extended based on the R-square value obtained. The flow chart of determining the best polynomial order is shown in Fig.4.

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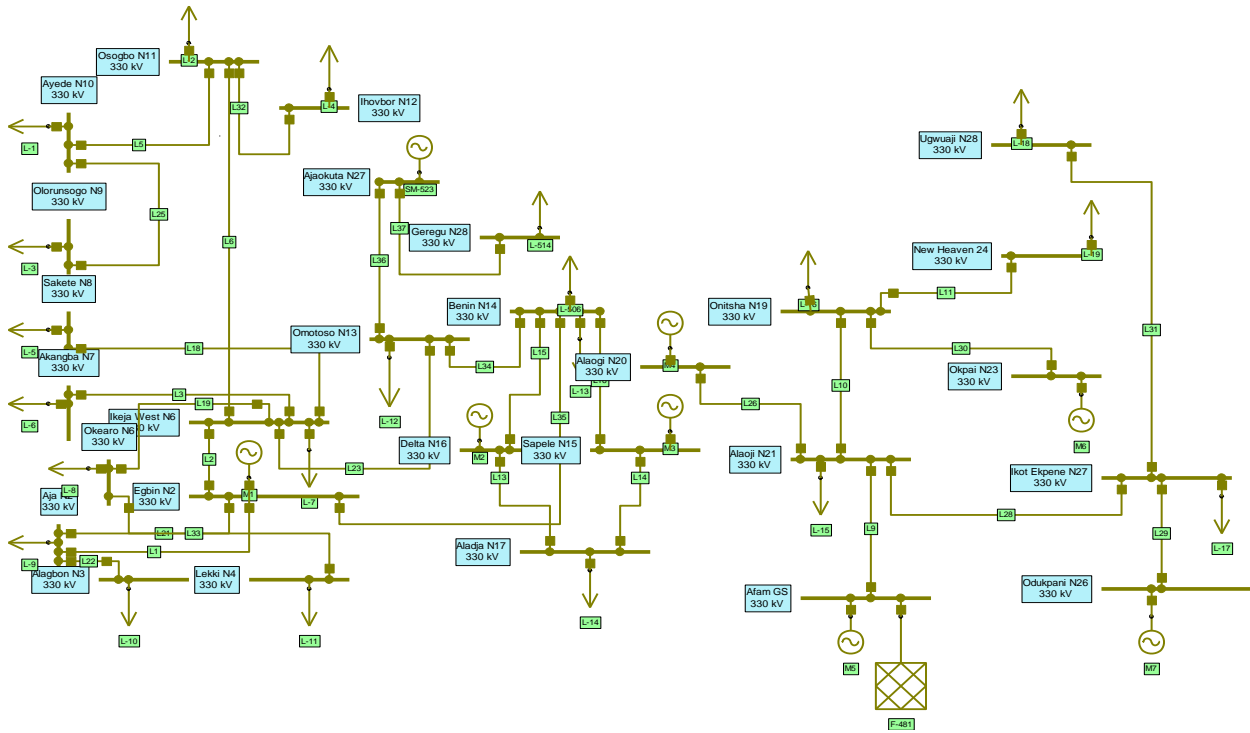


Fig.3. NEPLAN model of the power system

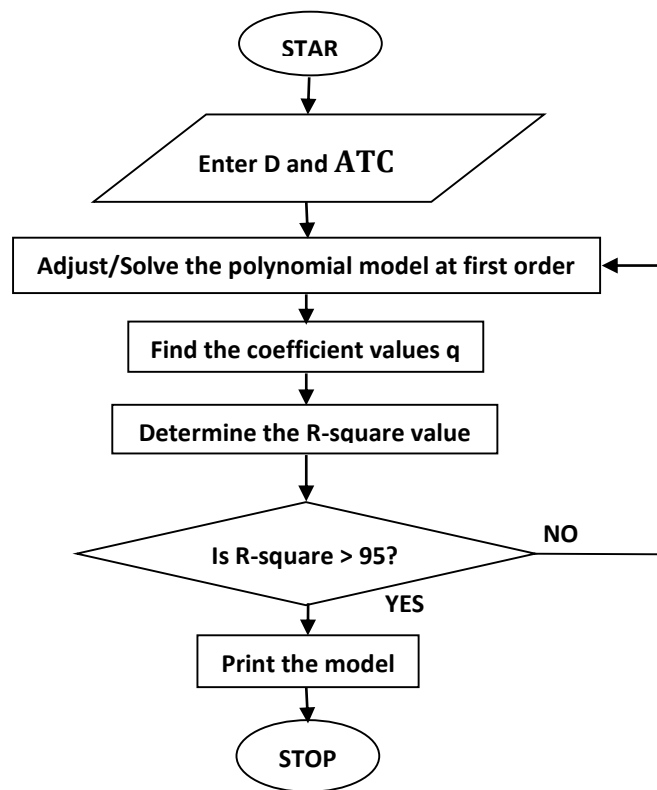


Fig.4. Flow chart of the polynomial model

From the flow chart in figure 4, the polynomial with the R-square value of 95% and above is selected and sent to the genetic algorithm for the determination of the optimal location for the installation of the FACTS.

IV. RESULTS AND DISCUSSION

The plot for the real and apparent power of the power system network without SVC FACTS controller is shown in Fig.5. Most of the transmission lines has real power losses more than 0.03MW and the reactive power losses recorded in some of the

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transmission lines were more than 0.04MVar. The losses recorded affected the level of power transfer because high power losses shows that the power transfer is low as shown in Fig.6.

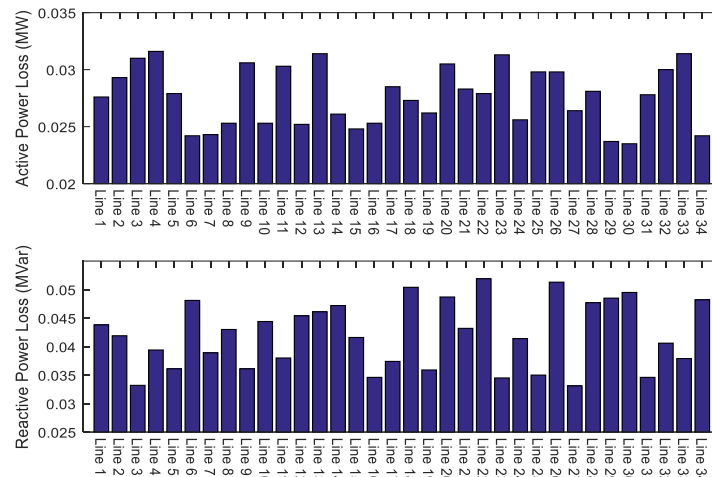


Fig.5. Real and reactive power losses without SVC controller

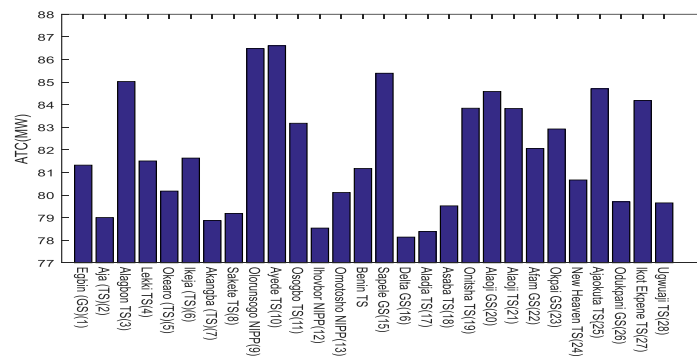


Fig.6. ATC without SVC contrller

From Fig.6, it can be seen that the available transfer capacity is low due to high active and reactive power losses. Based on this, it can be seen that there exist high power congestion level on the power transmission system which would require power enhancement as the highest ATC is 86.4MW. The outcome of the ATC without FACTS controller implemented in the model in equation 1 to determine the best model for the optimal placement of SVC with the results is presented in Table 1.

Table 1. Polynomial model order With the prediction accuracy

Polynomial model order	R-square value
1	0.7723
2	0.8713
3	0.9133
4	0.9517
5	0.9817
6	0.9862
7	0.9908

Based on the accuracy in Table 1, the best polynomial order to be optimized with genetic algorithm is the seventh order, and the outcome of the genetic algorithm ATC of 74.31MW at summative distance of 954.5km which lies on line 8 with SVC placed at Oshogbo transmission station. The real and reactive power losses with the introduction of SVC controller is shown in Fig.7. It can be seen that the introduction SVC reduced the power losses to a maximum of 0.019MW for active power and 0.032MVar for the reactive power. Hence, the losses were minimized with the introduction of SVC FACTS controller. The ATC of the transmission system with SVC FACTS controller is shown in Fig.8. There is an improvement with the introduction of SVC as the highest ATC

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improvement recorded is 90MW. A comparative analysis of the ATC for the system without and with SVC controller is shown in figure 9.

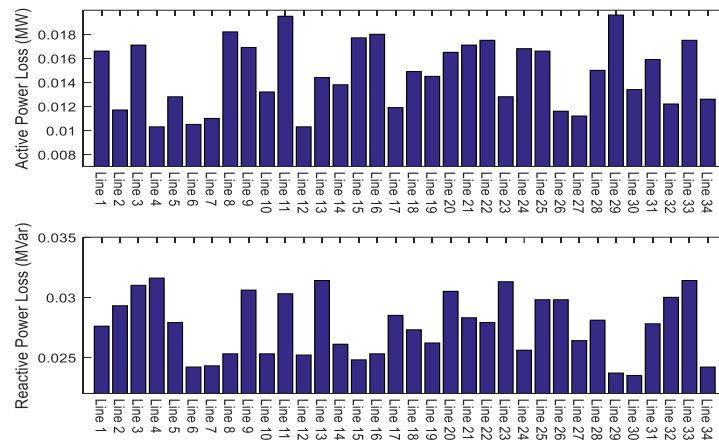


Fig.7. Power losses with SVC FACTS controller

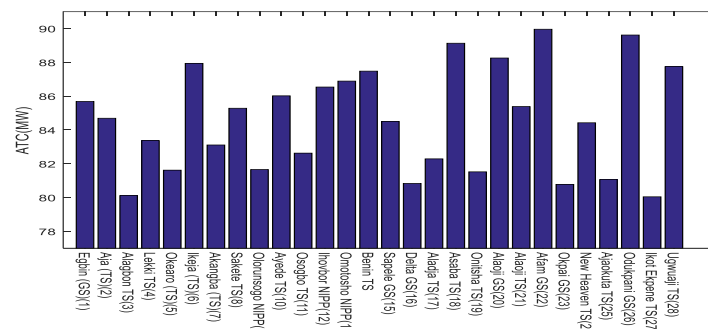


Fig.8. ATC of the transmission power system with SVC

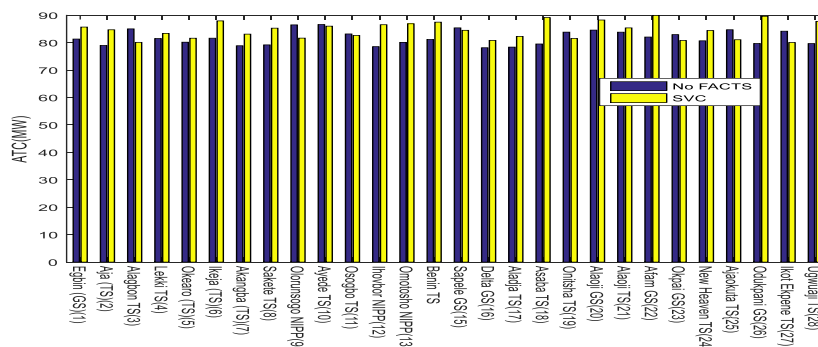


Fig.9. ATC without and with SVC controller

V. CONCLUSIONS

The increase in load demand and power losses has reduced the power transfer of the transmission system. The issue of load demand increases overtime but the power losses is minimized and load congestion reduced to improve the ATC of the power system network. The introduction of SVC FACTS controller reduced the reactive power losses by 32%, real power losses by 36%, and improved on the ATC by 18%. Hence, the results suggest that SVC should be utilized in improving the ATC of the power system network.

REFERENCES

- 1) Abramov, E. & Peretz, M.M. (2020). Multi-loop control for power transfer regulation in capacitive wireless systems by means of variable matching networks. In IEEE Journal of Emerging and Selected Topics in Power Electronics, 8(3), 2095-2110, doi: 10.1109/JESTPE.2019.2935631.
- 2) Abunike, E.C., Umoh, G.D., Nkan, I.E., & Okoro, O.I. (2021). Investigating the magnetic characteristics of 12/8 switched reluctance motor for enhanced starting torque. Nigerian Journal of Technological Development, 18(1), 70-75.

Power Transfer Capability Enhancement of The Nigerian 330kV Transmission Network with SVC FACTS Controller

- 3) Airoboman, A.E., John, S.N., Araga, I.A., Abba-Aliyu, S. & Aderibigbe, M.A. (2021). Power-flow analysis of shiroro-jebba-oshogbo 330-kv transmission network cluster. 2021 IEEE PES/IAS PowerAfrica, Nairobi, Kenya, 1-5, doi: 10.1109/PowerAfrica52236.2021.9543365.
- 4) Awah, C.C., Okoro, O.I., Nkan, I.E. & Okpo, E.E. (2022). Impact of structural dimensions and poles on the torque performance of dual-stator permanent magnet machines. Nigerian Journal of Technological Development, 19(1), 68-79.
- 5) Castilla, M., Velasco, M., Miret, J., Borrell, A. & Guzmán, R. (2022). Control scheme for negative-sequence voltage compensation and current sharing in inverter-based grid-connected microgrids. In IEEE Transactions on Power Electronics, 37(6), 6556-6567, doi: 10.1109/TPEL.2022.3140808.
- 6) Das, D., Singh, B. & Mishra, S. (2023). Grid interactive solar PV and battery operated air conditioning system: Energy management and power quality improvement. In IEEE Transactions on Consumer Electronics, 69(2), 109-117, doi: 10.1109/TCE.2022.3215557.
- 7) Jameson, F.P., Nkan, I.E., & Okpo, E.E. (2024). Improvement of power transfer capability of Nigeria national grid with TCSC FACTS controller. American Journal of Engineering Research (AJER), 13(1), 37-43.
- 8) Edifon, A.I., Nkan, I.E., & Ben, I.A. (2016). Estimation and ranking of the photovoltaic energy potential for local government areas in Akwa Ibom State, Nigeria. Science Journal of Energy Engineering, 4(6), 68-77.
- 9) Elgebaly, A.E., Taha, I.B.M., Azmy, A.M. & El-Ghany, H.A.A. (2021). Optimal design and control of SSSCs for TLS considering technical and economic indices using GA and SAMPE-JAYA algorithms. In IEEE Access, vol. 9, 38907-38919, doi: 10.1109/ACCESS.2021.3063807.
- 10) Ezeonye, C.S., Okpo, E.E., Nkan, I.E., & Okoro, O.I. (2020). Effects of saliency and core losses on the dynamic behaviour of permanent magnet synchronous motor. Bayero Journal of Engineering and Technology (BJET), 15(3), 124-133.
- 11) Gu, W., Qiu, D., Shu, X., Zhang, B., Xiao, W. & Chen, Y. (2023). A constant output capacitive wireless power transfer system based on parity-time symmetric. In IEEE Transactions on Circuits and Systems II: Express Briefs, 70(7), 2585-2589, doi: 10.1109/TCSII.2023.3237687.
- 12) Innocent, U.O., Nkan, I.E., Okpo, E.E., & Okoro, O.I. (2021). Dynamic response evaluation of a separately excited dc motor. Nigeria Journal of Engineering, 28(2), 56-61.
- 13) Innocent, U.O., Nkan, I.E., Okpo, E.E., & Okoro, O.I. (2021). Predicting the stability behaviour of three-horse power induction motor using eigenvalue method. Bayero Journal of Engineering and Technology (BJET), 16(2), 66-81.
- 14) Ji, N., Gao, Y., Zhou, M. & Li, G. (2009). The AC-DC hybrid transmission system ATC calculation based on continuation power flow. 2009 International Conference on Sustainable Power Generation and Supply, Nanjing, China, 1-7, doi: 10.1109/SUPERGEN.2009.5348352.
- 15) Jiang, X., Chow, J.H., Edris, A.A., Fardanesh, B. & Uzunovic, E. (2010). Transfer path stability enhancement by voltage-sourced converter-based FACTS controllers. In IEEE Transactions on Power Delivery, 25(2), 1019-1025, doi: 10.1109/TPWRD.2009.2034895.
- 16) Lu, F. (2019). A high-efficiency and long-distance power-relay system with equal power distribution. In IEEE Journal of Emerging and Selected Topics in Power Electronics, 8(2), 1419-1427, June 2020, doi: 10.1109/JESTPE.2019.2898125.
- 17) Luo, B., Hu, A.P., Munir, H., Zhu, Q., Mai, R. & He, Z. (2022). Compensation network design of cpt systems for achieving maximum power transfer under coupling voltage constraints. In IEEE Journal of Emerging and Selected Topics in Power Electronics, 10(1), 138-148, doi: 10.1109/JESTPE.2020.3027348.
- 18) Lyu, C., He, L., Tan, Z., Lin, Y., Luo, X. & Yan, Z. (2023). Feasible set projection method for calculating multi-line-coupled ATC. 2023 3rd Power System and Green Energy Conference (PSGEC), Shanghai, China, 791-797, doi: 10.1109/PSGEC58411.2023.10255986.
- 19) Mohan, N.M.M.V., Singh, J.G. & Suresh, R. (2018). Risk adjusted co-optimization of ATC in high-low voltage interconnected power systems. 2018 IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES), Chennai, India, 1-6, doi: 10.1109/PEDES.2018.8707502.
- 20) Natala, H., Nkan, I.E., Okoro, O.I., & Obi, P.I. (2023). Investigation of the transfer capability of the Nigerian 330 kV, 58-bus power system network using FACTS devices. Journal of Electrical Engineering, 22(1), 53-62.
- 21) Nkan, I.E., Okoro, O.I., Obi, P.I., Awah, C.C. & Akuru, U.B. (2019). Application of FACTS devices in a multi-machine power system network for transient stability enhancement: A case study of the Nigerian 330 kV 48-bus system. 2019 IEEE AFRICON, Accra, Ghana, 1-9, doi: 10.1109/AFRICON46755.2019.9133904.
- 22) Nkan, I.E., & Okpo, E.E. (2016). Electric power forecasting by the year 2020 using the least square method. International Journal of Research and Advancement in Engineering Science, 6(1), 205-215.

Power Transfer Capability Enhancement of The Nigerian 330kV Transmission Network with SVC FACTS Controller

- 23) Nkan, I.E., Okoro, O.I., Awah, C.C., & Akuru, U.B. (2019). Investigating the steady state stability of the Nigerian 48-bus systems using FACTS devices. *Nigerian Journal of Technology (NIJOTECH)*, 38(3), 732-743.
- 24) Nkan, I.E., Okoro, O.I., Awah, C.C., & Akuru, U.B. (2019). Investigating the dynamic stability of the Nigerian 48-bus systems for improved system performance using FACTS. *Proceedings of the 27th Domestic use of Energy Conference*, 34-42.
- 25) Nkan, I.E., Okpo, E.E., & Okoro, O.I. (2020). Multi-type FACTS controllers for power system compensation: A case study of the Nigerian 48-bus, 330 kV system. *Nigerian Journal of Technological Development*, 63-69.
- 26) Nkan, I.E., Okpo, E.E., Akuru, U.B., & Okoro, O.I. (2020). Contingency analysis for improved power system stability of the Nigerian 330 kV, 48-bus system using series FACTS controllers. *AIUE Congress 2020: International Conference on Use of Energy*.
- 27) Nkan, I.E., Okpo, E.E., & Inyang, A.B. (2023). Enhancement of power system transient stability with TCSC: A case study of the Nigerian 330 kV, 48-bus network. *International Journal of Multidisciplinary Research and Analysis*, 6(10), 4828-4841.
- 28) Nkan, I.E., Okpo, E.E., & Okpura, N.I. (2023). Optimum location of shunt FACTS devices for enhancement of power system loadability using continuation power flow. *International Multilingual Journal of Science and Technology (IMJST)*, 8(9), 6666-6674.
- 29) Oduleye, A.E., Nkan, I.E. & Okpo, E.E. (2023). High impedance fault detection and location in the Nigerian 330 kV transmission network using adaptive neuro-fuzzy inference system. *International Journal of Multidisciplinary Research and Analysis*, 6(11), 5390-5398.
- 30) Okoro, O.I., Abunike, C.E., Akuru, U.B., Awah, C.C., Okpo, E.E., Nkan, I.E., Udenze, P.I., Innocent, U.O., & Mbunwe, M.J. (2022). A Review on the State-of-the-Art Optimization Strategies and Future Trends of Wound-Field Flux Switching Motors. *IEEE PES/IAS PowerAfrica*, Kigali, Rwanda, 1-5.
- 31) Okpo, E.E., & Nkan, I.E. (2016). Constructional features and performance analysis of 3-phase linear induction motor. *International Journal of Scientific Innovations and Sustainable Development*, 6(1), 176-185.
- 32) Okpo, E.E., Nkan, I.E., Okoro, O.I., & Akuru, U.B. (2021). Winding reconfiguration of 5.5 kW three-phase induction motor for improved performance. *IEEE PES/IAS PowerAfrica*, Nairobi, Kenya, 1-5.
- 33) PHCN - Transmission Company of Nigeria, National Control Centre, Oshogbo, 2018.
- 34) Sahraei-Ardakani, M. & Blumsack, S.A. (2016). Transfer capability improvement through market-based operation of series FACTS devices. In *IEEE Transactions on Power Systems*, 31(5), 3702-3714, doi: 10.1109/TPWRS.2015.2508720.
- 35) Sahraei-Ardakani, M. & Hedman, K.W. (2017). Computationally efficient adjustment of FACTS set points in dc optimal power flow with shift factor structure. In *IEEE Transactions on Power Systems*, 32(3), 1733-1740, doi: 10.1109/TPWRS.2016.2591503.
- 36) Shukl, P. & Singh, B. (2023). 3P4W grid interactive PV-BES system with seamless transition capability. In *IEEE Transactions on Industry Applications*, 59(4), 4495-4504, doi: 10.1109/TIA.2023.3262508.
- 37) Takahashi, R., Hiraki, Y., Iwamoto, S., Morita, H. & Sakamoto, K. (2009). An efficient method of calculation for transient stability ATC in longitudinal power systems. *2009 IEEE Power & Energy Society General Meeting*, Calgary, AB, Canada, 1-6, doi: 10.1109/PES.2009.5275477.
- 38) Wang, Z., Zhou, Y., Guo, Q. & Sun, H. (2022). Interpretable neighborhood deep models for online total transfer capability evaluation of power systems. In *IEEE Transactions on Power Systems*, 37(1), 260-271, doi: 10.1109/TPWRS.2021.3091710.
- 39) Wokoma, B.A., Osegi, E.N., & Idachaba, A.O. (2019). Predicting voltage stability indices of Nigerian 330kV 30 bus power network using an auditory machine intelligence technique. *2019 IEEE AFRICON*, Accra, Ghana, 1-4, doi: 10.1109/AFRICON46755.2019.9133915.
- 40) Yang, G., Jiang, C., Han, R., Tan, J. & Liu, F. (2023). Reducing parameter estimation error of behavioral modeling and digital predistortion via transfer learning for RF power amplifiers. In *IEEE Transactions on Microwave Theory and Techniques*, 71(11), 4787-4799, doi: 10.1109/TMTT.2023.3267117.



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The Importance of Spare Strategy in a Research Facility



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ABSTRACT: This document shows the importance of spare part strategy in a research facility at one of the most important medical schools in the world. It presents technical concepts related to equipment criticality analysis and spare part management integrated with computerized maintenance management systems (CMMS). A case study utilizing VFDs on campus will be produced to reveals gaps, benefits, and opportunities to improve the current spare part management system. Challenges in the spare part process will also be addressed in this document, such as storage and external vendor support.

KEYWORDS: Spare Parts, Asset Criticality, Research Facility, Equipment Reliability, CMMS.

I. INTRODUCTION

In 2023, a study was conducted in one of the most important medical schools in the world to understand the importance of a spare part strategy for that environment. The main focus of this study was to identify how spare part strategies could potentially impact national research and document additional actions to mitigate issues related to spare parts.

The Facilities Team working in that school is in charge of keeping building systems and select research and lab equipment in good working order. The objective is to minimize downtime as much as possible, and having spare parts available promptly allows Facilities to meet their operational goals, ensure the welfare of people, research animals, research reliability, and meet students' needs. Without having critical parts on hand, the Facilities Team is also increasingly subject to the long lead times in the global market, with estimated delivery times up to one year.

During that study, it has been identified that there was no spare part management procedure in place at the medical school, which puts facilities managers and personnel in a difficult position when breakdowns occur, often leading to superficial or temporary repairs and the higher expenses of rush procurement, delivery, and installation.

In general, immediate benefits of a good spare parts management system are the Optimization of the spare parts purchasing process, reduction in costly equipment downtime, elimination of redundancies and obsolete components, and cost-effective resource usage (THOMPSON, 2020). In a broader view, the main factors affecting spare parts inventories are inventory control, operating strategy, stockout sources, and lead time for restocking (THOMPSON, 2020).

The objective of this paper is to analyse the spare part situation at that facility, present a case example, evaluate the potential impacts on critical research, illustrate the process to implement a spare part strategy, and suggest next steps.

II. CONTEXTUAL REFERENCE

Prior to that study, the medical school has been acquiring spare parts based solely on reactive measures to equipment failure, with almost no proactive approach to identify spare part needs in advance. The issues to address range from consumable materials used in routine maintenance, to stocking spare equipment with specific uses. Recently the Facilities Team has started ordering some critical components such as VFD drives, but a formal process to identify critical items across the campus is not in place yet.

The few spare parts currently at the medical school are located mainly at the penthouse of one of the research buildings and are tracked in the computerized maintenance management system (CMMS), Maximo, as spare. This was a recent implementation and not all spare equipment available has been catalogued. It is also important to note that most of the spare parts/assets available are used items saved from previous renovations. There is no procedure in place to evaluate the functional condition of much of this equipment, or it's longevity if put back in service. Are these assets deployable as-is, or being kept for their components, which in some cases may out of production? Determining the functional level of these assets is important. They take up the finite storage space available and can also lead to a false sense of having a viable backup.

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III. STUDY OF CASE

A frequency drive failure at one of the research buildings occurred, taking the air handling equipment offline and impacting conclusion of critical national studies. Although there were spare drives available, they were not large enough (100HP) to work as a replacement. The lead time for a replacement drive of similar size was approximately 52 weeks. The only alternatives available in the meantime were workarounds to energize the down equipment, or the possibility of renting equipment. All of these measures significantly increased the cost associated with correcting this failure. These costs came in the form of initial measures to triage the situation, additional monitoring of the system until a replacement is in hand, and lastly Labor to replace the failed component.

Therefore, this case shows how a poor spare part strategy can lead to loss of critical national research and increased costs to maintain infrastructure systems running properly. In research buildings like this one, critical medical research is in place, such as COVID-19 treatment or cancer therapies. This can bring a dimension of how serious an equipment failure can be and the impacts to the societal welfare.

IV. CRITICAL ASSETS AND SPARE PART STRATEGY

As described by OLIVEIRA (2024), spare part management is part of a bigger process that is frequently utilized to improve asset management in multiple industries. Usually, this step is put in place after the analysis of the maintenance strategy for each asset. The spare part strategy is an important analysis that will directly influence the budget applied to general asset management and the management of the space available for storing materials, equipment, and parts.

Still according to OLIVEIRA (2024), “the main objective of this step is simply to ensure that materials, equipment and spare parts will be available when required and in a timely manner in the event of failures so as not to harm campus operations and the development of critical research.” During this critical step, the criticality of each asset for the continuity of operations, the type of maintenance strategy defined, and the time required to obtain new equipment or spare parts to address possible infrastructure failures are deeply analyzed.

In the consequence classification, first the consequence that a failure in an asset could have on the operation of the installation is analysed. In other words, in the case of universities and research facilities, the impact that a failure of an asset would have on the development of research and the academic environment. This analysis is based on the severity of the failure (Trout, 2024).

Therefore, once the consequences and probabilities have been determined, the degree of consequence classification for each asset is defined. The higher or more critical the consequences and the greater the probability of the failure occurring, the higher the classification level (Trout, 2024).

Regarding the study of case presented above, the first step to address the issues is to identify the areas that are most vulnerable. A ready method would be to utilize the current asset data stored in the Maximo CMMS database and identify the types of equipment that pose the highest risk to operations. Assets should be graded according to criticality of the failure and availability of spare part. Below is the methodology and definitions utilized to accomplish this task:

A. Criticality: The impact to operations due to lose of equipment would be:

- a. Minor – Downtime has little to no impact or is local/end of line devices. Corrective action, though not critical or immediate.
- b. Important – Downtime will marginally impact operation of the other systems or result in less-than-optimal operation. System capacity or redundancies are in place to compensate. Corrective action as soon as possible.
- c. Significant – Downtime will have a negative effect on quality of life and research. Other systems will not perform or need to be adjusted while it is offline. Proactive corrective measures should be in place.
- d. Major – Downtime will have a direct negative impact on building occupancy and research operations. Damage to physical plant or research may occur if not corrected immediately. Proactive corrective measures and contingency should be in place.

B. Availability: Failure and time to fix would be:

- a. Low – Common machinery, parts/components readily available of the shelf.
- b. Medium – Some lead time to acquire parts. Spares on-hand recommended common to most uses.
- c. High - Significant lead time to acquire parts. Spares on-hand recommended, specific to sizing or other technical needs. Lead time measured in weeks-months.
- d. Very High – Specialized equipment with limited sourcing options. Lead time to acquire replacement measured in months.

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To conduct this process, multiple parties with building knowledge should be engaged about specifics of each building system.

V. MAXIMO CMMS ASSET INFORMATION

Once critical systems are identified, the next step is to draw on detailed information about that equipment. With a fully realized CMMS database, make, model, sizing, and key technical data about equipment can be utilized to develop a trend. This trend data can be used to determine the appropriate number of spare parts that should be on hand, proportional to the quantity of equipment and the technical specifications the spares would need to meet.

Computerized maintenance management systems are the tools that integrate all the stages in the asset management process and the best known on the market are SAP, MAXIMO, MANAGERPLUS, FIIX and EMANT. These systems are generally divided into several modules and require specific training for their users (IBM, 2024). Furthermore, it functions as a work control system for personnel responsible for carrying out maintenance in the field, where historical maintenance data and associated costs are stored.

Referencing the VFD example given above, identifying the technical specifications of all VFDs on campus will identify where the gaps in inventory may be.

VI. STORAGE

One of the main points of keeping a long list of spare parts is the storage space available. The amount of storage space in a research facility is finite, and leaving equipment in areas not intended for long term storage can lead to some negative outcomes, such as:

- a. The spare equipment is scattered, not accessible or difficult to find.
- b. The spare equipment is too accessible and can be borrowed to alleviate lead times on other projects.
- c. The storage area has conditions which may damage the stored equipment.
- d. The equipment requires a certain upkeep regime to maintain its components, and therefore cannot be left and forgotten.

A widely used solution to help organizations with limited physical space is the transfer of spare parts management to suppliers or partner companies (OLIVEIRA. 2024).

VII. EXTERNAL PROVIDERS

A second point to consider when keeping a long list of spare parts is the cost involved in keeping these items operational. It is even more important when considering specialized equipment serviced by external vendors. The availability of these items can be tricky. Those items should be put through the same risk assessment as other assets in the facility. In these cases, an additional inquiry should be made to determine if the age of the equipment will mean scarcity of available parts. Utilizing accurate data, can the Facilities Team determine:

- a. How many of the same type still exist on campus?
- b. Is there a renewal schedule/funding available?
- c. Has the team retained ownership of other decommissioned assets of the same type which can be used to source parts internally?

VIII. RESULTS

After analyzing the information in the database, 263 VFDs were found of 11 different manufactures and multiple sizes. A second analysis was performed to identify VFDs associated with equipment classified as major or significant criticality and spare availability ranging from medium to very high. After this second analysis, the list of VFDs went from 263 to 54 units. A third analysis was done on these 54 units to identify how many types and sizes should be considered. The final result of this analysis process identified 4 different VFDs that were instantly ordered and stored in place for immediate action as needed.

Additional steps have been identified to improve the spare part strategy at the medical school and its entire asset management system with a focus on ensuring critical research performance and lab equipment reliability.

IX. NEXT STEPS

The main points identified by the study conducted at the medical school that need additional work and should be considered in the future are storage management, vendor participation, and identification of other critical assets.

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Talking about storage, the following actions could be implemented:

- a. Clean up or out the current storage areas and identify new storage areas. Eliminate equipment that would not be practical to put back in service.
- b. Fully catalogue all spare equipment on hand and identify if equipment is ready to deploy or kept solely for harvesting components.
- c. Engage with vendors/suppliers to utilize their warehouse capabilities. Engage with them about the feasibility and cost for keeping stock on their premise until it's needed.
- d. Investigate options for off-site or alternative storage solutions which would allow Facilities to accept larger orders of stock.

Regarding vendor participation, the actions below would help with the spare part management:

- a. Being proactive about parts, which means bringing in the various vendors and suppliers that Facilities utilizes.
- b. Engage with vendors and suppliers about expectations for delivery, and that will require approaching some of our maintenance habits differently. As an example, filters typically have a short lead, but may also be delayed due to special orders or just out of stock at the time. The current method is to "order as you go", which delays planning efforts and leads to overdue preventive maintenance. A better approach is to be proactive with the needs and communicate that to vendors. What filters are needed to perform normal, timely maintenance this year? Communicate to the vendors the sizes, types and quantities of filter stock required in the next 6-12 months.
- c. Don't wait for individual work orders. Ordering in bulk will save on both time and cost, and ideally put Facilities in a position to take delivery of stock immediately.

Finally, as expected, not only VFDs but all additional critical assets utilized in national research and lab infrastructure systems must be identified and evaluated to understand what the best maintenance strategy and spare part program are to have in place.

X. CONCLUSIONS

This paper has presented academic concepts about asset integrity, specifically spare part strategy, equipment criticality, and computerized maintenance management systems (CMMS). An analyse of the spare part situation of the research facility at one of the most important medica schools of the world showed that four spare parts will be storage to cover over two hundred VFDs running on campus.

Another conclusion is that additional asset categories must be analysed to ensure all critical assets are covered by the spare part strategy. As potential impacts, the lack of a proper spare part strategy can cause interruption and loss of national critical research.

Finally, additional work is required to understand what the best approach is for storage management and vendor participation in this process.

REFERENCES

- 1) IBM. 2024. What is a computerized maintenance management system (CMMS)? Available at: <https://www.ibm.com/topics/what-is-a-cmms>. Accessed on: 26JAN2024.
- 2) Oliveira, R. S. 2024. Desenvolvimento de Metodologia para Gestão e Integridade de Ativos em Universidades e Centros de Pesquisa. Available at: <https://www.nucleodoconhecimento.com.br/engenharia-mecanica/gestao-de-integridade>. Accessed on: 31JAN2024.
- 3) THOMPSON, Emily. 2020. The Overwhelming Need for Spare Parts Management. Available at: <https://www.dxpe.com/benefits-need-spare-parts-management-plan/>. Accessed on: 30JAN2024.
- 4) TROUT, J. 2024. Criticality Analysis: What It Is and Why It's Important. ReliablePlant. Available at: <https://www.reliableplant.com/criticality-analysis-31830>. Accessed on: 26JAN2024.



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The Impact of ChatGPT on Tourists' Trust and Travel Planning Intention: International Researches and Current Situation in Vietnam



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ABSTRACT: This research investigates the impact of ChatGPT on tourists' trust and travel planning intention, with a focus on international perspectives and the current situation in Vietnam. The study comprises three main sections: Introduction, where the significance of ChatGPT in tourism is highlighted; Literature Review, encompassing an exploration of ChatGPT, its application in tourism, and the influence of trust and intention in utilizing ChatGPT for travel planning; and Current Situation, providing insights into the existing scenario. By examining factors affecting trust and intention in ChatGPT-based travel planning, this research contributes valuable insights for the tourism industry. The study concludes with a synthesis of findings and potential implications for future research and industry practices.

KEYWORDS: ChatGPT, customer behavior, tourism, planning intention

I. INTRODUCTION

In the ever-evolving landscape of technology, artificial intelligence (AI) has emerged as a transformative force, reshaping various aspects of our daily lives. With the emergence of Chat GPT, an artificial intelligence (AI) conversational tool developed by OpenAI, Chat GPT can understand human natural language and generate text that resembles human writing (Lock, 2022).

Chat GPT reached 100 million users within 2 months of its launch (November 30, 2022), making it the fastest-growing application in history (Milmo, 2023). One notable area where Chat GPT has made significant strides is in the field of travel. The advent of Chat GPT has paved the way for travelers to explore information and plan their trips in new ways. While travelers currently have to navigate multiple websites (e.g., search engines, maps, online travel agencies, review websites, and blogs) to compile lists of destinations or activities, they can streamline those complex and daunting processes through a simple conversation with Chat GPT (Mogelonsky & Mogelonsky, 2023). Since ChatGPT can recommend possible destinations or activities within a few seconds, in accordance with travelers' requests (e.g., dates, company, preferred activities, and time budget), a list of options recommended by the tool could be a valid initial reference for trip planning (Hayhurst, 2023). As we delve into this dynamic intersection of technology and tourism, this journal seeks to investigate the impact of ChatGPT on tourists' beliefs and travel planning intentions.

The tourism industry has witnessed significant transformations in recent years with the integration of artificial intelligence (AI) technology. A resounding 97.8% of travel executives in the Euromonitor International's Voice of the Industry: Travel Survey stated that AI would have an impact over the next five years. Travellers using artificial intelligence (AI) tools such as ChatGPT to plan their travel itineraries is set to boom, according to market research company Euromonitor International.

This study explores the echoes surrounding the use of Chat GPT in the tourism industry. The article synthesizes research in this area based on studies that have highlighted the impact of Chat GPT on the trust of travelers. Integrating Chat GPT in the tourism sector brings both convenience and challenges to the forefront. Clearly, discussions on the benefits of Chat GPT, such as creating value for travelers, as well as its drawbacks, such as the lack of human interaction and potential data security risks, will continue to persist in the tourism industry.

The statistics highlight a growing reliance on AI-driven platforms, raising important questions about the implications for traditional travel services and the broader tourism industry. This article aims to unravel the intricate dynamics between

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ChatGPT, tourists' beliefs, and travel planning intentions, providing valuable insights into the evolving landscape of AI in the travel sector.

II. LITERATURE REVIEW

A. ChatGPT

ChatGPT, developed based on the GPT-3.5 model, is an advanced chatbot that has gained significant attention in recent years (Hughes, 2023). Its remarkable ability to comprehend and engage in human-like conversations has made it a popular choice for various applications. According to OpenAI (2022), ChatGPT can handle follow-up questions, acknowledge its errors, challenge incorrect premises, and even reject inappropriate requests. Furthermore, it has the capability to understand code and retain information from previous interactions (Hughes, 2023).

However, despite its impressive fluency, ChatGPT has certain limitations. It lacks the reasoning capabilities of a human and may struggle when confronted with complex or abstract queries, as well as understanding the broader context and implications of the text input (OpenAI, 2022). Researchers have also noted its limited mathematical capabilities (Frieder et al., 2023). Another concern is the ambiguity surrounding the sources of information used by ChatGPT (Van Dis et al, 2023).

Furthermore, it's important to note that ChatGPT's knowledge is based on data available until 2021 (Zielinski et al, 2023). Consequently, it may not be up-to-date with recent developments. Additionally, biases present in the training data can lead to biased responses from ChatGPT (Krügel et al., 2023; OpenAI, 2022). Thus, the lack of transparency regarding information sources is a noticeable issue that raises concerns about the authenticity and reliability of ChatGPT's responses (Van Dis et al, 2023).

B. The use of ChatGPT in tourism - focusing on tourists

ChatGPT has demonstrated its versatility in various domains, including education, where it has gained significant popularity. However, its potential application in the field of tourism should not be overlooked. The utilization of ChatGPT also represents a potential factor that can bring numerous benefits and cater to various entities, including travel companies, tourist destinations, and individuals employing ChatGPT as a planning tool for their trips, which can be succinctly referred to as tourists.

One notable advantage of ChatGPT is its potential to contribute to the creation of travel itineraries in a fast, concise, and referential manner (Ali and OpenAI, 2023). According to Ines Carvalho (2023), tourists can utilize ChatGPT at every stage of their journey, ranging from seeking inspiration, making bookings, experiencing the trip, to reflecting on the post-trip phase. However, attention should be given to ChatGPT's role during the planning process.

When tourists consciously opt to engage with ChatGPT or other language learning models (LLMs) based chatbots, they can employ various approaches. For instance, if ChatGPT is integrated into travel websites with access to real-time data, travelers can receive personalized information and recommendations regarding tourism offerings at their destination, such as hotels, restaurants, transportation options, local attractions, and activities, e.g... (Carvalho, 2023). Furthermore, they can design tailored itineraries by verbally expressing their preferences, requirements, and constraints to ChatGPT. This could encompass factors like time and budget limitations, specific needs, or dietary restrictions. The integration of generative AI, coupled with the establishment of Self-sovereign identity (SSI), where individuals have control over the sharing and utilization of their personal data, has the potential to significantly enhance personalization, including in the tourism and hospitality domain (Sorrells, 2023).

Looking ahead, the future development of ChatGPT and similar technologies holds promise in the form of virtual companions who acquire knowledge about each individual and simulate emotional responses. If integrated with travel websites to access real-time data, these companions could provide support and guidance throughout travelers' journeys (Carvalho, 2023).

C. Trust and intention in using ChatGPT for planning

Trust: Trust is the belief and confidence an individual has in the actions and behavior of others, based on their expectations (Gu et al., 2009). It refers to an individual's willingness to rely on another party's decisions or actions without fearing negative outcomes (Cheng et al., 2022). While trust has traditionally been associated with human relationships, its applicability to the relationship between humans and technology remains a subject of debate (Przegalinska et al, 2019). Nonetheless, trust plays a vital role in the adoption of technology (Johnson et al, 2008).

Studies examining trust in technology, where the object of trust is a technological device such as an information system or a recommendation agent, indicate that trust in this context is akin to interpersonal trust. It refers to the extent to which individuals are willing to depend on a software program to accomplish specific tasks (F. Ali et al., 2023). Trust in AI agents, including chatbots, can be seen as an extension of interpersonal trust, representing the level of assurance and readiness a consumer feels in acting upon the actions or advice provided by an AI agent.

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The trust established in ChatGPT as a tool leads to trust in the recommendations it provides, ultimately influencing the intention to use those recommendations.

Intention to use ChatGPT's recommendations: Behavioral intention refers to a person's projected or planned behavior in the future. It reflects their anticipated actions in a specific context and can be measured by their likelihood of taking action. The Theory of Planned Behavior (TPB) posits that the primary determinant of behavior is an individual's intention to act in a particular way. When given the opportunity, intention translates into behavior. Therefore, accurately measuring intention can serve as the most reliable predictor of behavior (Lam and Hsu, 2006).

Trust is a crucial factor that influences consumers' behavioral intentions toward technology-based services like chatbots. Trust is instrumental in the adoption and continuous use of technology. Trust in technology mediates the relationship between users' perception of technology and their behavioral intentions. Several studies have found that trust in technology positively impacts consumers' behavioral intentions toward that technology (Zeithaml et al., 2002). A specific example of how trust influences the intention to use recommendations from this tool is a research titled "Investigating the Impact of User Trust on the Adoption and Use of ChatGPT: Survey Analysis" (Avishek Choudhury and Hamid Shamszare, 2023), which aimed to assess the influence of trust on both intention and actual usage of ChatGPT. Two relevant hypotheses regarding trust were proposed: "User trust in ChatGPT increases with intention to use" and "User trust directly drives actual usage of ChatGPT". To test these hypotheses, the researchers conducted an online survey with 607 regular ChatGPT users in the United States. The results revealed that the research model explained 50.5% and 9.8% of the variance in intention and corresponding usage behavior, respectively. Trust exhibited a strong relationship with both factors. These findings emphasize that trust is a critical determinant of users' acceptance and usage of ChatGPT.

D. Factors from ChatGPT that can influence Trust and Intention

Trust in chatbots can be influenced by various factors, including their visual appearance resembling humans, conversational content, and performance in avoiding communication breakdowns (Law et al, 2022). Additionally, contextual factors related to the chatbot service, such as the brand hosting the chatbot, the perceived level of security and privacy, and the user's general risk perceptions, can also impact trust. (Ali et al, 2023).

Recent researches have described the factors from ChatGPT that influence trust (as an intermediate factor) and their impact on users' intention to use ChatGPT for travel planning. These studies have emerged primarily outside of Vietnam, starting around 2020 and gaining more popularity in 2023. Some notable studies in this area include: "Adoption of AI-based chatbots for hospitality and tourism", a research conducted by Rajasshrie Pillai and Brijesh Sivathanu (2020). It investigated the behavioral intention and actual usage of chatbots supported by artificial intelligence (AI) in the hotel and travel industry. The research findings revealed that the predictive factors for the intention to use chatbots were perceived ease of use, perceived usefulness, perceived trustworthiness, perceived intelligence, and the theory of anthropomorphism. Additionally, the research indicated that concerns about technology did not influence the intention to use chatbots, and the attachment to traditional travel agents moderated the negative relationship between the intention to use chatbots and their actual usage in travel planning. It provided valuable insights into the commitment of managers in providing travel planning services using AI-based chatbots.

A more recent research by Faizan Ali et al (2023) focused on "Antecedents and Consequences of Tourists' Trust in Personalized Travel Recommendations by ChatGPT." It examined the impact of relevance, trustworthiness, usefulness, and intelligence of personalized travel recommendations provided by ChatGPT on tourists' trust and behavioral intention. The results of both studies indicated that relevance, trustworthiness, usefulness, and intelligence of the personalized travel recommendations from ChatGPT have a positive influence on tourists' trust. Furthermore, tourists' trust positively affects their behavioral intentions, including the intention to use ChatGPT in the future, recommend ChatGPT to others, and book travel services through ChatGPT. This research represents a significant step toward understanding the impact of ChatGPT on tourists' trust and behavioral intentions, while also providing practical implications for travel service providers to enhance tourists' experiences using ChatGPT.

However, according to C. Ischen et al (2020), although chatbots can provide various advantages to users, concerns regarding security and privacy may undermine trust due to potential breaches of customer data confidentiality and unauthorized third-party sharing. Security and privacy issues can be broadly categorized as threats and vulnerabilities (M.Deng et al, 2011). In this study, security threats are defined as the likelihood of compromising an organization's systems and data. Computer security threats encompass activities such as "Spoofing, Tampering, Repudiation, Information Disclosure, Denial of Service, and Privilege Elevation." System vulnerabilities refer to weaknesses in a computer system that unethical hackers can exploit to surpass privilege boundaries. A system becomes vulnerable when it possesses insecure coding, outdated hardware drivers, or a weak

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firewall, among other factors. These risks also need to be considered as negative factors that impact user trust, alongside the aforementioned elements that serve as "user perception boosters" for ChatGPT.

In conclusion, these researches shed light on the factors that influence trust in ChatGPT and its impact on users' intention to utilize the tool for travel planning, offering valuable insights for both researchers and travel service providers seeking to enhance the user experience with ChatGPT.

III. CURRENT SITUATION

A. The practical use of ChatGPT for travel planning purposes in Vietnam

In 2022, OpenAI marked a significant milestone by launching the Vietnamese version of ChatGPT, integrating advanced conversational AI into various aspects of Vietnamese society, particularly in tourism. Travelers have enthusiastically adopted the AI language model, transforming trip planning into a more interactive and user-friendly experience. ChatGPT's real-life conversational abilities have revolutionized the exploration of Vietnam, offering personalized recommendations for travel itineraries, local attractions, and dining options.

Based on Expedia's 2024 Travel Trends Report, compiled from vast datasets and a survey involving 20,000 global travelers, in 2023, only a small fraction of travelers utilized AI-powered search tools (such as ChatGPT) to plan their trips. However, this is expected to undergo significant changes by the year 2024. In particular, the trend of using smart guides and ChatGPT in tourism will help boost the stature of travel agents, the report noted. According to market research company Euromonitor International, travelers using ChatGPT to plan their travel itineraries is set to boom. According to the survey conducted by Expedia, more than half of the respondents in Expedia's survey express interest in using artificial intelligence to plan their next trip. Artificial intelligence is expected to streamline the planning and booking process, although some errors are still anticipated. Nearly 40% of travelers stated that they would utilize AI-powered search tools to ensure a seamless vacation experience.

The report "Government AI Readiness Index 2022" published by Oxford Insights (UK) stated that Vietnam has benefits, including a young population, strong levels of digital literacy, and the capacity to quickly adopt digital solutions - all of which are favorable conditions for the growth of AI. In Viet Nam, according to a survey on the use of ChatGPT to assist in travel planning revealed that out of a total of 300 respondents, 281 reported using ChatGPT on tourism. All of the surveyed participants were travelers to Vietnam, including both domestic and international tourists. The survey indicates that they utilized ChatGPT at various stages of their journeys, with a focus on pre-trip usage (29.6%), and less during and after the trip stages (Thuy et al., 2023). Furthermore, a communications employee of a company in Ho Chi Minh City, Viet Nam mentioned that his pre-travel routine used to involve reading reviews on platforms like TikTok, Instagram, and Facebook. However, since the emergence of ChatGPT, he regularly uses AI-powered chatbot applications as well as ChatGPT itself, in conjunction with social media to gather information about destinations and plan itineraries for his travels.

B. The challenges of using ChatGPT in the field of tourism in Vietnam

While ChatGPT's technology offers numerous intriguing advantages, some experts argue that its use may diminish individuals' creativity and cognitive abilities, potentially having a negative impact on the learning process... Additionally, some experts warn that AI is not consistently reliable, and there is a possibility of occasional inaccuracies in the information it provides. According to the Director of the Institute of Information Technology, ChatGPT helps people answer most questions in a very short time. The response content is a compilation of information derived from the training data set that OpenAI utilizes to train ChatGPT. Users should independently verify and assess the authenticity of ChatGPT's responses, viewing it as a dependable reference rather than an absolute source. Not only the Director of the Institute of Information Technology but also the Chief Executive Officer of DTT Technologies indicates that, although ChatGPT can answer questions in a manner similar to a human, it has the capability to grasp the context of the queries and provide coherent responses.

IV. CONCLUSIONS

In conclusion, the exploration of ChatGPT's influence on tourists' beliefs and travel planning intentions has unveiled intriguing insights. The integration of advanced language models in the tourism domain has not only empowered travelers with personalized and efficient information but has also subtly shaped their perceptions and decision-making processes. As we navigate this evolving landscape, it is imperative to remain cognizant of the dynamic interplay between technology and travelers' beliefs. By understanding and harnessing this impact responsibly, we can foster a symbiotic relationship that enhances the overall travel experience for individuals while respecting their autonomy and diverse perspectives.

The Impact of ChatGPT on Tourists' Trust and Travel Planning Intention: International Researches and Current Situation in Vietnam

REFERENCES

- 1) Shin, S., Kim, J., Lee, E., Yhee, Y., & Koo, C. (2023, November 29). ChatGPT for Trip Planning: The Effect of Narrowing Down Options. *Journal of Travel Research*.
[Online] Available: <https://journals.sagepub.com/doi/10.1177/00472875231214196#bibr57-00472875231214196>
- 2) Use of AI tools such as ChatGPT to plan travel set to boom. (2023, July 12). Euromonitor International.
[Online] Available: <https://www.euromonitor.com/press/press-releases/july-20232/use-of-ai-tools-such-as-chatgpt-to-plan-travel-set-to-boom>
- 3) Lock, S. (2022, December 5). What is AI chatbot phenomenon ChatGPT and could it replace humans? *The Guardian*.
[Online] Available: <https://www.theguardian.com/technology/2022/dec/05/what-is-ai-chatbot-phenomenon-chatgpt-and-could-it-replace-humans>
- 4) Milmo, D. (2023, February 3). ChatGPT reaches 100 million users two months after launch. *The Guardian*.
[Online] Available: <https://www.theguardian.com/technology/2023/feb/02/chatgpt-100-million-users-open-ai-fastest-growing-app>
- 5) Mogelonsky, A., & Mogelonsky, L. (2023, January 12). How ChatGPT Can Evolve Hotel Search. *Hospitality Technology*.
[Online] Available: <https://hospitalitytech.com/how-ChatGPT-can-evolve-hotel-search>
- 6) Hayhurst L. (2023, February 17). Tech experts insist ChatGPT and AI services 'not threat to agents'. *Travel Weekly*.
[Online] Available: <https://travelweekly.co.uk/news/tour-operators/tech-experts-insist-chatgpt-and-ai-services-not-threat-to-agents>
- 7) Aleksandra Przegalinska, Leon Ciechanowski, Anna Stroz, Peter Gloor, Grzegorz Mazurek. (2019). In bot we trust: A new methodology of chatbot performance measures. *Business Horizons*, Volume 62, Issue 6, 785-797.
- 8) Ali, F. (2023). Let the devil speak for itself: Should ChatGPT be allowed or banned in hospitality and tourism schools? . *Journal of Hospitality and Tourism*, 1-6.
- 9) Avishek Choudhury, Hamid Shamszare. (2023). Investigating the Impact of User Trust on the Adoption and Use Of ChatGPT: Survey Analysis. *Journal of Medical Internet Research* 25(3).
- 10) Carolin Ischen, Theo Araujo, Hilde Voorveld, Guda van Noort, Edith Smit (2020). Privacy Concerns in Chatbot Interactions. *CONVERSATIONS 2019: Chatbot Research and Design*, (pp. 34-48).
- 11) Devon S. Johnson, Fleura Bardhi, Dan T. Dunn. (2008). Understanding How Technology Paradoxes Affect Customer Satisfaction with Self-Service Technology: The Role of Performance Ambiguity and Trust in Technology. *Psychology and Marketing* 25(5), 416-443.
- 12) Effie Lai-Chong Law, Asbjørn Følstad, Nena Van As. (2022). Effects of Humanlikeness and Conversational Breakdown on Trust in Chatbots for Customer Service. *NordiCHI '22: Nordic Human-Computer Interaction Conference*, (pp. 1-13).
- 13) Eva A. M. van Dis, J. B. (2023, 02 03). ChatGPT: five priorities for research. *nature*. [Online] Available: <https://www.nature.com/articles/d41586-023-00288-7>
- 14) Faizan Ali, Open AI. (2023). Let the devil speak for itself: Should ChatGPT be allowed or banned in hospitality and tourism schools? *Journal of Global Hospitality and Tourism*, 2(1), 1-6.
- 15) Frieder, S., Pinchetti, L., Chevalier, A., Griffiths, R.-R., Salvatori, T., Lukasiewicz, T., Petersen, P. C., & Berner, J. (2023, January 31). Mathematical Capabilities of ChatGPT. *arXiv*. [Online] Available: <https://arxiv.org/abs/2301.13867>
- 16) Hughes, A. (2023, 09 25). ChatGPT: Everything you need to know about OpenAI's GPT-4 tool. *BBC Science Focus*. [Online] Available: <https://www.sciencefocus.com/future-technology/gpt-3>
- 17) Ines Carvalho, Stanislav H Ivanov. (2023). ChatGPT for tourism: applications, benefits, and risks. *Tourism Review*
- 18) Mina Deng, Kim Wuyts, Riccardo Scandariato, Bart Preneel Wouter Joosen . (2011). A privacy threat analysis framework: supporting the elicitation and fulfillment of privacy requirements. *Requirements Engineering*, (pp. 3-32).
- 19) Mitra Sorrells, PhocusWire. (2023, 01 14). What will ChatGPT mean for the travel industry?. *Travel Weekly*. [Online] Available: <https://www.travelweekly.com/Travel-News/Travel-Technology/What-will-ChatGPT-mean-for-the-travel-industry>
- 20) Rajasshrie Pillai, Brijesh Sivathanu. (2020). Adoption of AI-based chatbots for hospitality and tourism. *International Journal of Contemporary Hospitality Management* 32(10), 3199-3226.
- 21) Sebastian Krügel, Andreas Ostermaier, Matthias Uhl. (2023). The moral authority of ChatGPT. *Cornell University*.
- 22) Terry Lam, Cathy H. C. Hsu. (2006). Predicting behavioral intention of choosing a travel destination. *Tourist Management* 27(4), 589-599.

The Impact of ChatGPT on Tourists' Trust and Travel Planning Intention: International Researches and Current Situation in Vietnam

- 23) Valarie A. Zeithaml, Leonard L. Berry and A. Parasuraman. (1996). The Behavioral Consequences of Service Quality. *Journal of Marketing*, Vol. 60, No. 2, 31-46.
- 24) Xusen Cheng, Xiaoping Zhang, Jason Cohen, Jian Mou. (2022). Human vs. AI: Understanding the impact of anthropomorphism on consumer response to chatbots from the perspective of trust and relationship norms. *Information Processing & Management*.
- 25) Zielinski, C. (2023). Chatbots, generative AI, and scholarly manuscripts: WAME recommendations on chatbots and generative artificial intelligence in relation to scholarly publications. *Colombia Medica*.
- 26) AI-based tech must be used with caution: experts. (2023, February 11). *Viet Nam News*. [Online] Available: <https://vietnamnews.vn/society/1482665/ai-based-tech-must-be-used-with-caution-experts.html>
- 27) Bich Phuong - Van Khanh. (2023, October 9). Gen Z uses social media, AI self-schedules travel itineraries. *VnExpress*. [Online] Available: <https://vnexpress.net/gen-z-dung-mang-xa-hoi-ai-tu-len-lich-trinh-du-lich-4661377.html>
- 28) ChatGPT – A jolt to AI development in Vietnam. (2023, February 7). *VietnamPlus*. [Online] Available: <https://en.vietnamplus.vn/chatgpt-a-jolt-to-ai-development-in-vietnam/265638.vnp>
- 29) Nguyen Thi Bich Thuy, Pham Thai My Tinh, Nguyen Viet Tinh. (2023, October 31). The influence of chatbot quality factors on tourists's value co-creation behavior: a SOR framework approach. *Journal of Science and Technology - University of Danang*, 21. [Online] Available: <https://jst-ud.vn/jst-ud/article/view/8513>
- 30) Pham, T. (2023, November 27). AI and travel trends will boom in 2024. *Lao Dong Magazine*. [Online] Available: <https://dulich.laodong.vn/kham-pha/ai-va-nhung-xu-huong-du-lich-se-bung-no-trong-nam-2024-1271955.html>



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Solving Ordinary Differential Equations with Boundary Conditions Numerically



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ABSTRACT: This article elucidates the method and implementation of finite differences, aiming to enhance clarity for students and provide detailed insights into its application, as many authors assume a pre-existing understanding of numerical analysis. It includes two case studies employing Dirichlet and Cauchy boundary conditions, demonstrating the precision and effectiveness of this numerical tool in obtaining results.

KEYWORDS: Numerical analysis, finite differences, ordinary differential equations, boundary conditions, Newton-Raphson.

I. INTRODUCTION

Numerical analysis, pivotal in mathematics and science, traces its origins to ancient times, gaining prominence with Neptune's discovery in 1846 [1], affirming Newton's law of gravitation. Originating with the Babylonians and evolving, it saw significant advancements with the 16th-century advent of algebra and logarithm tables. The 18th century saw Stirling and Taylor laying finite difference calculus foundations, a key aspect of modern numerical analysis. The 19th century marked a leap in numerical analysis with automatic calculators [2], further accelerated post-World War II by high-speed electronic computers, enabling scientific breakthroughs and emphasizing precision in numerical calculations.

Modern numerical analysis, initiated by John von Neumann and Herman Goldstine in 1947 [3], addressed rounding errors and introduced scientific computing fundamentals. It is now defined by the synergy of programmable computers, mathematical analysis, and complex problem-solving. Numerical methods, essential in engineering for solving nonlinear algebraic equations and differential equations, rely on basic arithmetic operations [4-9].

In science and technology, mathematical models describe real phenomena, with applied mathematics seeking appropriate tools for problem-solving. Unfortunately, classical analytical methods are not always applicable due to various limitations, leading to the advancement of numerical methods, significantly influenced by computing advancements. Numerical analysis consists of iterative algorithms providing solutions based on stopping criteria and error estimates. These algorithms serve multiple purposes, including calculating numerical derivatives, integrals, differential equations, linear algebra, interpolations, curve fitting, and polynomials [4-9]. Numerical methods enable understanding and applying numerical schemes for solving mathematical, engineering, and scientific problems on computers. They involve simplifying basic numerical schemes, programming, and solving problems on computers.

Numerical analysis aims to design methods for efficiently approximating mathematical problem solutions. Its primary goal is to find approximate solutions to complex problems using simple arithmetic operations, involving a sequence of algebraic and logical operations. Numerical analysis has become crucial in engineering process simulator software development. For

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instance, Pipe Flow, a piping system design and modeling software, calculates fluid flow in various network configurations. Pipe Flow Expert determines flow rates and pressure drops [10-12]. Matlab, including SIMULINK, models, simulates, and analyzes dynamic systems, widely used in signal processing and control engineering [13-16]. COMSOL Multiphysics® models physical phenomena, virtually any phenomenon describable by PDEs, including heat transfer, fluids, electromagnetism, and structural mechanics [17-19]. It offers multiphysics capabilities for modeling combinations of phenomena based on PDEs. COMSOL simplifies application development with its Model Library, making it accessible for users without extensive mathematical or numerical analysis knowledge. Its features make it applicable in various fields, including acoustics, electromagnetism, MEMS, microwave engineering, chemistry, fluid dynamics, structural mechanics, physics, geophysics, optics, photonics, quantum mechanics, control systems, and applied mathematics.

Cadence PSpice, a Spice-based simulator, specializes in simulating designs with analog and digital components. It offers a range of simulation models and integrates with Allegro® Design Entry HDL and OrCAD® Capture for schematic capturing [20, 21]. Opera Simulation Software, a comprehensive CAE toolset for electromagnetic system design, analysis, simulation, and optimization, includes multiphysics effects [22, 23]. Created in 1984, Opera facilitates the design and optimization of 2D and 3D electromechanical devices, solving various electromagnetic problems.

This article aims to guide students in solving ordinary differential equations using finite difference numerical solutions, considering Maple 17's exact numerical solution. It presents four case studies applying the methodology under different boundary conditions.

This paper is organized as follows: Section II introduces the finite difference method in the context of ordinary differential equations. Section III presents two case studies for analysis. Section IV is dedicated to the discussion of the findings, and Section V concludes the paper.

II. SOME BASICS OF FINITE DIFFERENCES METHOD

The finite difference method (FDM) is applied to find the solution of ordinary differential equations (ODEs) with boundary conditions, that is, when the values of the function at the ends of the interval $[a, b]$ are known. This method involves replacing the numerical derivation formulas derived from the Newton-Gregory interpolating polynomial in the differential equation. Like the interpolating polynomial, the finite difference method adheres to specific rules, including constant spacing and pivoting. It consists of substituting the numerical derivation equations into the differential equation and then constructing a recurrence equation. This pivoting process, applied at n equidistant points within the interval $[a, b]$, results in a set of equations that will be solved by a specific numerical method. The application of this method allows for effectively addressing and solving ODEs with defined boundary conditions.

The FDM is a numerical approach to solving differential equations, providing numerical rather than symbolic solutions. In this method, functions are represented as arrays of discrete points, with the accuracy of the solution improving as more points are used, albeit at the cost of increased computational intensity. This represents a fundamental trade-off in the method. The procedure for FDM is as follows:

1 Identify the governing equation and boundary values.

For example, let the differential equation

$$\frac{d^2y(x)}{dx^2} - 2 \frac{dy(x)}{dx} + 1 = 0, \tag{1}$$

with boundary values given by

$$y(0) = 0, \quad y(1) = 0. \tag{2}$$

2 Approximate derivatives using finite differences, ensuring that each term in the finite-difference equation is evaluated at the same point.

The central finite difference equations for the second derivative, first derivative, and $y(x)$ are given by

$$\frac{d^2y(x)}{dx^2} = \frac{y(x + \Delta x) - 2y(x) + y(x - \Delta x)}{\Delta x^2}, \tag{3}$$

$$\frac{dy(x)}{dx} = \frac{y(x + \Delta x) - y(x - \Delta x)}{2\Delta x}, \tag{4}$$

$$y(x) = y(x). \tag{5}$$

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Substituting (3) and (4) in (1) we obtain

$$\frac{y(x + \Delta x) - 2y(x) + y(x - \Delta x)}{\Delta x} - 2 \frac{y(x + \Delta x) - y(x - \Delta x)}{2\Delta x} + 1 = 0. \quad (6)$$

3 Express the finite-difference equation using array indices.

Rewriting (6) using indices we have

$$\frac{y_{i+1} - 2y_i + y_{i-1}}{\Delta x} - 2 \frac{y_{i+1} - y_{i-1}}{2\Delta x} + 1 = 0. \quad (7)$$

4 Rearrange the finite-difference equation for clarity.

Simplifying the process, the finite-difference equation (7) is rearranged so as to collect the $y(x)$ terms.

$$(1 + \Delta x)y_{i-1} - 2y_i + (1 - \Delta x)y_{i+1} + \Delta x^2 = 0. \quad (8)$$

5 Set up the computational grid.

For instance, let us solve this equation using 40 points on the grid.

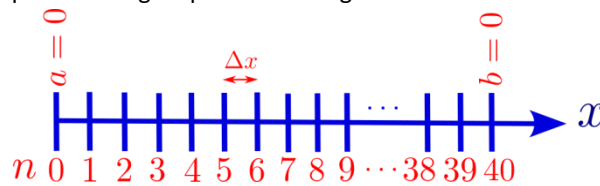


Figure 1. The grid spacing.

In this way, the grid spacing for $n = 40$. Note that we have 41 points including zero, this way

$$\Delta x = \frac{x_b - x_0}{n} = \frac{1 - 0}{41 - 1} = 0.025. \quad (9)$$

6 Revise the Finite-Difference Equation as needed.

In this way, substituting the value of Δx in (8) we obtain

$$1.025y_{i-1} - 2y_i + 0.975y_{i+1} + 0.000625 = 0 \quad (10)$$

7 Apply the finite-difference equation at each grid point.

Write finite-difference equation at each point on grid. In this way we will count i from 1 to 39 because the zero point, $i - 1 = 0, y_{i-1} = 0$ corresponds to the boundary $x = a = 0$ and the point 40, $i + 1, y_{i+1} = 0$, corresponds to the boundary $x = b = 1$, i.e.

$$\begin{aligned} 1.025y_0 - 2y_1 + 0.975y_2 + 0.000625 &= 0, \\ 1.025y_1 - 2y_2 + 0.975y_3 + 0.000625 &= 0, \\ 1.025y_2 - 2y_3 + 0.975y_4 + 0.000625 &= 0, \\ &\vdots \\ 1.025y_{36} - 2y_{37} + 0.975y_{38} + 0.000625 &= 0, \\ 1.025y_{37} - 2y_{38} + 0.975y_{39} + 0.000625 &= 0, \\ 1.025y_{38} - 2y_{39} + 0.975y_{40} + 0.000625 &= 0, \end{aligned} \quad (11)$$

This way, in this example we have $y_0 = 0, y_{40} = 0$ are the boundaries.

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8 Formulate the set of equations as a single matrix equation.

Writing the system of equations in matrix form we obtain

$$\begin{bmatrix}
 \boxed{1} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 1.025 & -2 & 0.975 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 1.025 & -2 & 0.975 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 1.025 & -2 & 0.975 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 1.025 & -2 & 0.975 & 0 & 0 & 0 & 0 & 0 \\
 \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\
 0 & 0 & 0 & 0 & \vdots & \vdots & \vdots & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & \vdots & \vdots & \vdots & 0 & 0 & 0 \\
 h_1 & 0 & 0 & 0 & 0 & 0 & 1.025 & -2 & 0.975 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.025 & -2 & 0.975 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \boxed{1} & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \boxed{1}
 \end{bmatrix}
 \begin{bmatrix}
 y_0 \\
 y_1 \\
 y_2 \\
 y_3 \\
 y_4 \\
 \vdots \\
 \vdots \\
 y_{38} \\
 y_{39} \\
 y_{40}
 \end{bmatrix}
 =
 \begin{bmatrix}
 \boxed{0} \\
 -0.000625 \\
 -0.000625 \\
 -0.000625 \\
 -0.000625 \\
 \vdots \\
 \vdots \\
 -0.000625 \\
 -0.000625 \\
 -0.000625 \\
 \boxed{0}
 \end{bmatrix}
 \tag{12}$$

See the red boxes that indicate the boundaries. Using the matrix form we can write as

$$\mathbf{A}\mathbf{y} = \mathbf{b}
 \tag{13}$$

9 Solve the matrix equation to find the solution.

Equation (13) can be solved by calculating the inverse of \mathbf{A} , using Newton-Raphson, Gauss-Jordan, among others. In this way solving for and we obtain

$$\begin{bmatrix}
 y_0 \\
 y_1 \\
 y_2 \\
 y_3 \\
 y_4 \\
 \vdots \\
 \vdots \\
 y_{38} \\
 y_{39} \\
 y_{40}
 \end{bmatrix}
 =
 \begin{bmatrix}
 0 \\
 0.0084887 \\
 0.0167716 \\
 0.0248383 \\
 0.0326776 \\
 \vdots \\
 \vdots \\
 0.03003592 \\
 0.01570591 \\
 0
 \end{bmatrix}
 \tag{14}$$

10 Plot the results, displaying x versus $y(x)$, where $y(x)$ is the solution vector obtained from the matrix equation.

Figure 2 shows the graph of the solution vector y against values of x .

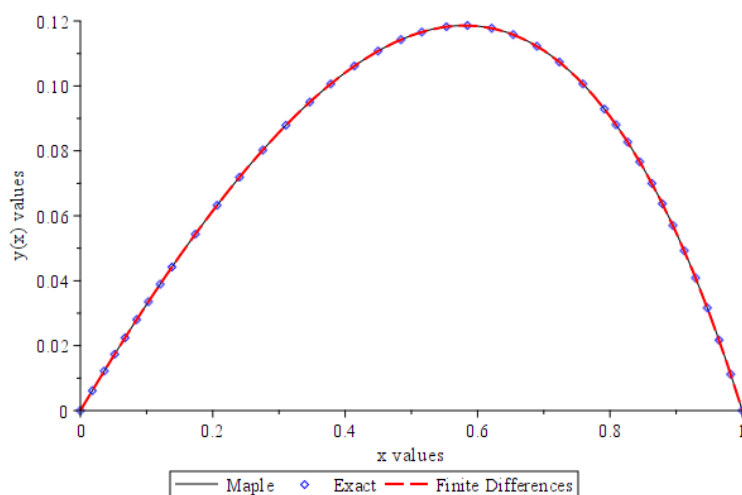


Figure 2. Solution vector y against values of x

III. STUDY CASES

A. Case 1. Differential equation with Dirichlet condition

In this case study, the second-order linear equation with Dirichlet conditions given by (1) will be solved.

Solution. The equation has an analytical solution and is given by

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$$y(x) = -\frac{e^{2x}}{2(e^2 - 1)} + \frac{x}{2} + \frac{1}{2(e^2 - 1)}. \quad (15)$$

The solution process used finite FDM is the one presented in section II for $n = 40$ and $\Delta x = 0.025$. Figure 2 shows the solution using FDM in dash line, against the exact solution with diamonds and the numeric provided by Maple 17 with solid line. Analysis of significant digits is outside the scope of this article. For further details, see [24, 25].

B. Case 2. Differential equation with Cauchy condition

A Cauchy boundary condition defines the function value and its normal derivative at the domain's boundary. This is equivalent to applying both Dirichlet and Neumann boundary conditions simultaneously. The term is attributed to the renowned 19th-century French mathematician and analyst, Augustin Louis Cauchy. Now we will solve equation (1) using Cauchy conditions given by

$$y(0) = 0, \quad y'(1) = 0. \quad (16)$$

Solution. Using the boundary conditions (16), the analytical solution of (1) is

$$y(x) = \frac{3e^{2x}}{4e^2} + \frac{x}{2} - \frac{3}{4e^2}. \quad (17)$$

Applying the FDM methodology of section II for $n = 100$ and $\Delta x = 0.01$, we obtain

$$1.01y_{i-1} - 2y_i + 0.99y_{i+1} + 0.0001 = 0. \quad (18)$$

We will now count i from 0 to 99 and we will have 99 equations with 100 unknowns. In $i = 0$ we we have the node of the first boundary condition. To achieve a total of 100 equations, we will incorporate the second boundary condition, utilizing its numerical derivative. As suggested in the literature on numerical algorithms, the implementation of a virtual node is a feasible approach for this substitution.

$$\begin{aligned} 1.01y_0 - 2y_1 + 0.99y_2 + 0.0001 &= 0, \\ 1.01y_1 - 2y_2 + 0.99y_3 + 0.0001 &= 0, \\ 1.01y_2 - 2y_3 + 0.99y_4 + 0.0001 &= 0, \\ 1.01y_3 - 2y_4 + 0.99y_5 + 0.0001 &= 0, \\ &\vdots \quad \quad \quad \vdots \\ 1.01y_{96} - 2y_{97} + 0.99y_{98} + 0.0001 &= 0, \\ 1.01y_{97} - 2y_{98} + 0.99y_{99} + 0.0001 &= 0, \\ 1.01y_{98} - 2y_{99} + 0.99y_{100} + 0.0001 &= 0, \\ -y_{99} + y_{100} - 0.02 &= 0. \end{aligned} \quad (19)$$

To resolve equation (19), we will first substitute the numerical value of the first boundary condition. Following this, we will employ numerical methods such as the Newton-Raphson and Gauss-Jordan algorithms, among others, to find the solution.

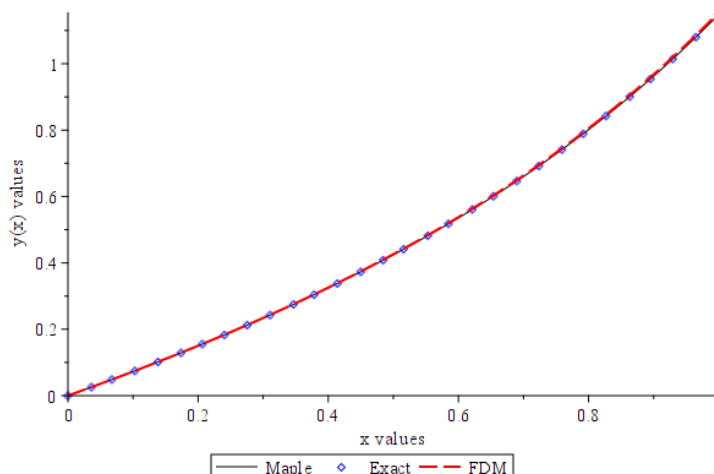


Figure 2. FDM solution vs analytical and numerical solution of Maple.

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IV. DISCUSSION

The second-order linear differential equation (1), with a solution under analysis, was solved using the Finite Difference Method (FDM) and served as a model to illustrate the detailed steps involved in applying the FDM method. Numerically, equation (1) was solved with the Maple dsolve command for each of the two case studies, considering the boundary conditions (2) and (16). Figure 3 displays the absolute error between the numerical solutions derived from Maple 17 and the one obtained using FDM with $n = 40$.

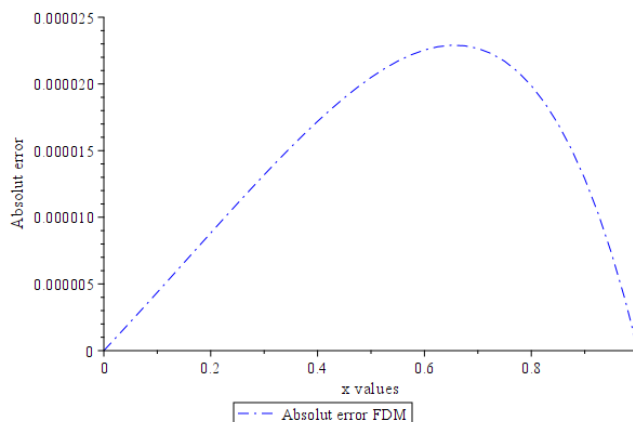


Figure 2. Absolut error for study case 3.FDM solution vs. analytical solution and Maple.

The maximum error encountered is $2.29001976 \times 10^{-5}$ at $x = 0.65$ for $i=26$. It's important to highlight that this error is relatively small, considering that only 40 iterations were employed. To achieve higher accuracy, an increase in the number of nodes can be implemented, though it should be noted that this will demand more computational effort. Additionally, it is observed that the error is smaller at the boundaries, as expected, since these are the known points provided to the system of equations (19). The determination of the absolute error for case study 2 is left as an exercise for the reader.

V. CONCLUSIONS

This paper comprehensively presents the Finite Difference Method (FDM) for student comprehension, as numerical analysis textbooks often emphasize its application in partial differential equations while overlooking its use in ordinary differential equations. We advocate for an initial understanding and application of FDM in ordinary differential equations before implementing it in solving partial differential equations. In this study, two case analyses were conducted for a linear differential equation, considering Dirichlet and Cauchy conditions. The results demonstrated good accuracy when compared with solutions from numerical software like Maple.

DECLARATION OF INTERESTS STATEMENT

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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REFERENCES

- 1) Lyttleton, R. A. 1960. The rediscovery of Neptune. *Vistas in Astronomy*, 3, 25-46.
- 2) Swade, D. D. 2003. *Calculation and tabulation in the 19th century: Airy versus Babbage*. University of London, University College London (United Kingdom).
- 3) Von Neumann, J., & Goldstine, H. H. 1947. Numerical inverting of matrices of high order.
- 4) Burden, R., & Faires, J. 2011. *Numerical Analysis* 9th edn (Boston: Brooks/Cole).
- 5) Chapra, S. C., Canale, R. P., Ruiz, R. S. G., Mercado, V. H. I., Díaz, E. M., & Benites, G. E. (2011). *Métodos numéricos para ingenieros* Vol5. New York, NY, USA: McGraw-Hill.
- 6) Daniels, R. W. 1978. An introduction to numerical methods and optimization techniques. *Elsevier*.
- 7) Butenko, S., & Pardalos, P. M. 2014. *Numerical methods and optimization: An introduction*. CRC Press.
- 8) Corless, R. M., & Fillion, N. 2013. *A graduate introduction to numerical methods*. Springer.
- 9) Luthe, R., Olivera, A., & Schutz, F. 1978. *Métodos Numéricos*, Editorial Limusa.

Solving Ordinary Differential Equations with Boundary Conditions Numerically

- 10) Goswami, S., & Hemmati, A. 2020. Response of turbulent pipeflow to multiple square bar roughness elements at high Reynolds number. *Physics of Fluids*, 32(7).
- 11) Messa, G. V., & Matoušek, V. 2020. Analysis and discussion of two fluid modelling of pipe flow of fully suspended slurry. *Powder Technology*, 360, 747-768.
- 12) Avila, M., Barkley, D., & Hof, B. 2023. Transition to turbulence in pipe flow. *Annual Review of Fluid Mechanics*, 55, 575-602.
- 13) Moore, H., Olguín, V. C., & Nuño, R. M. 2007. *MATLAB para ingenieros*. Pearson Educación.
- 14) Giron-Sierra, J. M. 2017. *Digital Signal Processing with Matlab Examples, Volume 1*. Singapore: Springer.
- 15) Wang, L. 2020. *PID control system design and automatic tuning using MATLAB/Simulink*. John Wiley & Sons.
- 16) Shanmugasundaram, N., Kumar, S. P., & Ganesh, E. N. 2022. Modelling and analysis of space vector pulse width modulated inverter drives system using MatLab/Simulink. *International Journal of Advanced Intelligence Paradigms*, 22(1-2), 200-213.
- 17) Jeong, J., Kim, Y., Bae, S., & Youn, S. 2023. Simulation of classical axion electrodynamics using COMSOL multiphysics. *Journal of the Korean Physical Society*, 1-7.
- 18) Lliev, I. K., Gizzatullin, A. R., Filimonova, A. A., Chichirova, N. D., & Beloev, I. H. 2023. Numerical Simulation of Processes in an Electrochemical Cell Using COMSOL Multiphysics. *Energies*, 16(21), 7265.
- 19) Hulkó, G., Belavý, C., Buček, P., & Zajíček, K. O. P. 2009. Control of Systems Modeled by COMSOL Multiphysics as Distributed Parameter Systems. In *COMSOL Conference 2009*.
- 20) López, D. B. 2009. *Análisis de circuitos con PSpice*. Alpha Editorial.
- 21) Sedra, A., Smith, K. C., Carusone, T. C., & Gaudet, V. 2020. *Microelectronic circuits 8th edition* Oxford.
- 22) Lalitha, M. P., Kumar, K. V. P., & Samala, V. 2014. Design and simulation of voltage and electric field distribution on disc insulators using finite element method in Opera software. In *2014 International Conference on Smart Electric Grid (ISEG)* (pp. 1-6). IEEE.
- 23) Jolissaint, L., Veran, J. P., & Marino, J. 2004. OPERA, an automatic PSF reconstruction software for Shack-Hartmann AO systems: application to Altair. In *Advancements in Adaptive Optics* (Vol. 5490, pp. 151-163). SPIE.
- 24) Sandoval-Hernández, M. A., Vazquez-Leal, H., Filobello-Nino, U. A., Morales-Alarcón, G. J., Velez-López, G. C., Castañeda-Sheissa, R., Campos-Dominguez S. Y., Ocaña-Pimentel, S., Domiguez-Chavez, J. A., Sampieri-Gonzalez, C.E., Pretelin-Canela, J. E., Bagatella-Flores, N., Escobar-Flores, A. R., Contreras-Hernandez, A. D., Alvarez-Gasca, O., Gasca-Herrera, A. E., Perez-Jacome-Friscione, J. E, Cuellar-Hernandez, L. & Pablo-López, B. 2023. Using Horner's Algorithm to Reduce Computing Times. *International Journal of Engineering Research & Technology (IJERT)*, 12(6), 325-331, ISSN 2278-0181.
- 25) Sandoval-Hernandez, M., Vazquez-Leal, H., Filobello-Nino, U., De-Leo-Baquero, E., Bielma-Perez, A. C., Vichi-Mendoza, J. C., Alvarez-Gasca, O., Contreras-Hernandez, A. D., Bagatella-Flores, N., Palma-Grayeb, B. E., Sanchez-Orea, J., Cuellar-Hernandez, L. & Cuellar-Hernandez, L. 2021. The Quadratic Equation and its Numerical Roots. *International Journal of Engineering Research y Technology*, 10(6), 301-305.



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Effect of Aeration Time on *Chlorella vulgaris* Growth



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ABSTRACT: Microalgae is a raw material used in many different sectors and is helpful in absorbing carbon dioxide. *C. vulgaris* is one of best candidates as an additional material for biofuel. Biofuel is made in part from the fatty acids found in *C. vulgaris*. Thus, more research is required to identify the variables that can spur its growth. Aeration time is one of the most significant growth factors. In this research, experiments were carried out with differences in aeration time between 12 hours and 24 hours. Some of the fixed variables used are an air flow rate of 2 L/minute, 20 ppt of salinity, and a light intensity of 6,000 lux. Observations were made every day for 14 days. Measurements of the solution's pH, temperature, and carbon dioxide content in the reactor's air were made, along with the density of *C. vulgaris* cells. According to the observation data, *C. vulgaris* grew more effectively in the reactor that had 24-hours aeration. The peak day occurs on the tenth day, while the required adaptation phase lasts six days. Up until the peak day, the microalgae growth rate was 1.59 cells/mL.day.

KEYWORDS: aeration, cultivation, microalgae, photobioareactor, salinity

I. INTRODUCTION

Five groups of microalgae are recognized: *Phaeophyceae*, *Cyanophyceae*, *Phaeophyceae*, *Rhodophyceae*, and *Bacillariophyceae*. Prokaryotic and eukaryotic forms of microalgae are known to exist. Microalgae can develop in a variety of aquatic habitats, such as rivers, ocean, and brackish water. The size of microalgae are varies depending on its species [1]. A microalgae's life cycle lasts between ten and twelve days [2]. Microalgae use photosynthesis to lower CO₂ levels. The production of oxygen by this mechanism will raise the water's dissolved oxygen (DO) levels [3]. Microalgae has been used as material in several industries including biofuel, bioethanol, food, cosmetics, medicine, and fertilizer [4]. *Chlorella sp.* is one of mostly found microalgae in Indonesia [5].

The green microalgae *Chlorella sp.* belongs to the *Chlorophyceae* family and reproduces asexually by producing autospores. Its fatty acid contents can be used as additional material of biofuel [6]. These microalgae reproduce best in salinities of 15-30 ppt [7]. Temperature and pH are two more variables that can affect *Chlorella sp.* reproduction in addition to salinity. The ideal pH range for culture is 6.8 to 9.4, and the usual temperature ranges from 20 to 42°C [8], [9]. Reference to [10], 6.400 lux is the best light intensity for its growth. The adaptation phase of *Chlorella sp.* lasts only around five days. Following that, growth persisted after the seventh day. The microalgae's adaptation phase, which lasts from days 2 to 6, is impacted by the addition of nutrients [11]. In addition, air and light are two other elements that need to be considered.

Microalgae growth is influenced by aeration and medium stirring. The microalgae shift from a middle position to the surface position and back again when stirred. In order to maintain the microalgae's viability, this is done to ensure that energy sources are distributed evenly and carbon dioxide sources are extracted [1]. An air flow rate of 0.7 air volume per culture volume per minute (vvm) is suitable for microalgae. Microalgae growth is also influenced by aeration duration; the longer the aeration period, the more microalgae growth is generated [12]. To stop the predatory bacteria *Vampirovibrio chlorellavarous* from growing, aeration must also be done during the dark hours. This will ensure that the quantity of microalgae will not decrease gradually [13].

To support its function as an additional material for biofuel, growth factors of *C. vulgaris* need to be identified. In this study one of the factor, aeration time, will be investigated. How does media aeration time affect the growth of *C. vulgaris* and which one is the best for cultivation.

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II. MATERIALS AND METHODS

Research was done in batches. There was a duplicate sample utilized. Distilled water, *C. vulgaris* inoculum, sodium chloride (NaCl) made by Merck (Denmark), vitamins, trace metals, and Walne fertilizer were the materials employed in this study. A 50 mL beaker glass, a 100 mL measuring glass, a spray bottle, a spatula, and an analytical balance were the instruments utilized in this study. Bulb, aerator, rubber hose, and 1 L transparent plastic container are additional instruments required for facilitating the growth of microalgae. A bulb used in this research is a 4-Watt (420 lm) Philips brand with cool daylight type for each container. The aerator in use has a 2 L/minute air flow.

A. Media

The artificial brackish water utilized in this study had a salinity of 20 ppt. As a source of nourishment for *C. vulgaris*, distilled water combined with vitamins, trace metals, and Walne fertilizer. The first step in creating artificial brackish water was weighed 10 grams of NaCl for each container using an analytical balance. Three hundred fifty milliliters of distilled water were added to the plastic container after NaCl was added. Walne fertilizer, vitamins, and trace metals added 0.5 mL each. The addition of these three nutrients was conducted every week.

B. Inoculum of Microalgae

Inoculum of *C. vulgaris* is from Laboratorium Pakan Alam Situbondo. Inoculum added 150 mL into each plastic container filled with media.

C. Fixed Variables

Light and dark cycle done with 12:12 hours daily. The light intensity was arranged around 6.000 lux. There are 2 aeration time applied 12 hours and 24 hours. As for 12 hours variation applied when the lamp turned off. The airflow is set to 2 L/min.

D. Data Measurement

Temperature, pH, CO₂ concentration in the atmosphere, and the density of microalgae cells were the data observed in this study. For fourteen days, observations were done each day. Measuring instruments used were thermometer, pH meter, and CO₂ meter. Meanwhile, a microscope and hemocytometer were used to measure microalgae cell density. Hemocytometer measurement was made by choosing five squares based on the size of the microalgae. The volume of the square employed in this investigation was 4×10^6 mL because it was 0.2 mm in length and 0.1 mm thick. The average number of cells from five randomly chosen squares divided by the square's volume is the formula used to determine cell density [14].

$$\rho_{cell} = \frac{\bar{x} \times fp}{V}$$

where:

ρ_{cell} = cell density, cells/mL

\bar{x} = average number of cells per square, cells

fp = dilution factor if any

V = volume of selected square, mL

III. RESULT AND DISCUSSION

This study used a media and inoculum ratio of 7:3. The media consisted of 20 ppt salinity; 0.5 mL Walne fertilizer; 0.5 mL vitamins; and 0.5 mL trace metal. *C. vulgaris* can grow well at salinities between 15 ppt – 30 ppt [8]. The results of physical observations as shown in Figure 1. The solution in the reactor with 24 hours aeration time was faster become dark green in colour compared to the 12 hours aeration treatment. Apart from that, the dark colour did not last long in a reactor with 12 hours of aeration. On the 10th day the concentration decreased which was then followed by the formation of a lot of precipitate on the 13th day.

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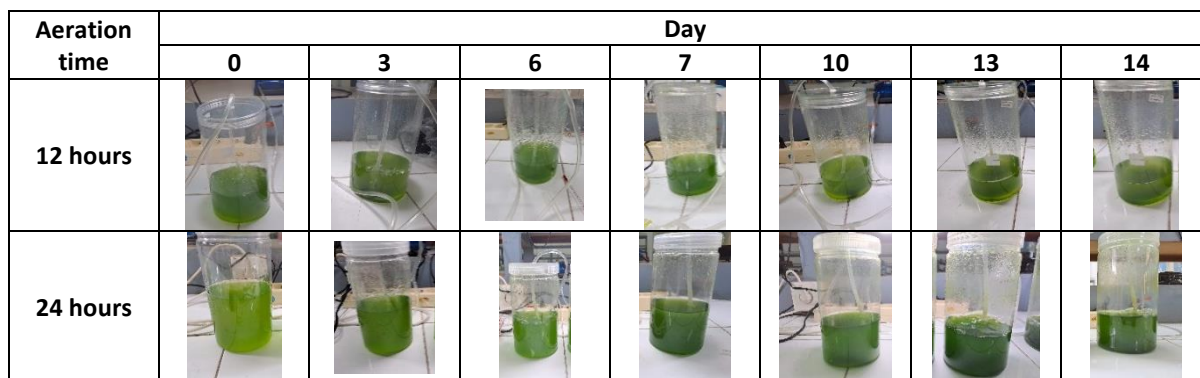


Figure 1. Physical observation of the solution in the reactor

The results of quantitative observations on temperature parameters (Figure 2) show an increase in temperature with 24-hours aeration compared to 12-hours aeration. Continuous use of an aerator can affect the temperature of the air produced, thereby increasing the temperature of the solution. However, the range of temperature differences in both reactors were still within the optimum growth range for *C. vulgaris*, namely 20-42°C [8], [9]. The pH of both reactors was neutral, which also indicates that the solution is in optimum condition.

pH causes changes in the solubility of inorganic carbon in waters. Based on this graph, most of the available carbon is in the form of bicarbonate (HCO_3^-). Bicarbonate is a carbon nutrient used by microalgae for photosynthesis. The highest bicarbonate content is at pH 8 [1]. Reactors with 12-hours aeration experienced a decrease in pH (Figure 3). It can occur because when microalgae grow, more bicarbonate ions are used. Another reason might be because the CO_2 supply from the aerator is not always available, so it continues to decrease. In contrast to reactors with 24-hours aeration, there was a decrease at the beginning due to continuous aeration which increased CO_2 levels in the solution. During the exponential phase, the number of microalgae conducting photosynthesis increases so that the supply of bicarbonate in the solution can be balanced and the pH rises towards neutral.

CO_2 can keep the balance of its concentration in air and water [15]. CO_2 concentration in the air inside the 24-hours reactor is higher than 12-hour reactor (Figure 4). It happens because of two possibilities. Excessive dissolved CO_2 in 24-hours reactor is released to the air or CO_2 in 12-hours reactor is dispersed into the water that lack of dissolved CO_2 . This also indicates that *C. vulgaris* inside the reactor were consumed the dissolved CO_2 daily. Photosynthesis happened and results on growing microalgae cell density.

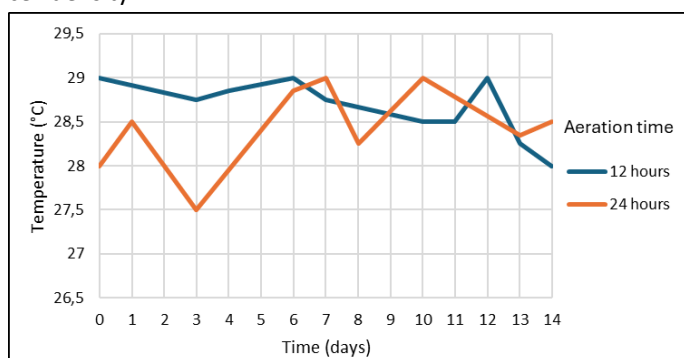


Figure 2. Temperature of the solution in the reactor

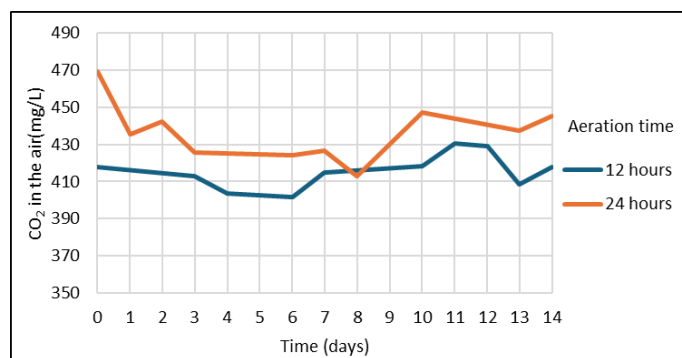


Figure 4. CO_2 concentration in the air inside the reactor

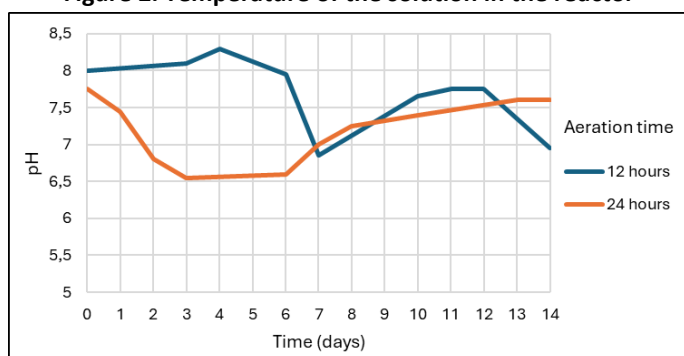


Figure 3. pH of the solution in the reactor

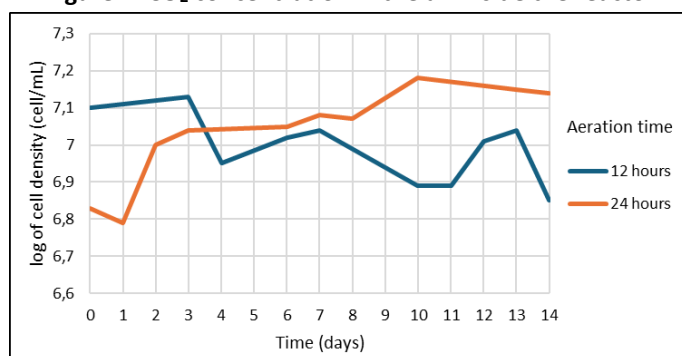


Figure 5. log of microalgae cell density in solution inside the reactor

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Microalgae cell density shows the difference between both reactor (Figure 5). Usually, microorganisms have their growth phases. It starts with adaptation phase (lag phase), exponential phase, and stationary phase. In a 24-hours reactor those phases can be seen as the number increases day by day. The first week is notably as an adaptation phase. After *C. vulgaris* adapt well, it continues to the exponential phase until reach the peak growth on 10th day. Followed by decreases in number slowly until the 14th day. In a 12-hours reactor these phases are not seen as the numbers keep decreasing day by day. It might be caused by lacks DO at night. DO is needed for respiration to recharge microalgae's electron acceptors on making ATP [3]. If the respiration process is disturbed, photosynthesis will be disturbed as well. It can cause low biomass production. From the data we can get specific growth number for 24-hours reactor by using this formula. The specific growth of 24-hours reactor from initial to peak day is 1,59 cells/mL/day.

$$\mu = \frac{\ln(\rho_1 - \rho_0)}{t}$$

where:

- μ = microalgae specific growth, cell/mL/day
 ρ_1 = cell density on peak/final day, cell/mL
 ρ_0 = cell density on initial day, cell/mL
 t = time, day

IV. CONCLUSION

Continuous aeration for 24 hours is the optimal growing condition for *C. vulgaris*. The airflow used for 500 mL solution is 2 L/min. With a light : dark cycle duration of 12:12 and 6,000 lux for light intensity.

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REFERENCES

- 1) I. Floriana, "Experimental Studies on microalgae cultivation in urban wastewater: nutrients removal, CO₂ absorption, biomass harvesting and valorisation," University of Molise, Campobasso, 2018.
- 2) H. Tjahjono and K. Wibowo, "Dasar-dasar pengoperasian fotobioreaktor skala laboratorium menggunakan mikroalga untuk penyerapan emisi CO₂," *Jurtekling*, vol. 11, no. 3, pp. 475–480, Dec. 2010, doi: 10.29122/jtl.v11i3.1193.
- 3) A. M. J. Kliphuis, M. Janssen, E. J. Van Den End, D. E. Martens, and R. H. Wijffels, "Light respiration in *Chlorella sorokiniana*," *J Appl Phycol*, vol. 23, no. 6, pp. 935–947, Dec. 2011, doi: 10.1007/s10811-010-9614-7.
- 4) S.-H. Ho, C.-Y. Chen, D.-J. Lee, and J.-S. Chang, "Perspectives on microalgal CO₂-emission mitigation systems — A review," *Biotechnology Advances*, vol. 29, no. 2, pp. 189–198, Mar. 2011, doi: 10.1016/j.biotechadv.2010.11.001.
- 5) T. B. Saputro, K. I. Purwani, D. Ermavitalini, and A. F. Saifullah, "Isolation of high lipids content microalgae from Wonorejo rivers, Surabaya, Indonesia and its identification using rbcL marker gene," *Biodiversitas*, vol. 20, no. 5, pp. 1380–1388, Apr. 2019, doi: 10.13057/biodiv/d200530.
- 6) A. Widjaja, C.-C. Chien, and Y.-H. Ju, "Study of increasing lipid production from fresh water microalgae *Chlorella vulgaris*," *Journal of the Taiwan Institute of Chemical Engineers*, vol. 40, no. 1, pp. 13–20, Jan. 2009, doi: 10.1016/j.jtice.2008.07.007.
- 7) J. Church *et al.*, "Effect of salt type and concentration on the growth and lipid content of *Chlorella vulgaris* in synthetic saline wastewater for biofuel production," *Bioresource Technology*, vol. 243, pp. 147–153, Nov. 2017, doi: 10.1016/j.biortech.2017.06.081.
- 8) Y. I. P. Dyniari, F. Farikhah, and A. R. Rahim, "Dinamika populasi *C. vulgaris* dalam paparan logam berat timbal (Pb) dengan konsentrasi yang berbeda skala laboratorium," *Jurnal Perikanan Pantura (JPP)*, vol. 2, no. 1, pp. 42–50, Mar. 2019, doi: 10.30587/jpp.v2i1.810.
- 9) R. R. Rusdiani, R. Boedisantoso, and M. Hanif, "Optimalisasi teknologi fotobioreaktor mikroalga sebagai dasar perencanaan strategi mitigasi gas CO₂," *JTITS*, vol. 5, no. 2, pp. F188–F192, Dec. 2016, doi: 10.12962/j23373539.v5i2.16942.
- 10) A. Lamadi, M. Mulis, and A. E. Kristanto, "The Growth of *Chlorella* sp. Cultivated in Walne Media with Different Intensities of Light," *Tomini J. Aquat. Sci.*, vol. 3, no. 1, pp. 1–7, May 2022, doi: 10.37905/tjas.v3i1.9999.

Effect of Aeration Time on *Chlorella vulgaris* Growth

- 11) M. Kawaroe, T. Prartono, A. Sunuddin, D. W. Sari, and D. Augustine, "Laju pertumbuhan spesifik *Chlorella sp.* dan *Dunaliella sp.* berdasarkan perbedaan nutrisi dan fotoperiode," *Jurnal Ilmu-ilmu Perairan dan Perikanan Indonesia*, vol. 16, no. 1, pp. 73–77, 2009.
- 12) B. Tangahu, M. Berlianto, and A. A. Kartika, "Deconcentration of chromium contained in wastewater using a bacteria and microalgae consortia with a high rate algal reactor system," *J. Ecol. Eng.*, vol. 21, no. 8, pp. 272–284, Nov. 2020, doi: 10.12911/22998993/126878.
- 13) S. Attalah *et al.*, "Application of deoxygenation-aeration cycling to control the predatory bacterium *Vampirovibrio chlorellavorus* in *Chlorella sorokiniana* cultures," *Algal Research*, vol. 39, pp. 1–34, May 2019, doi: 10.1016/j.algal.2019.101427.
- 14) BTI, "Algae to Energy - Using and Re-using a." 2015. [Online]. Available: <https://btiscience.org/wp-content/uploads/2015/12/e.-Algae-to-Energy-Counting-Algae-Cells.pdf>
- 15) I. C. Prentice, G. D. Farquhar, and M. J. R. Fasham, "The Carbon cycle and Atmospheric Carbon Dioxide," in *Climate Change 2001: The Scientific Basis (Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change)*, Cambridge: Cambridge University Press, 2001, pp. 183–237.



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Species Composition and Morphometric Characteristics of Nike Fish in Marisa Waters, Gulf of Tomini, Indonesia



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ABSTRACT: Nike fish are juveniles of amphidromous gobies species known for their intricate morphological features and high ecological significance found in the Gulf of Tomini, Indonesia. This study aimed to investigate the species composition and morphometric characteristics of Nike schools in the waters of Marisa District, Pohuwato Regency, Gorontalo Province. A total of 5.223 individuals were collected from four catch efforts by fishers. Samples were observed and grouped based on melanophore patterns for species identification, and morphometric measurements were performed using Image-J software application. The results show that there were 6 species of Nike in the schoolings, namely: *Sicyopterus longifilis*, *Belobranchus segura*, *Stiphodon semoni*, *Belobranchus belobranchus*, *Sicyopterus parvei*, and *Sicyopterus cynocephalus*. Apparently *S. longifilis* 98,24% dominating the schools. These findings provide valuable insights into the population structure and biodiversity of Nike fish, which are essential for their conservation efforts, management, and future studies.

KEYWORDS: Nike fish, species composition, morphometrics, Marisa Waters, Gulf of Tomini, Indonesia

INTRODUCTION

Fish biodiversity and its ecological significance are crucial aspects of estuarine ecosystems. The Nike fish, which have a transparent, colourless, and scale less body, in the Gulf of Tomini, especially along the coast of Gorontalo Province, play an important role in the local aquatic food webs. The larvae drift from upstream to the river mouth and hatch in the sea. Nike occurs as juvenile schooling in the last ten days of each lunar month of the Hijri calendar in estuarine waters along the coastline, including Marisa, Tilamuta, Paguyaman, and Taludaa (Salam et al., 2016; 2017). Nike fish has high protein and mineral content, especially calcium and magnesium, and is one of the favorite menus for human consumption (Yusuf, 2011). Nike fish in the Gulf of Tomini exhibit relatively high genetic and morphological diversity (Sahami et al. 2020; Sari & Kusumawati, 2019).

The Gulf of Tomini, where the research took place, is the largest gulf in Indonesia, covering an area of approximately 6 million hectares, and is known for its diverse marine resources, including seaweed, milkfish, tiger prawns, pearl oysters, baronang fish, and groupers (Albasri & Pratama, 2019). It is located at the equator and is known for its fertility and rich potential for marine resources (Pramudji, 2018; Fauzi & Kurniawan, 2021). The high biodiversity of the Nike fish in the Gulf of Tomini highlights the importance of this region for the conservation of marine resources in Indonesia. The province of Gorontalo, which encompasses the Gulf of Tomini, has significant fishery resources in its waters, including the Gulf of Tomini, Sulawesi Sea, and Indonesian Exclusive Economic Zone (ZEE) waters (Olii et al. 2017).

Research on Nike fish has been conducted by various researchers, including Olii et al. (2017) on larvae distribution; Pasingi & Abdullah (2018) on occurrence; Sahami et al. (2019a) on morphological alteration based on molecular analysis and melanophore pattern; Sahami et al. (2020) on morphometric and genetic variations and Hasana (2020) on spacial and temporal abundance. Pasingi et al. (2021) on morphometric characteristics, and Olii and Pasingi (2022) on daily growth and morphometric body ratios.

Understanding the species composition and morphometric characteristics of the Nike fish in this region is essential for effective conservation efforts and sustainable management practices. However, there is limited information available on the species composition and morphometric characteristics of Nike fish in the waters of the Marisa District. Therefore, this study aimed to investigate the species composition and morphological variation of Nike fish in Marisa waters, thereby enhancing our knowledge of local fish fauna and supporting biodiversity conservation efforts, management, and future studies. Therefore, this

Species Composition and Morphometric Characteristics of Nike Fish in Marisa Waters, Gulf of Tomini, Indonesia

study aimed to investigate the species composition and morphometric characteristics of Nike schools in the waters of the Marisa District, Pohuwato Regency, Gorontalo Province.

MATERIALS AND METHODS

1. Study Area

Marisa Waters in Marisa District, Pohuwato Regency, Gorontalo Province, was selected as the study area due to its rich aquatic biodiversity, important habitat for various fish species and the presence of Nike fish species. This research was conducted from December 2022 to March 2023 in the study area, which encompasses diverse aquatic habitats in the estuary of the Marisa River.

Marisa Town is the capital of Pohuwato Regency which is on the coastal line of the Tomini Gulf, located on: Latitude: 0° 26' 57.12" N and Longitude: 121° 56' 20.4" E (see Fig.1). The Marisa River Basin, with an area of 248.43 km² is one of the watersheds of the Paguyaman River area. The upstream area of the Marisa Taluduyunu River, which is located in the Marisa District, has been converted from forest land to corn fields (Wolok et al., 2014).

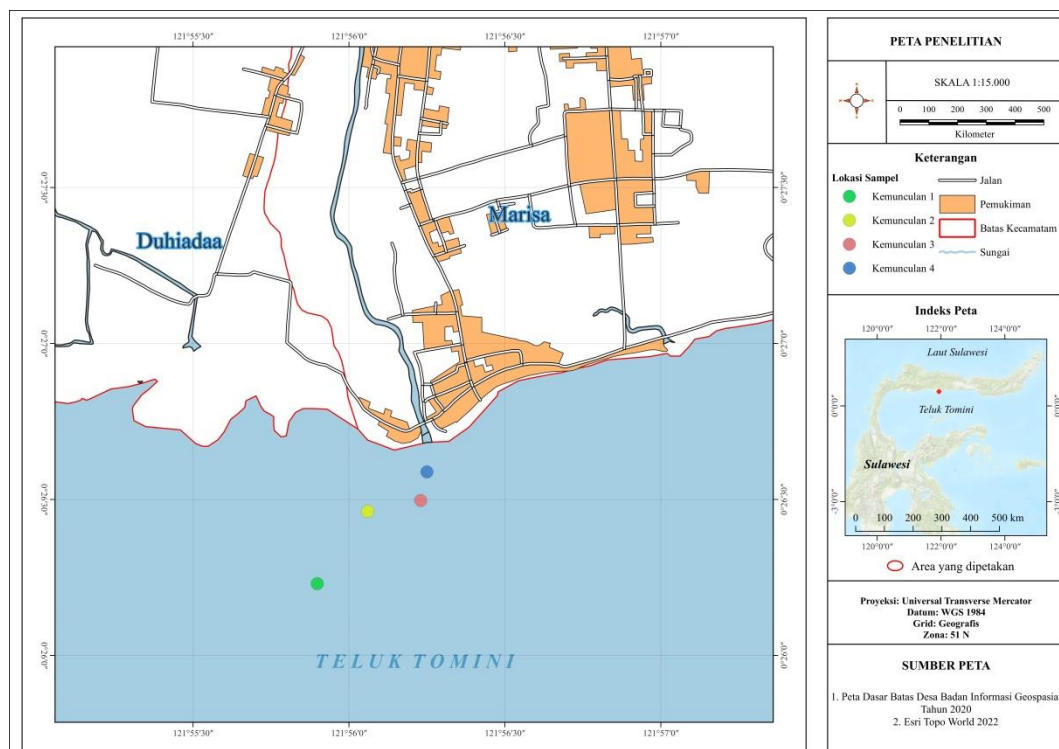


Fig. 1 Map of research site

2. Sample Collection

A total of 5.223 individuals of Nike fish were collected from Marisa Waters. Sampling in this study followed the fishing season and was performed randomly from the fishermen's catch. Nike fish samples of up to 220 ml were collected using used plastic cups for mineral water from each catch (see Table 1 for sample quantity). The collected specimens were handled carefully to avoid damage during transportation. The samples were placed in a cool box and given ice, brought from the research site to the laboratory, and stored in a freezer before analysis.

Between December 2022 and March 2023, Nike fish appeared on four days in the Marisa River Estuary. Fishermen catch nike fish for only one day in each season. The first sampling (SI) was on 21 December 2022 (26 of Jumadil Awal 1444 H), the second sampling (SII) was on 21 January 2023 (27 of Jumadil Akhir 1444 H), and the third sampling (SIII) was on 21 February 2023 (29 of Rajab 1444 H) was carried out at noon, while the fourth sampling (SIV) was on 19 March 2023 (26 of Sha'ban 1444 H) taken at night. Fishermen in Marisa use *tagahu* to catch nike fish, a traditional fishing gear that is a purse seine with a very fine mesh size operated by two boats in shallow waters on the shoreline (Salam et al., 2016).

3. Species Identification

The collected specimens were examined for taxonomic identification using relevant taxonomic keys by sorting and grouping based on differences in melanophore patterns. Nike fish sample examination was carried out of Nike with reference to Sahami et al. (2019b), Sahami et al. (2020) and Sahami et al. (2020a) (Fig. 2).
















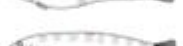




Melanophore Pattern	Sample Code	Species
	N1	<i>Sicyopterus pugnans</i>
	N2	<i>Scyopterus cynocephalus</i>
	N3	<i>Belobranthus segura</i>
	N4	<i>Bunaka gyrinoides</i>
	N5	<i>Belobranthus segura</i>
	N6	<i>Sicyopterus parvei</i>
	N7	<i>Sicyopterus longifilis</i>
	N8	<i>Sicyopterus cynocephalus</i>
	N9	<i>Belobranthus belobranthus</i>
	N10	<i>Belobranthus belobranthus</i>
	N11	<i>Stiphodon semoni</i>
	N12	<i>Stiphodon semoni</i>
	N13	<i>Sicyopterus longifilis</i>
	N14	<i>Sicyopterus longifilis</i>
	N15	<i>Belobranthus belobranthus</i>
	N16	<i>Sicyopterus cynocephalus</i>
	N17	unidentified
	N18	<i>Sicyopterus lagocephalus</i>
	N19	<i>Sicyopterus parvei</i>
	N20	<i>Sicyopterus longifilis</i>

Fig. 2. Species identification sheet adapted from Sahami *et al.* (2020a)

4. Species Composition

The composition of the species that made up the Nike fish was calculated by counting the number of individuals from each sample species obtained and then dividing it by the total number of samples. Arsyad (2022) uses the following equation to calculate species composition:

$$pi = (ni/N) \times 100\%$$

where pi is the species composition (%), ni is the number of individuals in each species, and N is the number of samples. A descriptive analysis was carried out to describe the species composition of the Nike schools in Marisa Waters, Marisa District, Pohuwato Regency during four fishing seasons.

5. Morphometric Analysis

Morphometric analysis was used to study the kinship relationships between species. This is because species that have similarities or close kinship relationships will have similar characteristics; otherwise, different species will have different characteristics (Zakaria, 2017). Morphometric measurements in this study were used to assess physical characteristics. These measurements were based on a diagram modified by Sahami *et al.* (2020), following Benbow *et al.* (2004). Physical characteristics included total length (TL), standard length (SL), preorbital length (PL), eye diameter (ED), head length (HL), body depth (BD), and

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peduncle depth (PD) (Fig. 3). Each individual Nike fish that was examined was photographed using a camera with a 58 mm pro Digital Wide Converter 0.45X Lens. The resulting photos were then measured using Image-J software application.

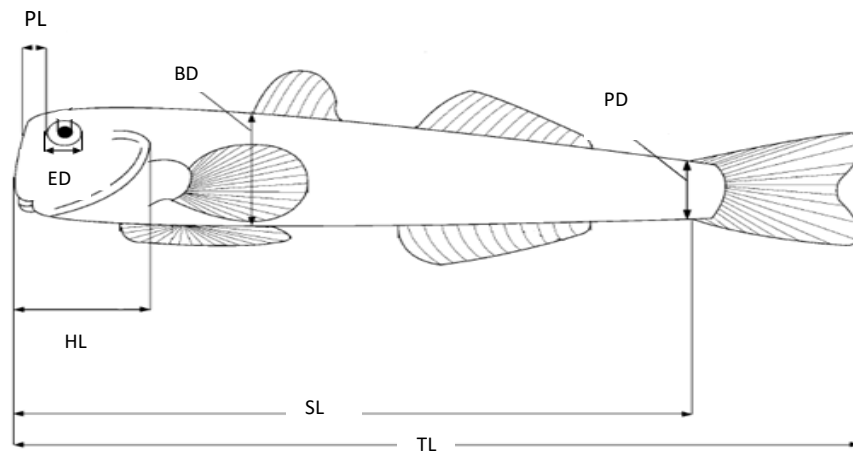


Fig. 3 Morphometric characters of Nike fish (Sahami et al., 2020)

SL represents the length from the tip of the snout to the end of the last vertebra, and TL represents the entire length of the fish. BD represents the height at the highest part of the body, excluding the fleshy part and scales belonging to the fins. The preorbital length (PL) was used to describe the length of the snout of a fish. It is the distance from the tip of the snout to the anterior margin of the orbit or eye socket. Eye diameter (ED) is the diameter of the eye of a fish. It is measured as the widest diameter of the eyeball transverse to its axis. Head length (HL) is a morphometric measurement used to describe the head length of a fish.

It is measured as the distance from the tip of the snout to the posterior margin of the operculum or the gill cover. Peduncle depth (PD) is the depth of the caudal peduncle of a fish. The caudal peduncle is the narrow part of the fish body that connects the tail fin to the rest of the body. PD was measured as the depth of the caudal peduncle at its narrowest point.

In this study, 50 individuals of each species found in the sample were measured. If the number of individuals of a species was less than 50, then all individuals of that species were measured morphometrically. As a result, 292 Nike fish specimens were analysed morphometrically, as shown in Table 2. Morphometric measurements were tabulated in a spread sheet. Based on the tabulated data, the average of each character from each species and important morphometric ratios were calculated. There are no specific morphometric ratios commonly used for small fish. However, traditional morphometric analyses rely on the measurement of shape indicators, such as length, area, angle, and ratio (Caillon & Lecomte-Finiger, 2018). Morphometric measurements are widely used to identify differences between fish populations, determine sex, and evaluate the body yields of rounded fish (Le Cren, 1951).

The most important morphometric ratios to be measured for Nike fish are the standard length (SL) to total length (TL) ratio (SL:TL), head length (HL) to SL ratio (HL:SL), body depth (BD) to SL ratio (BD:SL), and eye diameter (ED) to HL ratio (ED:HL). These ratios are commonly used in morphometric analyses to assess the size, shape, and proportion of small fish. They provide valuable information about the morphology and body proportions of fish, which can be used to understand their ecology, behaviour, and population dynamics, as well as to develop effective conservation strategies to maintain the biodiversity of aquatic ecosystems (Caillon & Lecomte-Finiger, 2018; Mojekwu & Anumudu, 2015; Marr, 1955; Neto et al., 2012).

RESULTS

1. Species Composition

The systematic sampling efforts resulted in the collection of various Nike fish specimens from Marisa Waters. Through taxonomic identification, it was determined that the Nike fish population in the study area primarily consisted of 6 species as can be seen in Table 1.

Table 1. Species composition of Nike fish taken in Marisa Waters

No.	Species	Samples taken				N <i>ni</i>	Compo. <i>pi (%)</i>
		SI	SII	SIII	SIV		
1.	<i>Sicyopterus longifilis</i>	+1173	+1197	+1375	+1386	5131	98,24
2.	<i>Belobranchus segura</i>	+45	+3	+5	+4	57	1,09

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3.	<i>Sicyopterus parvei</i>	+16	+4	-	-	20	0,38
4.	<i>Stiphodon semoni</i>	-	-	+3	+4	7	0,13
5.	<i>Belobranthus belobranthus</i>	+5	-	-	-	5	0,10
6.	<i>Scyopterus cynocephalus</i>	+1	+2	-	-	3	0,06
		1240	1206	1383	1394	5223	100,00

Remarks : (+xxxx) = present with number; (-) = None; Compo. = Species Composition

Approximately 1300 individuals contain in a 220ml used plastic cup of mineral water. The occurrence of the species varied during each fishing season. Species *S. longifilis* and *B. segura* appeared in every fishing season, but in terms of quantity, *B. segura* was not significant. *S. semoni* appears in two seasons, namely in February and March 2023, in a very small number. Species *B. belobranthus* appears only once in December 2022, also in a very small number. Species *S. parvei* and *S. cynocephalus* each appear twice in December 2022 and January 2023, in a very small number for each occurrence.

The data show that *S. longifilis* is obviously the dominant species, with a percentage of 98.24%, followed by *B. segura*, *S. parvei*, *S. semoni*, *B. belobranthus*, and *S. cynocephalus* with percentages ranging from 1.09% to 0.06%. Some species, such as *S. longifilis* and *B. segura*, are more consistently present, while others, like *S. semoni* and *B. belobranthus*, have limited occurrences. The information provided suggests that the occurrence and abundance of different Nike fish species vary across fishing seasons.

2. Morphometric Characteristics

The data collected on the morphometric characteristics of these species can provide valuable insights into the population dynamics and ecological roles within the Marisa River water. Morphometric measurements revealed significant variations in the size and shape of the Nike fish specimens. The collected data allowed for the calculation of various morphometric ratios and indices, providing insights into the body proportions of Nike fish in the Marisa Waters.

The results of the measurements of all Nike fish samples taken from the waters of Marisa show that range of their Total Length is 1,7 – 2,99 cm and range of Body Depth is 0,17 – 0,54 cm. *S. cynocephalus* had the highest values for most morphometric characters, whereas *S. semoni* had the lowest values for most morphometric characters. *S. cynocephalus* had the highest Total Length with an average of 2.85 cm within the range of 2.74 to 2.99 cm. *S. semoni* has the lowest Total Length with an average of 1.84 cm within the range of 1.7 to 2.0 cm (Table 2). Based on visual morphology observations, *S. cynocephalus* has a relatively large body, whereas *S. semoni* has a small body with a slightly white color.

Table 2. Morphometric characteristics of Nike fish

Species	n	Morphometric characters (cm)						
		TL	SL	PL	ED	HL	BD	PD
<i>S. longifilis</i>	200	2,374	1,931	0,090	0,164	0,417	0,363	0,200
<i>B. segura</i>	57	2,099	1,765	0,094	0,113	0,374	0,281	0,155
<i>B. parvei</i>	20	2,655	2,214	0,105	0,129	0,467	0,413	0,209
<i>S. semoni</i>	7	1,840	1,515	0,067	0,083	0,261	0,191	0,119
<i>B. belobranthus</i>	5	2,114	1,796	0,109	0,110	0,385	0,252	0,152
<i>S. cynocephalus</i>	3	2,853	2,364	0,118	0,147	0,480	0,473	0,267

*Figures in grey sheet have less accountability due to shortage in number of samples measured

The number of specimens obtained for four species (*B. parvei*, *S. semoni*, *B. belobranthus*, and *S. cynocephalus*) did not meet the required number of 50 individuals for measurement. Extra attention was given to the top two specimen those fulfil the minimum required number of samples for measurement. i.e. *S. longifilis* and *B. segura*. Seems that *S. longifilis* is at the modest size among the Nike fish species as indicate by its morphometric characters. The average TL of *S. longifilis* is 2.374 cm within ranges from 2.0 to 2.8 cm and its BD is 0.363 within ranges from 0.25 to 0.5 cm. While *B. segura*, which is smaller in size has average TL of 2.099 within a range from 1.9 to 2.4 cm and has average BD of 0.281 within a range from 0.2 to 0.4 cm (see Table 2). Further analysis of morphometric ratios was only conducted on the two species (*S. longifilis* and *B. Segura*), which will be presented in Table 3.

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Table 3. Ratios of morphometric characteristics

Species	n	Ratios			
		SL:TL	HL:SL	BD:SL	ED:HL
<i>S. longifilis</i>	200	0,814	0,216	0,188	0,394
<i>B. segura</i>	57	0,841	0,212	0,159	0,302

Both species showed morphometric ratios that were not significantly different, indicating that they have similar body postures, although *B. segura* has a smaller average size for almost all morphometric characteristics except for PL, which is slightly larger or can be considered the same (see Table 2). Only the SL:TL ratio of *B. segura* was slightly larger than that of *S. longifilis*, while the other ratios (HL:SL; BD:SL; and ED:HL) possessed by *B. segura* were smaller.

DISCUSSION

There were four appearances of Nike fish in the Marisa River estuary during the research and fishermen only catch at one day in each season. In contrast to several other places, such as at the mouth of the Bone River, where fishing can take up to 5 days in each appearance period (Olii *et al.*, 2017) and even up to 9 days (Pasingi & Abdullah, 2018). In Paguyaman Bay, fishing for Nike is up to 3 days in one appearance period (Sahami & Habibie, 2021). In Taludaa Village (Damopolii, 2021) and in Bilungala Village (Arsyad, 2022) Nike fishing takes 1-2 days in one appearance period.

In this study, 6 species that make up the Nike school were obtained. This is slightly different from previous studies in several places such as in Taludaa (Damopolii, 2021) and Bilungala Village (Arsyad, 2022), there were 7 species that make up the Nike fish, with extra presence of *S. lagocephalus*. Nike fish in Paguyaman Bay were found of 7 species with extra presence of *E. melanosoma* (Sahami & Habibe, 2021). In Taludaa, Bilulanga Village and Paguyaman Bay *S. longifilis* and *B. segura*, just like in Marisa Waters, were always present in each seasons. Molecular identification results show that the melanophore pattern of Nike fish in Gorontalo Bay consists of 6 species, with extra presence of *S. lagocephalus*, and lack of *B. segura* (Sahami *et al.*, 2020).

Results of this study and some of the results of previous studies show that the Nike fish that were found the most and appeared in every catch were from the genus Sicyopterus. According to Nurjirana *et al.* (2022) the genus Sicyopterus has a wide distribution in Indo-Pacific waters consisting of 26 species, however only 12 species are found in Indonesian waters. This is in line with research conducted by Sahami & Habibie (2021) in Paguyaman Bay, at certain times the species *S. longifilis* has a dominating composition value. According to Nurjirana *et al.* (2022) in the sea and river waters of Lariang Village which are dominated by *Scyopterus* species, in this case *S. longifilis*. Different results showed by Arsyad (2022) in Bilungala Village whereas *S. parvei* was dominant (54.14%) in a season and *S. lagocephalus* was dominant (39.09%) in another season.

The dominance of *S. longifilis* in the Nike fish assemblages in Marisa Waters is consistent with previous studies on Nike fish in Gorontalo Bay waters (Olii *et al.*, 2017; Sahami *et al.*, 2020). The high abundance of *S. longifilis* in the region may reflect its ecological importance as a primary consumer and prey item for higher trophic levels in the food web (Olii *et al.*, 2017). The presence of other species of Nike fish in Marisa Waters, although in lower abundance, highlights the need for further research on the ecological roles and conservation status of these species in the region.

The dominance of *S. longifilis* in the population of Nike fish in the Marisa Waters suggests that this species may play a crucial role in the ecological dynamics of the region. The high abundance of this species may have implications for the population dynamics of other species in the ecosystem, as well as for the overall health and sustainability of the ecosystem. Further research is needed to understand the ecological roles of different species of Nike fish in the Marisa waters and to develop effective conservation strategies to maintain the biodiversity of the region.

The morphometric measurements of different species of Nike fish can provide valuable insights into their population dynamics and ecological roles within the Marisa Waters. The high abundance of *S. cynocephalus* in the population of Nike fish in the Marisa waters suggests that this species may play a crucial role in the ecological dynamics of the region. Further research is needed to understand the ecological roles of different species of Nike fish in the Marisa waters and to develop effective conservation strategies to maintain the biodiversity of the region (Bell *et al.* 2021; Sahami *et al.* 2020a; Sahami & Habibie 2020).

The differences in the morphometric characters of the Nike fish found in Marisa Waters and those in several other waters in Tomini Bay, Gorontalo are most likely influenced by environmental factors. Pasingi & Abdullah (2018) stated that species identification through a morphometric approach require extra precision because environmental factors can determine the life and development of larvae. The same species may exhibit different morphometric performance if they inhabit different water conditions as an adaptation for survival. Gobies species are capable of developing various morphological specificities as adaptation strategies to their environment (Roesma *et al.*, 2020).

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Morphometric measurements such as TL, SL, PL, ED, HL, BD, and PD are commonly used to assess the size, shape, and proportions of fish species. These measurements can provide insights into the ecological roles, swimming performance, and sensory capabilities of fish. For example, the caudal peduncle depth factor (CPdDF) is strongly related to the swimming speed and an important determinant of the swimming ability of fish (de Assumpção *et al.*, 2012).

The findings of this study highlight the diverse morphometric characteristics and species composition of Nike fish in the Marisa Waters of Marisa District, Pohuwato Regency, Gorontalo Province. The presence of multiple Nike fish species indicates a rich and diverse fish community in this region. The morphometric measurements provided valuable insights into the body proportions of Nike fish. The calculated ratios and indices can help assess the functional adaptations and ecological roles of these fish species. For example, variations in body depth and caudal peduncle length may indicate differences in swimming abilities and habitat preferences among the identified species.

Morphometric measurements and ratios are important for understanding the ecology, behavior, and population dynamics of fish species, as well as for developing effective conservation strategies to maintain the biodiversity of aquatic ecosystems. Some studies have used specific morphometric ratios for determining fish sex, such as the ratio of the anal fin length to the standard length in chinook salmon (Mojekwu & Anumudu, 2015). Other studies have used various morphometric ratios to evaluate swimming performance, muscle ratio, and caudal fin area in different fish species (Ribeiro & Santos, 2014).

The morphometric data presented in Table 2 provide important information on the physical characteristics of Nike fish, which can be used to identify and distinguish different species, as well as to understand their ecology, behaviour, and population dynamics. The differences in the morphometric characters among the species may reflect their adaptations to different habitats and ecological niches, as well as their genetic and evolutionary relationships. Further research is needed to explore the morphological and genetic variations of Nike fish in different regions of Indonesia, as well as to develop effective conservation strategies to maintain the biodiversity of these species.

Both species *S. longifilis* and *B. segura* have high SL to TL ratios indicate a relatively longer body compared to the total length, suggesting a more elongated body shape (Caillon, & Lecomte-Finiger, 2018; Le Cren, 1951). SL to TL ratio is used in taxonomic studies, as different species may exhibit distinct body proportions and ratios (Mojekwu & Anumudu, 2015; Ribeiro & Santos, 2014).

Both species *S. longifilis* and *B. segura* have low HL to SL ratios suggest a relatively smaller head compared to the standard length, indicating a more compact or rounded head shape (Caillon, & Lecomte-Finiger, 2018; Le Cren, 1951). HL to SL ratio is used to understand feeding habits, sensory capabilities, and ecological roles. A lower HL to SL ratio may suggest a fish species with a more generalized feeding strategy or reduced reliance on visual cues (Mojekwu & Anumudu, 2015; Ribeiro & Santos, 2014).

Both species *S. longifilis* and *B. segura* have a low BD to SL ratios suggest a relatively shallower body compared to the standard length, indicating a more slender body shape (Caillon, & Lecomte-Finiger, 2018; Le Cren, 1951). BD to SL ratio is used to understand swimming performance, buoyancy, and hydrodynamics. a lower BD to SL ratio may suggest a fish species with a more flattened body shape and increased surface area, which may improve its buoyancy and stability (Ribeiro & Santos, 2014).

Both species *S. longifilis* and *B. segura* have a low ED to HL ratio suggests a relatively smaller eye compared to the head length, indicating a fish species with reduced reliance on visual cues (Caillon & Lecomte-Finiger, 2018). A lower ED to HL ratio may suggest a fish species with a more herbivorous or detritivorous diet or a preference for well-lit environments (Ribeiro & Santos, 2014).

CONCLUSION

In conclusion, this study provides valuable insights into the species composition and morphometric characteristics of Nike fish in the Marisa Waters of Marisa District, Pohuwato Regency, Gorontalo Province. The observed variations in morphometric characteristics highlight potential adaptations to different ecological niches, while the identified species composition emphasizes the richness and diversity of the Nike fish community in this region.

This diversity highlights the importance of preserving the habitat and maintaining suitable environmental conditions for the Nike fish population and other cohabitating species. Conservation efforts in the Marisa Waters should consider the unique morphometric characteristics and species composition of Nike fish and ecological requirements of each species to ensure their long-term survival and sustainability. By preserving the diverse habitats and maintaining the water quality, we can protect the habitats necessary for the survival and reproduction of these fish species. Furthermore, continued researches on the population dynamics and reproductive biology of Nike fish will contribute to their long-term conservation. Additionally, long-term monitoring of the Nike fish population and other cohabitating species is necessary to assess their population dynamics and responses to environmental changes. Such knowledge will aid in the development of conservation strategies that promote the sustainable management of Marisa Waters and the preservation of its diverse fish community.

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REFERENCES

- 1) de Assumpção L., Makrakis M.C., Makrakis S., Wagner R.L., da Silva P.S., de Lima, A.F., Kashiwaqui E.A.L. (2012). The use of morphometric analysis to predict the swimming efficiency of two Neotropical long-distance migratory species in fish passage. *Neotropical Ichthyology* 10 (4) Oct 2012. <https://doi.org/10.1590/S1679-62252012000400012>
- 2) Albasri H., Pratama I. (2019) Potensi dan Pengelolaan Budi Daya Laut Wilayah Pengelolaan Perikanan Negara Indonesia (WPPNRI) 715. *Potensi Sumber Daya Kelautan dan Perikanan WPPNRI 715*, 2019, 978-623-7651-07-9. hal-03259166
- 3) Arsyad S. (2022) Komposisi Spesies Penyusun Dan Morfometrik Ikan Nike Di Perairan Teluk Tomini Desa Bilungala Kecamatan Bone Pantai Kabupaten Bone Bolango. *Skripsi*. Universitas Negeri Gorontalo. Fakultas Perikanan Dan Ilmu Kelautan. Jurusan Manajemen Sumber Daya Perairan.
- 4) Bell A, Marugán-Lobón J, Navalón G, Nebreda SM, DiGuilido J and Chiappe LM (2021) Quantitative Analysis of Morphometric Data of Pre-modern Birds: Phylogenetic Versus Ecological Signal. *Front. Earth Sci.* 9:663342. doi: 10.3389/feart.2021.663342
- 5) Benbow M.E., Burky A.J., Way C.M. (2004) Morphological characteristics and species separation of Hawaiian postlarval amphidromous fishes. *Micronesica* 37 (1): 129-144.
- 6) Caillon S. & Lecomte-Finiger R. (2018) A morphometric dive into fish diversity. *Ecosphere* 9(5), e02220. <https://esajournals.onlinelibrary.wiley.com/doi/10.1002/ecs2.2220>
- 7) Le Cren E.D. (1951) The use of morphometric data in systematic, racial and relative growth studies in fishes. *Journal of the Fisheries Research Board of Canada*, 8(4), 377-393.
- 8) Damopolii R.W. (2021) Komposisi Spesies Penyusun Ikan Nike di Perairan Teluk Tomini Desa Taludaa Kecamatan Bone Kabupaten Bone Bolango. *Skripsi*. Jurusan Manajemen Sumber Daya Perairan. Fakultas Perikanan dan Ilmu Kelautan Universitas Negeri Gorontalo.
- 9) Fauzi A. & Kurniawan A. (2021) Jurnal Sumberdaya Akuatik Indopasifik. *Berkala Ilmiah Penelitian Perikanan dan Kelautan* 5(4). Retrieved from <https://ejournalpikunipa.ac.id/index.php/JSai/issue/download/13/Vol%205%20No%204%20November%202021>
- 10) Hasana N. (2020) Kelimpahan Ikan Nike Secara Spasial Dan Temporal Berdasarkan Pola Melanofor Di Perairan Kota Gorontalo. *Skripsi*. Universitas Negeri Gorontalo. Fakultas Perikanan dan Ilmu Kelautan. Jurusan Manajemen Sumberdaya Perairan.
- 11) Marr J.C. (1955) The use of morphometric data in systematic, racial and relative growth studies in fishes. *Copeia*. Volume 1955 No.1 (Feb. 18, 1955) Pp: 23-31. American Society of Ichthyologists and Herpetologists (ASIH). <https://www.jstor.org/stable/1439448>.
- 12) Mojekwu T.O., Anumudu C.I. (2015) Advanced Techniques for Morphometric Analysis in Fish. *J Aquac Res Development* 6(8): 354. doi:10.4172/2155-9546.1000354
- 13) Neto R., Reis V., de Freitas R.T.F., Serafini M.A., Costa A.C., Freato T.A., Rosa P.V., Allaman I.B. (2012) Interrelationships between morphometric variables and rounded fish body yields evaluated by path analysis. *Aquaculture. Revista Brasileira de Zootecnia* 41 (7). July 2012. <https://doi.org/10.1590/S1516-35982012000700004>
- 14) Nurjirana, Burhanuddin I.A., Haris A., Afrisal M. (2022) DNA Mitokondria untuk Identifikasi Pascarva Ikan Panja (Oxudercidae: *Scyopterus*) di Perairan Desa Laring Kabupaten Pasangkayu Sulawesi Barat. *Prosiding Seminar Nasional Ikan* 1(1), 192-201. Bogor
- 15) Olii A. H., Pasingi N., (2022) Diel catch of marine life stage of "nike" in Gorontalo waters: daily growth and morphometric body ratios. *AACL Bioflux* 15(4):1938-1947.
- 16) Olii, A.H., Sahami, F.M., Hamzah, S.N., Pasingi, N. (2017) Preliminary findings on distribution pattern of larvae of nike fish (*Awaous sp.*) in the estuary of Bone River, Gorontalo Province, Indonesia. *AACL Bioflux* 10(5), 1110-1118.
- 17) Pasingi N., Abdullah S. (2018) Pola Kemunculan Ikan Nike (Gobiidae) di Perairan Teluk Gorontalo, Indonesia. *Depik Jurnal Ilmu-Ilmu Perairan, Pesisir dan Perikanan*, 7(2),111-118.
- 18) Pasingi N., Katili V.R.A., Mardin H., Ibrahim P.S., (2021) Variation in morphometric characteristics of Nike fish (amphidromous goby larva) in Leato waters, Gorontalo Bay, Indonesia. *AACL Bioflux* 14(1):28-36.

Species Composition and Morphometric Characteristics of Nike Fish in Marisa Waters, Gulf of Tomini, Indonesia

- 19) Pramudji. (2018) *Kondisi Umum Perairan Teluk Tomini*. Lembaga Ilmu Pengetahuan Indonesia - LIPI. Retrieved from <http://lipi.go.id/publikasi/kondisi-umum-perairan-teluk-tomini-1-5/26767>
- 20) Ribeiro F.B. & Santos J.E. (2014) Interrelationships between morphometric variables and rounded fish body yields evaluated by path analysis. *Revista Brasileira de Zootecnia*, 43(11), 610-616.
- 21) Roesma D.I., Tjong D.H., Aidil D.R. (2020) Analisis filogenetik dari ikan gobi transparan di tiga danau Sumatera, disimpulkan dari gen mitokondria cytochrome oxidase I (COI). *Keanekaragaman Hayati* 21 (1): 43-48. DOI: 10.13057/biodiv/d210107.
- 22) Sahami F.M., Kepel R.C., Ollie A.H., Pratasik S.B. (2019a) Determination of Morphological Alteration Based on Molecular Analysis and Melanophore Pattern of the Migrating Nike Fish in Gorontalo Bay, Indonesia. *Aquaculture, Aquarium, Conservation & Legislation*, 12(4), 1358-1365.
- 23) Sahami F.M., Kepel R.C., Ollie A.H., Pratasik S.B. (2019b) What Species Make Up the Nike Fish Assemblages at the Macrotidal Estuary in Gorontalo Bay, Indonesia? *F1000Research*, 8(1654), 1654.
- 24) Sahami F.M., Kepel R.C., Ollie H.A., Pratasik S.B. (2020) *Metode Identifikasi Ikan Nike (Perciformes: Gobiidae) Menggunakan Sketsa Pola Melanofor Sertifikat Paten Sederhana*. Sentra KI Universitas Sam Ratulangi. Manado. Kementerian Hukum dan Hak Asasi manusia.
- 25) Sahami F.M., Kepel R.C., Ollie H.A., Pratasik S.B., Lasabuda R., Wantasen A., Habibie S.A. (2020a) Morphometric and genetic variations of species composers of nike fish assemblages in Gorontalo Bay Waters, Indonesia. *BIODIVERSITAS* 21(10): 4571-4581, October 2020. DOI: 10.13057/biodiv/d211015
- 26) Sahami F.M. & Habibie S.A. (2021) Diversity of Species in Making Up Nike Fish and A New Record of *Eleotris melamosoma* in Tomini Paguyaman Bay, Gorontalo, Indonesia. *BIODIVERSITAS* 22(12).
- 27) Sahami F.M. & Habibie S.A. (2020) Exploration of adult phase of Nike fish to maintain its sustainability in Gorontalo Bay waters, Indonesia. *AAFL Bioflux*, 13(5): 2859-2867. <http://www.bioflux.com.ro/aafl>.
- 28) Sahami M.F., Kadim M.K., & Pasingi, N. (2020) Morphometric analysis of Nike fish (*Stiphodon* spp.) in Gorontalo Bay, Indonesia. *BIODIVERSITAS Journal of Biological Diversity*, 21(4), 1679-1686. doi: 10.13057/biodiv/d210447
- 29) Salam A., Sahami F.M., & Panigoro C. (2016) Nike (*Awaous melanocephalus*) Fishery and Mercury Contamination in the Estuary of BoneBolango River. *Omni-Akuatika* 12 (2).
- 30) Salam A., Sahami F.M., Panigoro C., Arifin Y.I., Sakakibara M. (2017) Threats to Food Safety and Sustainability of Nike (*Awaous melanocephalus*) in Gorontalo Province in *2nd International Conference on Sustainable Agriculture and Food Security: A Comprehensive Approach*, KnE Life Science. Pages: 43-54. DOI 10.18502/kls.v2i6.1018
- 31) Sari N.I. & Kusumawati R. (2019) *Sumber Daya Laut Perairan Kepulauan Togean, Teluk Tomini*. Penerbit BRIN. Retrieved from <https://penerbit.brin.go.id/press/catalog/book/172>
- 32) Wolok E., Suhartanto E., Harisuseno D. (2014) Studi Tingkat Kekritisan Lahan Sebagai Dasar Arahan Rehabilitas Hutan Dan Lahan DAS Marisa Di Kabupaten Pohuwato Provinsi Gorontalo. *Jurnal Teknik Pengairan*. 5(1): 119-129.
- 33) Yusuf. (2011) Karakterisasi Gizi dan Pendugaan Umur Simpan Savory Chips Ikan Nike (*Awaous melanocephalus*). *Tesis*. (Tidak Dipublikasikan). Institut Pertanian Bogor. Bogor.
- 34) Zakaria Z. (2017) Analisis Morfometrik Ikan *Stiphodon* sp. Di Perairan Danau Limboto. *Jurnal Entropi*, 12(2): 237-241. Universitas Negeri Gorontalo



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Comparative Study of Cube and Cylinder Crushing Strengths of Laterized Concrete



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ABSTRACT: The non availability or shortage of river sand in some areas affects the concrete construction industry negatively. Hence there is need to find alternatives to river sand and one of the major materials locally available is lateritic soil commonly called laterite. It has been successfully used partially or wholly to replace sharp sand in concrete. This study investigated the relationship between the cube compressive strength and cylinder compressive strengths of laterized concretes made with various combinations of laterite and river sand. Laterized concretes of 1:1½:3 mix proportions were prepared with sand partially replaced with laterite at 0%, 20%, 40%, 50%, 60%, 80% and 100% at a water/cement ratio of 0.55. Granite of 20mm maximum size was the coarse aggregate used; batching was done by weight. A total of 84 cubes and 84 cylindrical specimens were prepared for testing after 3, 7, 21 and 28 days respectively. At each replacement level, the cube crushing strength as well as the cylinder crushing strength of the specimens was determined for proper comparison. At 7 days, the cylinder crushing strength was found to be 72% of the cube strength while for 14, 21 and 28 days they were 77%, 80% and 80% respectively.

1.0 INTRODUCTION

As the world population increases, the demand for housing and other infrastructures also increase. The demand for concrete and its constituents also increases. In Nigeria and most other countries, river sand is traditionally used as fine aggregate in concrete. The continuous mining of sand from our rivers has led to environmental degradation and unchecked depletion in its natural reserve. Hence, many sand mining sites have been closed because of the damage caused to the environment. This has led to scarcity of the product. Moreover, because of scarcity of the product, it is often transported from relatively distant places at high cost. The need for a readily available and economical alternative to sand becomes obvious. To solve this problem, several attempts have been made to either partially or completely replace river sand with other materials in concrete production. Such materials have included laterite and quarry dust.

Laterite is a mixture of clayey iron and aluminum oxides and hydroxides and it is abundantly available in tropical regions including Nigeria. Concrete containing laterites are termed laterized concrete. Researches on properties of laterized concrete have yielded positive results. Udoeyo et al (2006) investigated properties of concrete with partial and complete replacement of sand with laterite and observed that the workability of the resulting concrete was directly proportional to the percentage of laterite while compressive strength, split tensile strength, flexural strength and water absorption were inversely proportional to the percentage of laterite in the mix. Most of the investigations studied the compressive strengths of laterized concretes using cube specimens. Little or no effort has been made to investigate the compressive strengths of laterized concretes using cylindrical specimens. Moreover, attempts have not been made to compare strengths of cubes with those of cylindrical specimens to deduce if they follow patterns of other concretes. Eurocode specifies that the compressive strength of cylindrical specimens should be about 80% of that of the cube. This study attempted to determine strengths from both specimens and compared the two. It is believed that the findings of this study would be of immense guide to concreters using laterized concretes.

1.1 Aims and Objectives of the Study

The objectives of this study included the following;

- To determine the cube crushing strengths for laterized concretes at different percentages of laterite contents.
- To determine cylinder crushing strength for laterized concretes at different percentages of laterite contents.
- To compare the crushing strengths of laterized concrete cubes with those of cylinders at 3, 7, 14, 21 and 28 days respectively.
- To determine other properties of laterized concretes at the different replacement levels.

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1.2 Significance of the study

Compressive strength is unarguably the most widely used strength parameter for concrete since concrete is good in compression and weak in tension. The study will enable concrete designers and users to appreciate the relationship between the cube and cylinder crushing strengths of laterized concretes in comparison to other standard concretes in case design is made using any specimen's strength. This will help in reducing the cost of concrete since laterite is easily available and affordable. The continuous exploitation of the sand resulting in environmental degradation will reduce.

2.0 LITERATURE REVIEW

The term "laterite" is used to describe a ferruginous, vesicular, unstratified and porous material with yellow ochre caused by its high iron content, occurring abundantly in Malabar, India (Osunade, 2002).

Ettu et al (2006) reported that a reasonable number of laterized concrete mix compositions met the minimum compressive strength of 25MPa for reinforced concrete as specified by BS 8110: 1997. It was also observed that the resulting concrete had an average density of 22.81kN/m³ which was lower than 24kN/m³, an average value for traditional concrete

Adepegba (1975) compared the strengths of normal concretes with those of laterized concretes and concluded that laterized concretes can be used as a structural material provided laterite content does not exceed 50%. According to Balogun and Adepegba (1982), the most suitable mix for structural applications is 1: 1½: 3 (Cement: sand/laterite : gravel) with a water-cement ratio of 0.65. Lasisi and Osunade (1984) established that the finer the grain size of lateritic soils, the higher the compressive strength of the concrete cubes made from such soils.

Osunade (1994) found out that increases in shear and tensile strengths of laterized concretes were obtained as the grain size range and curing ages increased. Also, greater values of shear and tensile strengths were obtained for rectangular specimens than those obtained for cylindrical ones

3.0 MATERIALS AND METHODS

3.1 Materials Used

Portland limestone cement of UNICEM brand sold in sealed 50kg bags was used. The cement was purchased in bags and transported to the laboratory. It was also protected from dampness to avoid lumps. The cement conformed to the requirements of BS 12: 1954 and NIS 444: 1988. Laterite, one of the two fine aggregates used for this research was obtained from a borrow pit in the Main campus, University of Uyo, Akwa Ibom State at a depth of 3.0 meters. It was treated in conformity with the requirements of BS 812-103.1:1985. The sharp sand was obtained from Ikpa River in Uyo, Akwa Ibom State, Nigeria and was treated in conformity with the requirements of BS 812-103.1:1985. It had a maximum particle size of 5mm. Natural crushed granite aggregate was used for this study. The material was obtained from Akamkpa quarry in Cross River State, Nigeria. It had a maximum size of 25mm and satisfied the requirements of BS 812-103.1:1985. Portable tap water supplied by the Civil Engineering laboratory, University of Uyo was used throughout the research experiments. The water conformed to BS3148.

3.2 Experimental Methods

Laterized concrete cubes and cylinders were prepared for compressive strength tests. Replacement of sharp sand with laterite fine aggregate was carried out at 0%, 20%, 40%, 50%, 60%, 80%, and 100% levels. The batching of concrete was done by weight and the different constituent materials were weighed based on the adopted mixes of 1:1½:3 and 1:2:4 respectively at water – cement ratio of 0.55. Three specimens were cast for each replacement level using cube and cylinder moulds. The specimens were demoulded after 24 hours and cured in a water bath until ready for test. Compressive strength results were taken after 3, 7, 14, 21 and 28 days of curing.

The tests conducted in the course of this study were:

- (a) Sieve analysis test on all aggregates (in accordance with BS 882:1983)
- (b) Specific gravity test on aggregates (in accordance with BS 882: Part 2:1983)
- (c) Workability test on fresh concretes (in accordance with BS 1881:1970)
- (d) Density test on concretes produced (in accordance with BS 1881:1970)
- (e) Compressive strength test on concrete cubes and cylinders (in accordance with BS 1881: Part 4: 1970)
- (f) Water absorption test on concrete specimens (in accordance with BS 1881:1970)

3.2.1 The compressive strength of the concrete was determined using equation [2].

$$f_c = P/A_c \quad [2]$$

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Where;

f_c = is the compressive strength in N/mm².

P = is the maximum load at failure in Newton.

A_c = is the cross sectional area of the cube.

4.0 RESULTS AND DISCUSSIONS

4.1 Properties of Materials Used

The laterite had a specific gravity of 2.53, while sand and coarse aggregate had 2.66 and 2.71 respectively. These values satisfy the conditions for use as aggregates as stipulated in BS 1377: Part 2:1990.

4.2 Sieve Analysis Result

The particle size distributions of the aggregates are presented on Tables 4.1, 4.2 and 4.3 for laterite, sand and coarse aggregate respectively. They are also plotted on Figures 4.1, 4.2 and 4.3 for the respective aggregates.

Table 4.1 Sieve Analysis for Laterite

Source: University of Uyo permanent Campus				
Wt. Of Dry Sample: 1000g			Air dry Mc: 0.80%	
Wt. Of Washed Sample: 775.0g				
Sieve size (mm)	Weight Retained (g)	% Retained	Cum. % Retained	% Passing
4.75	0.00	0.00	0.00	100.00
3.35	0.00	0.00	0.00	100.00
2.36	0.00	0.00	0.00	100.00
1.18	49.50	4.99	4.99	95.01
0.85	64.20	6.47	11.46	88.54
0.60	146.80	14.80	26.26	73.74
0.425	239.00	24.09	50.35	49.65
0.25	188.60	19.01	69.36	30.64
0.15	67.80	6.83	76.19	23.81
0.075	13.70	1.38	77.58	22.42
Pan	5.60	0.56		

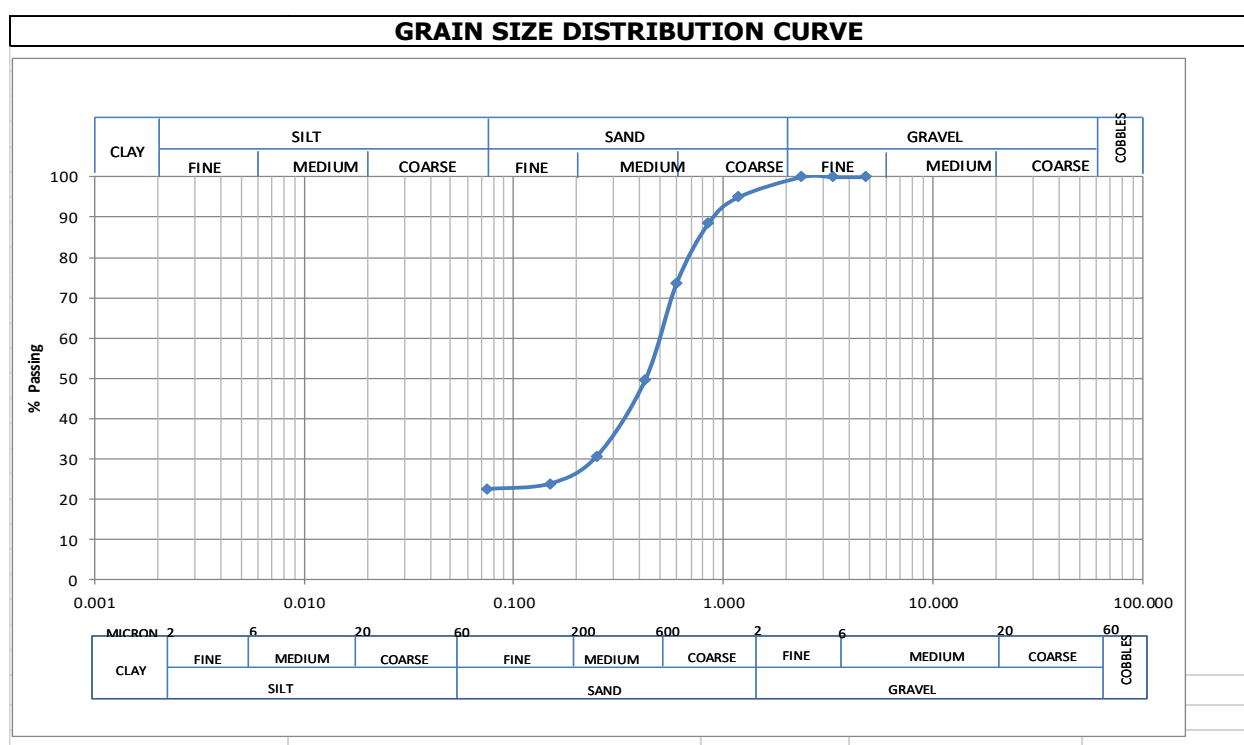


Fig 4.1 Grading Curve for Sieve Analysis of Laterite.

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Table 4.2: Sieve Analysis for Sand

Source:		University of Uyo permanent Campus		
Wt. Of Dry Sample:		1000g	Air dry Mc: 0.80%	
Wt. Of Washed Sample:		775.0g		
Sieve size (mm)	Weight Retained (g)	% Retained	Cum. % Retained	% Passing
4.75	4.50	0.46	0.46	99.54
3.35	3.80	0.38	0.84	99.62
2.36	13.20	1.33	2.17	98.28
1.18	54.10	5.46	7.64	92.82
0.85	55.60	5.62	13.25	87.20
0.60	114.10	11.52	24.78	75.68
0.425	189.20	19.11	43.89	56.57
0.25	251.10	25.36	69.25	31.21
0.15	120.00	12.12	81.37	19.09
0.075	30.70	3.10	84.47	15.99
Pan	4.40	0.44		

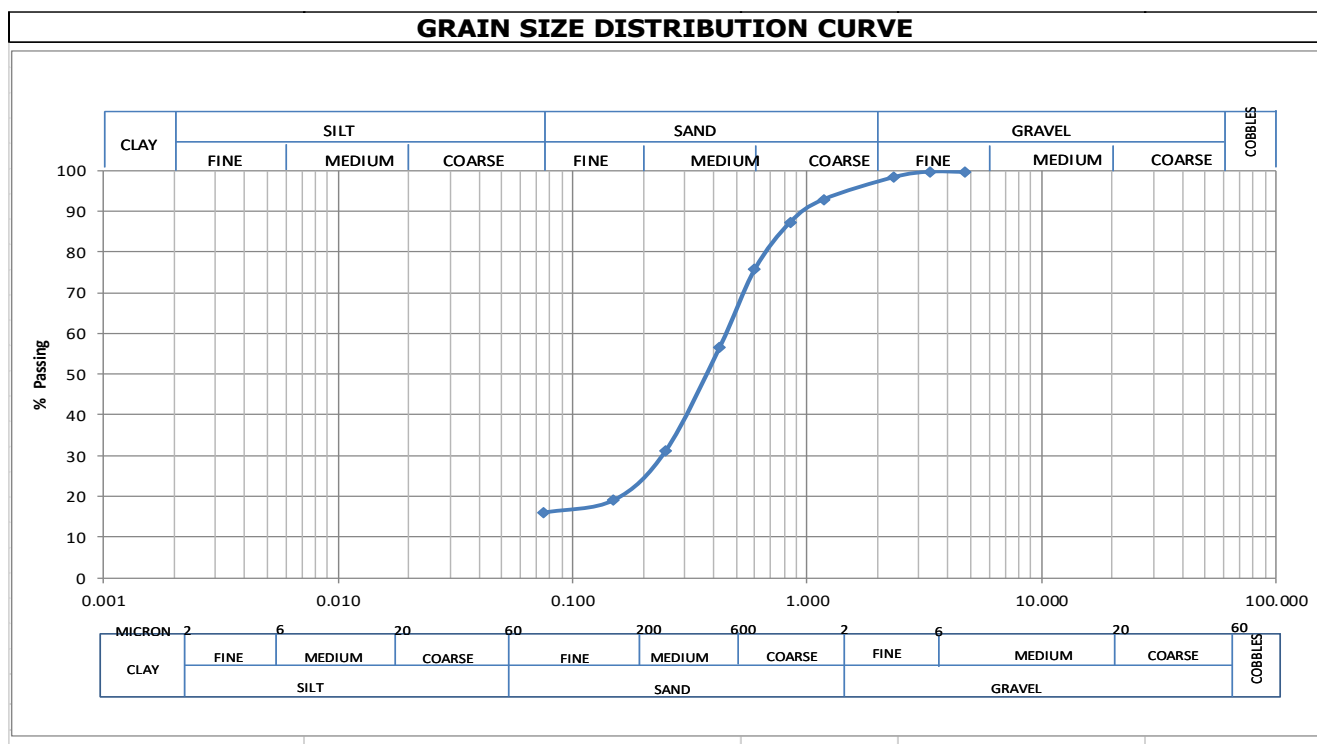


Fig 4.2 Grading Curve for the River Sand Used

Table 4.3 Sieve Analysis of Coarse Aggregate

Source:		University of Uyo permanent Campus		
Wt. Of Dry Sample:		2000g	Air dry Mc: 0.80%	
Wt. Of Washed Sample:		775.0g		
Sieve size (mm)	Weight Retained (g)	% Retained	Cum. % Retained	% Passing
37.50	0.00	0.00	0.00	100.00
25.00	223.00	11.16	11.16	88.84
22.40	272.40	13.63	24.78	75.22
19.00	841.80	42.11	66.89	33.11
16.00	390.30	19.52	86.42	13.58
12.50	117.20	5.86	92.28	7.72
9.50	5.70	0.29	92.57	7.43
PAN	141.20	7.06		

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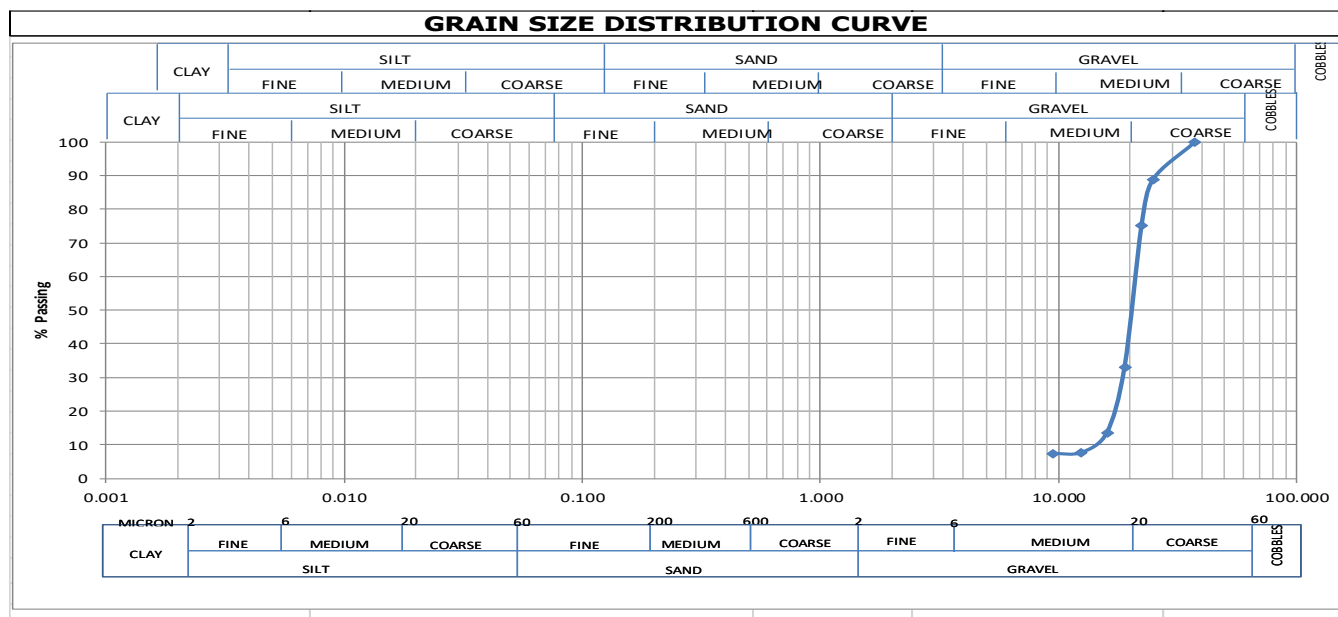


Fig 4.3: Grading Curve for Coarse Aggregate size 25mm

4.3 Workability (Slump Test)

The results of the workability test using the slump experiments are shown on Table 4.4 and Figure 4.4. Laterized concretes containing 0% of laterite exhibited 165mm slump as against 10mm for that containing 100% laterite. Generally the slump (that is workability) reduced as the percentage of laterite increased.

Table 4.4: Slump Test Results

Combination		Slump (mm)
Laterite	Sand	
0%	100%	165
20%	80%	95
40%	60%	42
50%	50%	34
60%	40%	30
80%	20%	15
100%	0%	10

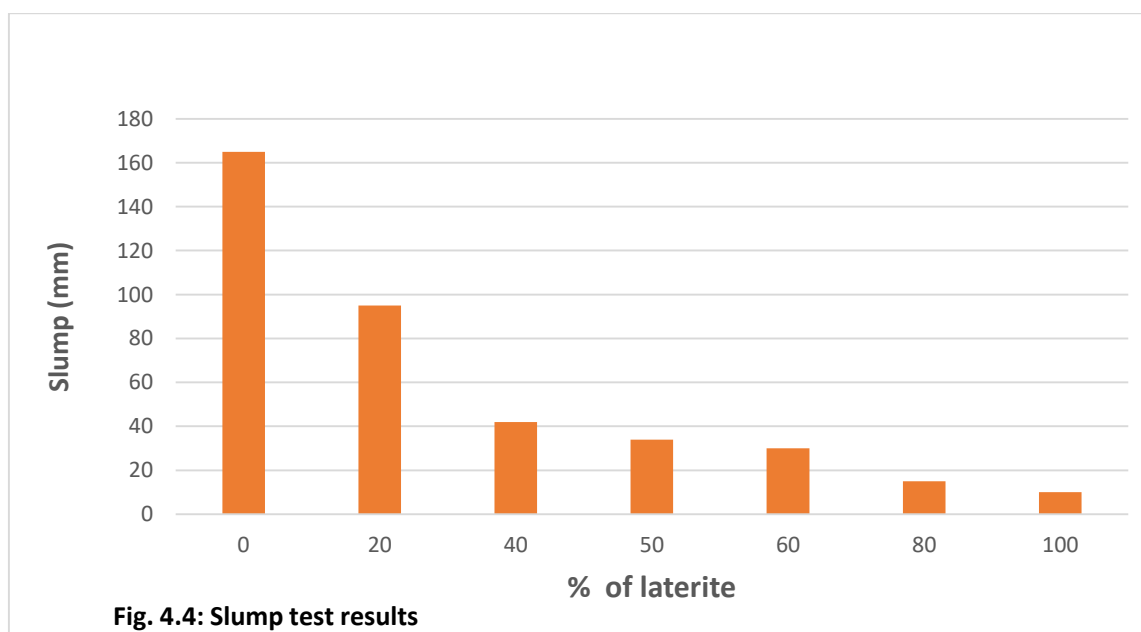


Fig. 4.4: Slump test results

Comparative Study of Cube and Cylinder Crushing Strengths of Laterized Concrete

4.4 Density of Normal Laterized Concrete

Table 4.5 shows the range of densities of the laterized concretes used in this experimentation. The densities between 2401kg/m³ and 2470kg/m³ indicating that the laterized concretes used were normal weight concretes.

Table 4.5: Average 28th Day Densities of Laterized Concretes Used

Combination		Density (kg/m ³)
Laterite	Sand	
0%	100%	2401
20%	80%	2427
40%	60%	2423
50%	50%	2432
60%	40%	2402
80%	20%	2452
100%	0%	2470

4.5 Compressive Strengths of Laterized Concrete Cubes and Cylinders

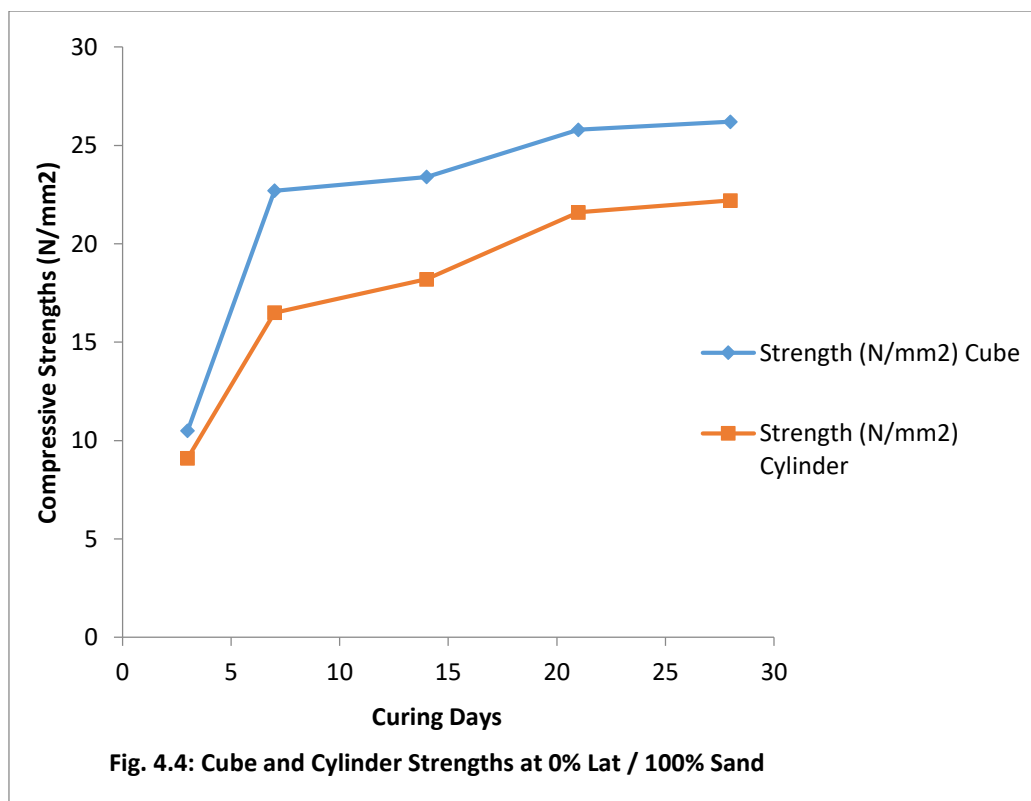
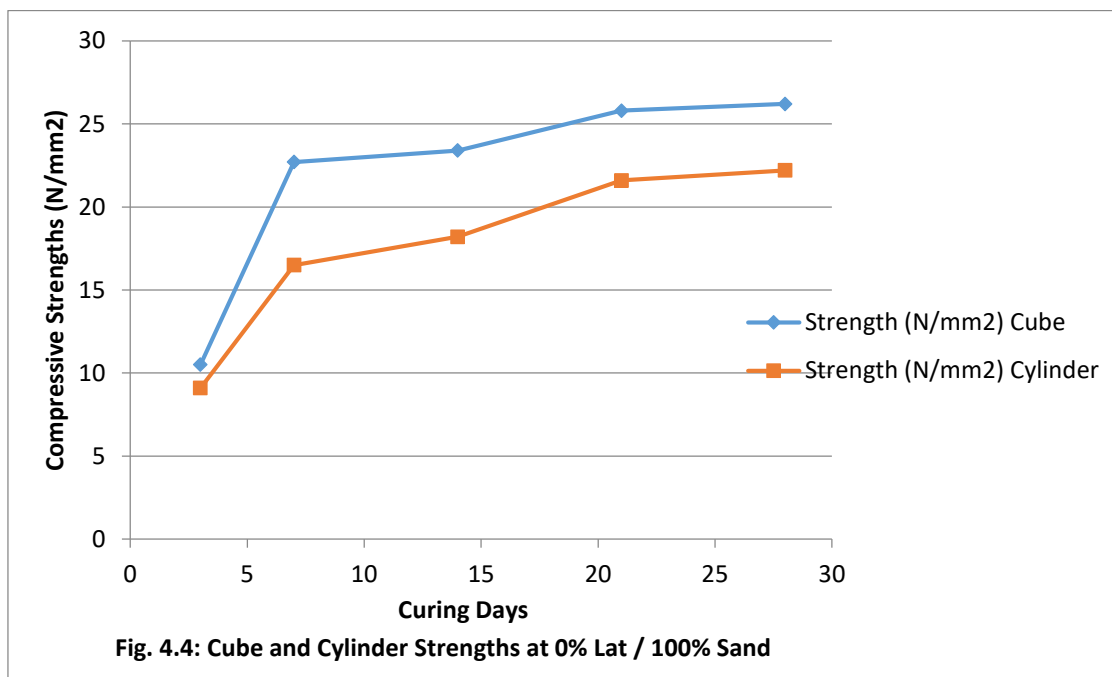
The Compressive strengths of the laterized concrete cubes and cylindrical specimens studied are presented on Table 4.6 and Figures 4.4 to 4.8.

Table 4.6: Compressive Strengths of Cube and Cylinder Specimens

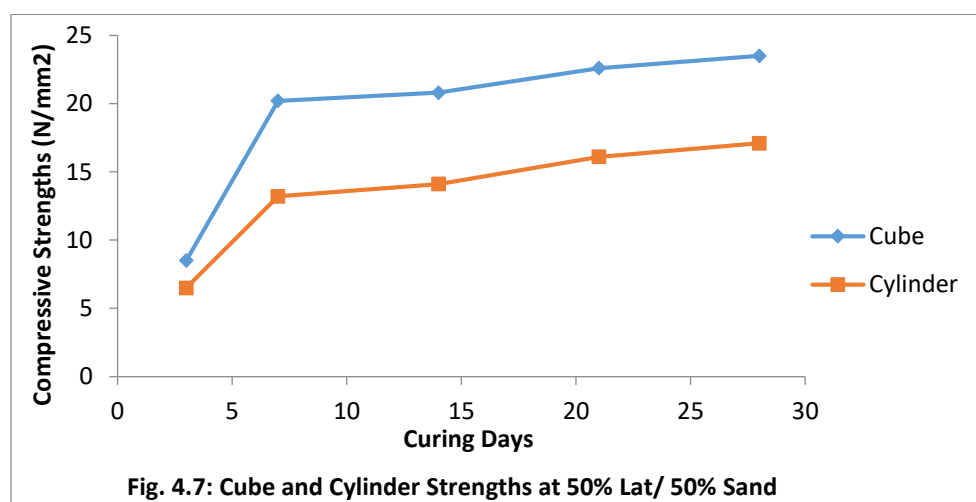
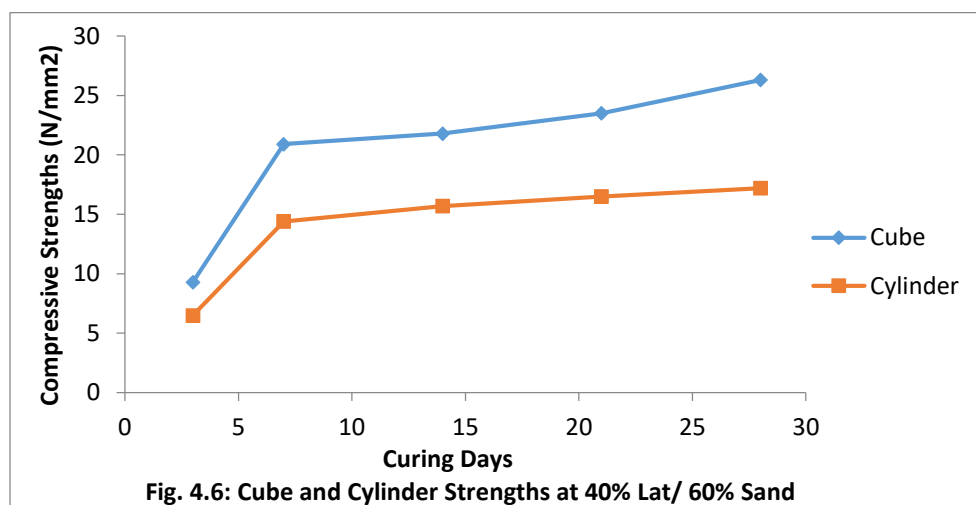
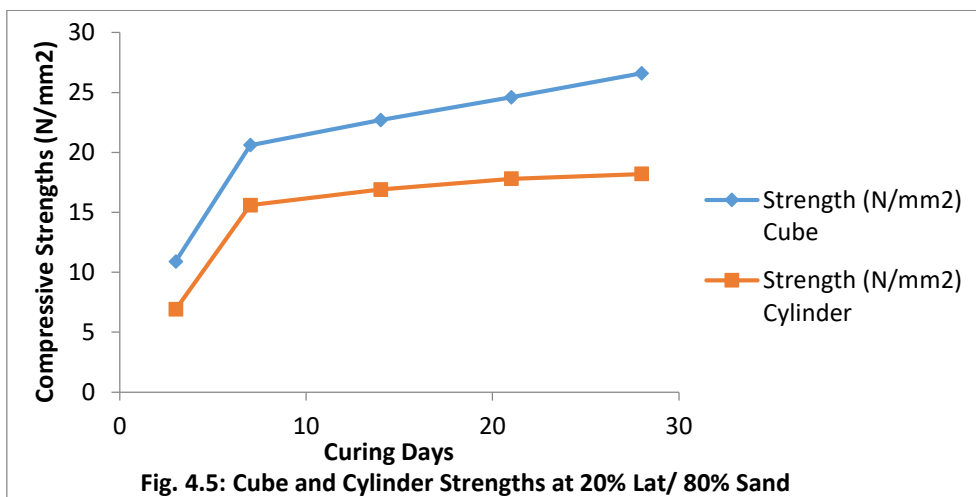
Combination		Curing Days	Cube Strength N/mm ²	Cylinder Strength N/mm ²	Cube/Cylinder Strength Ratio
Laterite	Sand				
		3	10.5	9.1 ± 0.15	0.86
		7	22.7 ± 0.10	16.5 ± 0.40	0.73
0%	100%	14	23.4 ± 0.15	18.2 ± 0.45	0.77
		21	25.8 ± 0.10	21.6 ± 0.20	0.84
		28	26.2 ± 0.17	22.2 ± 0.11	0.85
20%	80%	3	10.9 ± 0.10	6.9 ± 0.10	0.63
		7	20.6 ± 0.49	15.6 ± 0.57	0.76
		14	22.7 ± 0.35	16.9 ± 0.15	0.74
		21	24.6 ± 0.32	17.8 ± 0.37	0.72
		28	26.6 ± 0.35	18.2 ± 0.16	0.68
40%	60%	3	9.3 ± 0.15	6.5 ± 0.10	0.70
		7	20.9 ± 0.10	14.4 ± 0.32	0.69
		14	21.8 ± 0.50	15.7 ± 0.50	0.72
		21	23.5 ± 0.10	16.5 ± 0.31	0.70
		28	26.3 ± 0.15	17.2 ± 0.20	0.65
50%	50%	3	8.5 ± 0.20	6.5 ± 0.15	0.76
		7	20.2 ± 0.25	13.2 ± 0.60	0.65
		14	20.8 ± 0.26	14.1 ± 0.50	0.68
		21	22.6 ± 0.60	16.1 ± 0.32	0.71
		28	23.5 ± 0.15	17.1 ± 0.26	0.73
60%	40%	3	9.0 ± 0.10	6.1 ± 0.30	0.68
		7	17.8 ± 0.05	12.8 ± 0.99	0.72
		14	19.7 ± 0.11	13.9 ± 0.60	0.71
		21	22.7 ± 0.32	14.2 ± 0.15	0.63
		28	23.7 ± 0.05	15.3 ± 0.25	0.65
80%	20%	3	8.4 ± 0.15	5.4 ± 0.20	0.64
		7	18.3 ± 0.25	10.7 ± 0.46	0.58
		14	20.3 ± 0.26	12.6 ± 0.58	0.62

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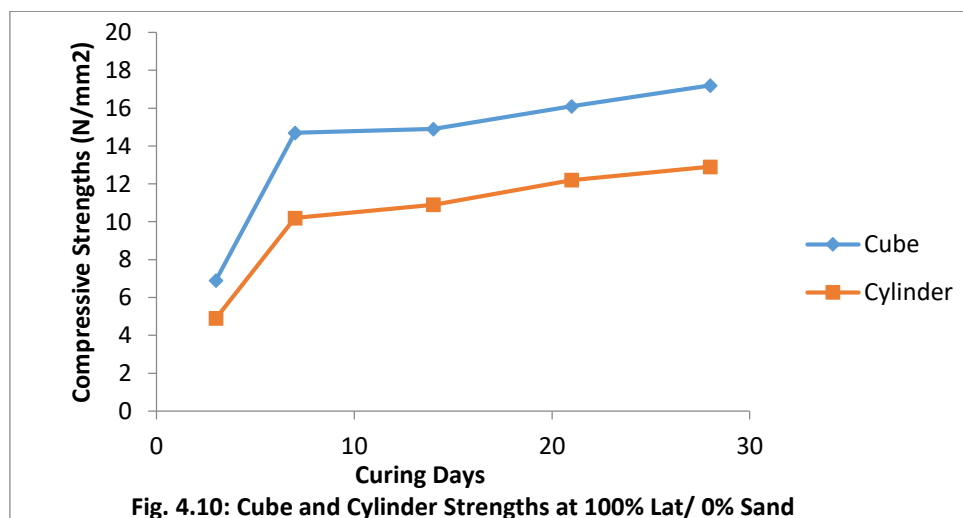
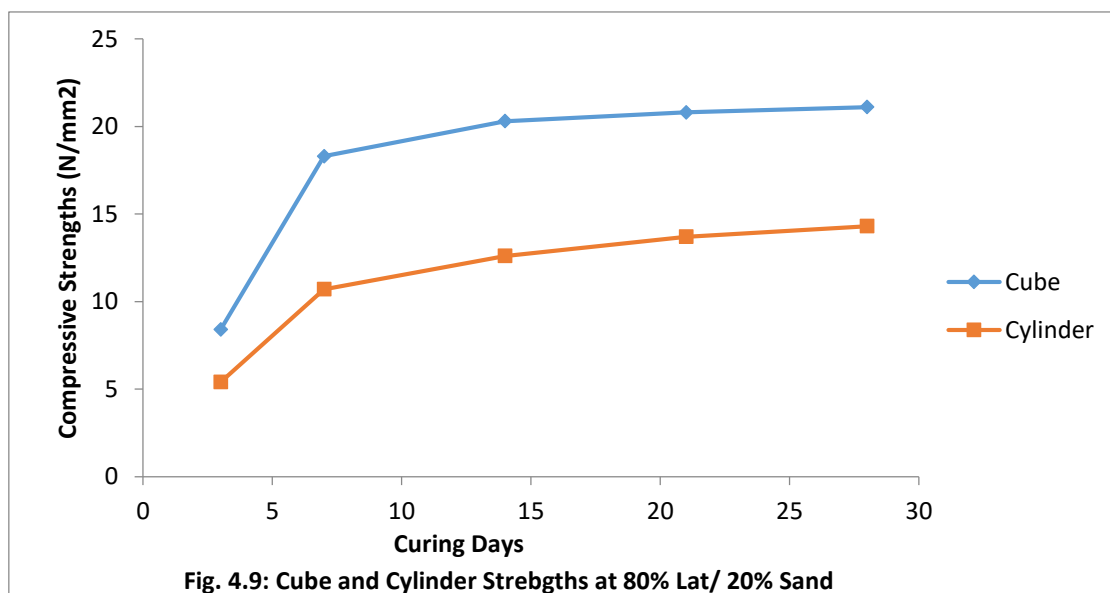
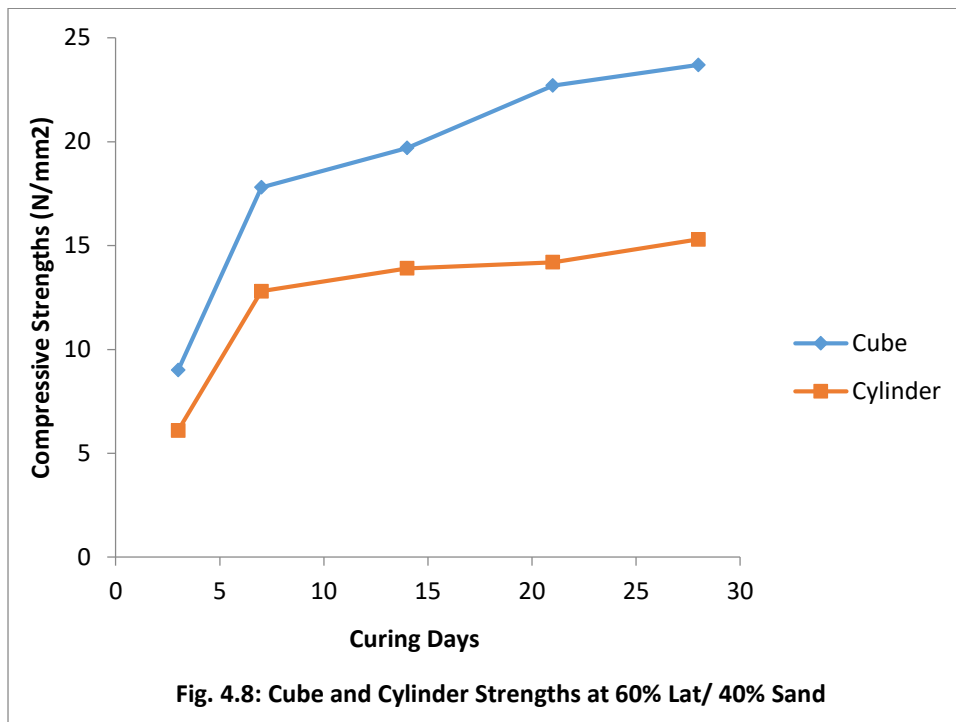
		21	20.8 ± 0.10	13.7 ± 0.52	0.66
		28	21.1 ± 0.10	14.3 ± 0.16	0.68
100%	0%	3	6.9 ± 0.25	4.9 ± 0.20	0.71
		7	14.7 ± 0.10	9.0 ± 0.63	0.61
		14	14.9 ± 0.10	8.6 ± 0.30	0.58
		21	16.1 ± 0.20	8.5 ± 0.50	0.53
		28	17.2 ± 0.10	8.8 ± 0.35	0.51



Comparative Study of Cube and Cylinder Crushing Strengths of Laterized Concrete



Comparative Study of Cube and Cylinder Crushing Strengths of Laterized Concrete



Comparative Study of Cube and Cylinder Crushing Strengths of Laterized Concrete

At 3 days curing for all the combinations of laterite and sand, the cylinder specimens had strengths 68% that of the cube. Similarly the respective percentages for 7 days, 14 days, 21 days and 28 days were 77, 69, 70, and 80. These indicated that for laterized concretes the cylinder specimens have strengths lower than the cube specimens. BS 8110 stipulates that the cylinder strength should be about 80% of the cube strength. The cylinder strengths of the laterized concrete studied at 14, 21, and 28 conformed to this.

Additionally, the cube-to-cylinder strength ratio was found to be higher for the samples at 14 and 21 days, compared to those at 7 and 28 days. This suggests that the concrete samples gained strength during the intermediate curing period, but not as much during the earlier or later stages of the curing process. The exact reasons for this behavior are not entirely clear and may be influenced by a range of factors such as the mix design, curing conditions, and testing protocols.

Moreover, cylinder/cube strengths were higher for the samples at 14, 21, and 28 days compared to those at 7 days. This suggests that the concrete samples gained more strength during the later stages of the curing process.

5.1 CONCLUSION AND RECOMMENDATION

The following conclusion has been made from this study:

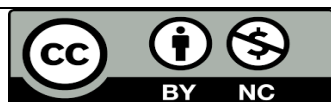
1. There is decrease in the workability of concrete as the percentage of laterite increase hence laterized concretes require increased water – cement ratio.
2. Compressive strength increased with curing age for both cube and cylinder specimens.
3. The maximum compressive strength was obtained at 25% replacement of sand with laterite.
4. Compressive strength decreases with increase in the laterite content.
5. The compressive strengths of cube specimens were higher than those of cylinder at all replacement levels.
6. The ratio of cylinder to cube compressive strengths ranged between 0.65 and 0.8.

5.2 RECOMMENDATION

A ratio of 1:1½:3 concrete is recommended for laterized concretes meant for structural purposes and the percentage replacement of sand with laterite should not exceed 50%.

REFERENCES

- 1) Balogun, L. A. and Adepegba, D. 1982. Effect of Varying Sand Content in Laterized Concrete. International Journal of Cement Composite and Lightweight Concrete. Vol. 4. Pp 235 – 240.
- 2) Lasisi, F; Osunade, J. A. and Olorunniwo, A. 1987. Strength Characteristics of Cube and Cylinder Specimens of Laterized Concrete."West Indian Journal of Engineering, Vol.12, No.1, pp.50-59.
- 3) Neville, A.M. Properties of Concrete. London: Pitman, 1981, 3rd ed; pp. 529-604.
- 4) Osunade, J. A. 2002. Effect of Replacement of Lateritic Soils with Granite Fines on the Compressive and Tensile Strengths of Laterized Concrete. Building and Environment, 37(5). Pp 491 – 496.
- 5) Udoeyo, F. F; Iron, U. H. And Odim, O. O. (2006). Strength Performance of Laterized Concrete.
- 6) Construction and Building Materials, Vol. 20 No. 10. Pp 1057 – 1062.



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The Relationship between Personality Dimensions and Anxiety of Parents Who Have Children with Autism in Upt. Samarinda City Autism Service Center



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ABSTRACT: The existence of an autistic child affects family life, especially parents. With heavy parenting demands, parents experience pressure and may experience stress, anxiety or sadness. The aim of this research is to determine personality dimensions and the relationship between parental anxiety for autistic children in Upt. Autism Service Center in Samarinda City. This research is quantitative correlational with a cross sectional study design approach. The sampling technique uses a total sampling technique. Personality dimensions with HEXACO and anxiety with Cronbach's alpha are the instruments used in this research. Normality test based on Kolmogorov-Smirnov was used for data analysis. Univariate and bivariate analyzes were also used, and SPSS version 26.0 was used to process the data.

Results: The level of parental anxiety is quite high, and the impact of this anxiety can cause delays in treatment which causes the child to recover slowly. The anxiety level of parents of autistic children is significantly correlated with personality dimensions. This suggests that parents should be more aware of the fact that their children's anxiety levels can be influenced by their personality traits. Therefore, they must find ways to control and manage these dimensions of their personality to reduce their anxiety levels.

Conclusion: Parent's personality and anxiety level greatly impact the child. When the parent's personality and anxiety level are very severe, this will affect the development or healing stage of the child with autism

KEYWORDS: Personality Dimensions, Anxiety, Parents, Children with Autism, Samarinda

I. INTRODUCTION

Autism is a group of neurological diseases that inhibit normal brain development in a person[1], this disorder is usually characterized by the emergence of impaired communication, social interaction, and very rare imagination activity[2]. Where the main characteristics of the disorder experienced are the inability to convey one's intentions to others, deviant behavior, and isolation in the social environment[3].

[4]states that 1 in 160 children throughout the world suffer from Autism Spectrum Disorder (ASD) which is included in World Health Organization (WHO) data in 2018. This is reinforced by the statement made[5]that around 1 in 68 children or 1.5% have autism in the 2016 Community Report on Autism prevalence of autism in the United States. The Indonesian Ministry of Health estimates that there are around 1.2 million people with autism spectrum disorders in Indonesia. About 500 people with autism spectrum disorder experience an increase every year. 5,530 children with developmental disorders, including autism spectrum disorders, were recorded between 2020 and 2021 at community health centers[6].

The results of a survey conducted in the city of Samarinda, from 2014 to 2016 there was an increase in the number of children with special needs from 502 children in 2014 to 610 children in 2016 in Samarinda.[7]. Meanwhile, in 2017 there were around 357 children with autism recorded in East Kalimantan and there were 177 children with autism in Samarinda City, then there were 29 children with autism at the Pembina State Special School[8]. But according to[9]There is no definite data regarding the prevalence of autistic children in East Kalimantan and Samarinda City. However, 25 to 30 autistic children were found in Palaran District, Samarinda City.

[8]states that having an autistic child affects family life, especially parents. This is because autistic children have many limitations that require more attention than other children[10]. Therefore, with heavy parenting demands, parents experience pressure and may experience stress, anxiety or sadness[11].

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Based on the results of a preliminary study found by researchers at the Upt research location. Samarinda Autism Service Center, precisely Jl. Batu Besaung No.02 that eight out of six parents stated that the anxiety felt by parents really depended on the parent's personality regarding the parent's readiness in building the independence of their autistic child. This is in answer to the question, "Are parents ready to build independence for their autistic child?" This is related to the future prospects of autistic children, if their parents cannot demand special care in the future, and if parents find it difficult to face problems because of the qualities and feelings they have.

There has been a lot of research related to the dimensions of personality and anxiety, but until now researchers have not found research results that specifically discuss the relationship between personality and anxiety in parents of autistic children. This attracts researchers to investigate further the personality dimensions of parental anxiety. So the researchers raised the title "The relationship between personality dimensions and anxiety of parents who have children with autism in Upt. Samarinda City Autism Service Center".

II. METHODOLOGY

This research is included in the type of quantitative correlational research with a cross-sectional study design approach which aims to determine the significant relationship between the variables studied. This research was carried out at Upt. Autism Service Center in Samarinda City. The population of this study were parents of autistic children in Upt. Autism Service Center in Samarinda City.

Sampling of the research population used a total sampling technique where the entire population was used as a sample. The criteria determined in sampling were parents who have autistic children in Upt. Samarinda City Autism Service Center with 88 people.

Personality dimensions with HEXACO and anxiety with Cronbach's alpha are the instruments used in this research. In this study, the Kolmogorov-Smirnov normality test was used for data analysis. Univariate and bivariate analyzes were also used, and SPSS version 26.0 was used to process the data.

III. RESULTS AND DISCUSSION

Samarinda City Education Office Employees, parents and special guidance teachers at the Samarinda City Inclusive School benefit from the education and training provided by Upt. Samarinda City Autism Service Center. Upt. The Autism Service Center in Samarinda City implements a technical training and guidance system that is carried out online and offline, a schedule for technical support and employee training in Samarinda City regarding intervention/handling of children with disabilities, a schedule for technical guidance and training for parents regarding how to handle children disabilities at home as well as training schedules and technical guidance for supervising teachers regarding learning for children with disabilities at school.

This research is included in the type of quantitative correlational research with a cross-sectional study design approach which aims to determine the significant relationship between the variables studied. The entire population is used as a sample in research that uses the total sampling method. The sampling criteria were as follows: Parents of 88 autistic children who sought treatment at Upt. Samarinda City Autism Service Center. Personality dimensions with HEXACO and anxiety with Cronbach's alpha are the instruments used in this research. In this study, the Kolmogorov-Smirnov normality test was used for data analysis. Univariate and bivariate analyzes were also used, and SPSS version 26.0 was used to process the data.

In the data results, the relationship between personality dimensions and anxiety of parents who have children with autism in Upt. Samarinda City Autism Service Center is based on the following:

Characteristic Frequency Distribution

Characteristics	Frequency	Percentage
Age		
Early adulthood (18-40 years)	52	59.0
Middle adults (41 – 60 years)	36	40.0
Gender		
Man	41	46.6
Woman	47	53.4

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The table above shows that 88 respondents were early adults aged 18-40 years, namely 52 people (59.0%) respondents and middle adults aged 41-60 years were 36 people (40.0%) respondents. Most of the respondents were male, namely 41 people (46.6%) and female, namely 47 people (53.4%).

Normality Test Results with Kolmogrov Smirnov Test

Personality	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistics	Df	Sig.	Statistics	Df	Sig.
	,786	88	,200*	,988	88	,622

- The statistic that describes the slope of skewness data is the skewness ratio. Shows data tends to be in the middle or slanted to one side. This statistic can be used to see the normal distribution of data, namely skewness. It is said to be normal when the skewness ratio is in the range -2 to 2. Obtained from the Skewness ratio = skewness/standard error skewness = $-.128/.257 = -0.49$ based on the results obtained by researchers that the skewness ratio value is 0.49 so it can be concluded that the data is normal.
- The Kurtosis Ratio shows the sharpness of the data. The normality criteria are the same as the skewness ratio, namely -2 to 2. Calculations with the Kurtosis ratio = kurtosis/standard error kurtosis = $-.327/.508 = -0.64$ can be concluded that the kurtosis ratio value is in the range of -2 to 2, which shows that the data that's normal.
- The normality test that the researchers carried out used the Kolmogorov Smirnov test. If the test results (p value > 0.05) then the data is normally distributed. Based on the results of table 2, the significance value of Kolmogorov Smirnov is 0.2, which means that the results show normally distributed data.

Univariate Analysis of Personality Dimension Variables for Parents of Children with Autism at UPT. Samarinda City Autism Service Center

Personality Dimensions	Frequency	Percentage
Good	46	52.3
Bad	42	47.7
Amount	88	100.0

The results of univariate analysis on personality dimension variables showed that some respondents experienced good personality dimensions, namely 46 people (52.3%) respondents, 42 people (47.7%) experienced bad personality dimensions.

Univariate Analysis of Anxiety Variables for Parents of Children with Autism at UPT. Samarinda City Autism Service Center

Worry	Frequency	Percentage
Normal	13	14.8
Light	6	6,8
Currently	22	25.0
Heavy	47	53.4
Very heavy	0	0
Amount	88	100.0

The results showed that most respondents experienced severe anxiety as many as 47 people (53.4%) respondents, Moderate Anxiety as many as 22 people (25.0%) respondents, Mild Anxiety as many as 6 people (6.8%) respondents, Normal Anxiety as many as 13 people (14.8%) respondents.

Bivariate analysis was carried out to test the meaning of the relationship between the independent variables, namely Personality Dimensions, and the dependent variable, namely Anxiety, so Spearman Rank was used and can be seen in the following table.

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Analysis of the Relationship between Personality Dimensions and Parental Anxiety Personality Anxiety Crosstabulation

		Worry			
		Normal	Light	Currently	Heavy
Personality	Good	3 3.4%	1 1.1%	4 4.5%	38 43.2%
	Bad	10 11.4%	5 5.7%	18 20.5%	9 10.2%
Total		13 14.8%	6 6.8%	22 25.0%	47 53.4%

The results of statistical tests using the gamma test obtained a p value of 0.000 and a gamma correlation value of -0.786. So it can be stated that the relationship between Personality Dimensions and Anxiety is strong and the correlation value is negative, which means that the higher the personality dimension value, the lower the anxiety value.

The results of the characteristics of the majority of subjects were aged 22-39 years, namely 17 respondents (53.0%) and the majority experienced a high level of anxiety.[12]. The results of the survey conducted showed that there was a relationship between age and anxiety in parents. It was found that most of the age group of parents under 40 years who had children suffering from physical and mental disorders experienced more severe anxiety than the age group over 40 years.[3]. According to research[13], the majority of respondents were women as many as 24 respondents (75.0%) and some respondents experienced good personality dimensions with severe levels of anxiety, namely 47 respondents (53.4%). Research results state that gender factors can have a significant impact on anxiety levels; research finds that women are more at risk than men[14].

According to Simon Philips (in Fatchul Mu'min), personality is a set of values that leads to a system that underlies the thoughts, attitudes and behavior displayed in a person. Univariate analysis in personality dimensions[15]. A good personality is manifested in good habits in everyday life, such as good thoughts, good hearts, and good behavior. Having a good personality means knowing and acting well[16]. On the other hand, individuals who have bad behavior patterns and often act strangely are said to have bad character[17].

Univariate analysis of the anxiety dimension of research results conducted by Hanjoyo Limas shows that 73% of parents with children with autism experience anxiety about their child's development and recovery. The impact of this anxiety can cause parents to delay receiving early treatment that they should be able to do. Autistic children who are treated slowly may need more time to recover[18]. The statistical test used in the research found that the majority of respondents' anxiety levels fell into the severe anxiety category, with 26 people (72.2%) falling into that category.

Bivariate analysis shows a p-value = 0.000 < α 0.05 which indicates a correlation between anxiety and parental knowledge, and a correlation coefficient (r) of 0.372 which indicates a low correlation. Suggestions that can be recommended to parents are to increase their insight in the form of information related to autism problems[19]. That parents who have children with autism have concerns about their writing ability, reading ability, ability to complete school well, ability to interact with school friends and teachers, ability to follow lessons well, ability to understand lesson material[20]. Mild levels of anxiety are related to tension in daily life, causing a person to become alert[21].

The bivariate analysis consisted of a sample of 31 parents of children with autism spectrum disorders. Parental hassles, difficult children, and dysfunctional parent-child interactions. Parenting stress consists of 29 inquiry items. Validity ($r = > 0.361$) and reliability ($r = 0.915$) have been achieved by researchers. Data were analyzed using advanced regression with SPSS software[22]. that the three subjects had quite good self-control overall, the ability to fully accept their child's autism diagnosis, and a very low level of anxiety regarding the success of their child's autism education in the third subject[23]. The statistical test used in the research showed that most of the respondents' knowledge was sufficient, namely 15 people (41.7%) were included in this category, and most of the respondents' anxiety level was severe, as many as 26 people (72.2%) were included in this category. .

Bivariate analysis shows a p-value = 0.000 < α 0.05 which indicates a correlation between anxiety and parental knowledge, and a correlation coefficient (r) of 0.372 which indicates a low correlation. Suggestions that can be recommended to parents are to increase their insight in the form of information related to autism problems[2]. Acceptance impacts the level of support received from extended family, family financial capacity, religious background, education, marital status, age, and support received from experts and the general public[24].

Based on the relationship between personality dimensions and anxiety in parents of people with autism, Upt. Samarinda City Autism Service Center. Regarding parental anxiety, the findings show a very high level, with the impact of this anxiety often causing

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delays in treatment and a prolonged healing process in children. The anxiety level of parents of autistic children is significantly correlated with personality dimensions. This suggests that parents should be more aware of the fact that their children's anxiety levels can be influenced by their personality traits. Therefore, they must look for ways to control and regulate these dimensions of their personality to reduce their anxiety levels.

CONCLUSIONS

In this study, the majority of parents' personalities were in the good category, where it was explained that the personality in the good category was based on 6 indicators of personality dimensions, namely being sincere in establishing interpersonal relationships, not emotional and not dependent on other people, having a tendency to like various social things, usually preferring to be alone. and has an imaginative nature. The results for parental anxiety show a fairly severe level of anxiety, and the impact of this anxiety can cause delays in treatment and a prolonged healing process in the child. Based on research findings, there is a correlation between anxiety and personality dimensions of parents whose children have autism at Upt. Autism Service Center in Samarinda City.

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REFERENCES

- 1) E.Jeniu, D. Widodo, and E. Widiani, "The Relationship between Knowledge about Autism and the Level of Anxiety of Parents of Children with Autism at the Bhakti Luhur Malang Special School," *Nurs News*, vol. 2, no. 2, 2017.
- 2) ALAtmadiyahanti, A. Sriati, and I. Nurhidayah, "The Relationship between Parental Anxiety Levels and Parenting Patterns for Children on the Autism Spectrum in SLB Bandung City," *P-Issn*, vol. 9, no. 1, 2018.
- 3) R.Nurussakinah, HS Mediani, and D. Purnama, "OVERVIEW OF THE LEVEL OF ANXIETY OF PARENTS WHO HAVE CHILDREN WITH AUTISM IN SLB," *Indonesian Community Health Journal*, vol. 15, no. 2, 2019, doi: 10.37058/jkki.v15i2.1255.
- 4) EAL Leeet al., "'We Can See a Bright Future': Parents' Perceptions of the Outcomes of Participating in a Strengths-Based Program for Adolescents with Autism Spectrum Disorder," *J Autism Dev Disord*, vol. 50, no. 9, 2020, doi: 10.1007/s10803-020-04411-9.
- 5) A. Ibrahim, "Practicum Students Views about Field Experience Program for Children with Autism Spectrum Disorders," *International Journal of Education and Practice*, vol. 8, no. 3, pp. 457–467, 2020, doi: 10.18488/journal.61.2020.83.457.467.
- 6) Ministry of Health, "Autism AZ Webinar Commemorating World Autism Awareness Day 2022," Indonesian Ministry of Health Directorate General of Public Health, 2022.
- 7) PAulita, "Resilience and Social Support in Mothers of Children with Autism," *Psychoborneo: Scientific Journal of Psychology*, vol. 9, no. 1, 2021, doi: 10.30872/psikoborneo.v9i1.5670.
- 8) S.Sinaga, "PARENTING SELF EFFICACY IN MOTHERS WHO HAVE AUTICAL CHILDREN," *Journal of Medika: Health Scientific Works*, vol. 3, no. 2, pp. 57–64, 2018.
- 9) A.A. , NEY , & HYO Nahdah, "The RELATIONSHIP OF STRESS LEVEL WITH PARENTING PATTERNS OF PARENTS WHO HAVE CHILDREN WITH AUTISM IN THE AUTISM SERVICE CENTER OF SAMARINDA CITY," *Verdure: Health Science Journal*, vol. 4, no. 1, pp. 206–215, 2022.
- 10) YMSo seeni, "The Relationship of Parenting Self-Efficacy to Anxiety of Parents of Children with Autism," *Psyche 165 Journal*, pp. 40–44, Jan. 2021, doi: 10.35134/jpsy165.v14i1.95.
- 11) W. Zhou, D. Liu, X.Xiong, H. Xu, and M. Manchia, "Emotional problems in mothers of autistic children and their correlation with socioeconomic status and the children's core symptoms," *Medicine (United States)*, vol. 98, no. 32, 2019, doi: 10.1097/MD.00000000000016794.
- 12) H.Lubis, A. Ramadhani, and M. Rasyid, "Students' Academic Stress in Carrying Out Online Lectures During the Covid 19 Pandemic," *Psychostudia: Journal of Psychology*, vol. 10, no. 1, 2021, doi: 10.30872/psikostudia.v10i1.5454.
- 13) B.ASyafira, SC Dewi, and Sutejo, "Self Efficacy is Associated with Anxiety in Preoperative Patients with General Anesthesia at Kardinah Tegal Regional Hospital," *Mandira Cendikia Nursing Journal*, vol. 1, no. 1, 2022.

The Relationship between Personality Dimensions and Anxiety of Parents Who Have Children with Autism in Upt. Samarinda City Autism Service Center

- 14) INPrakusya Mulyono, "The Relationship between Elderly Characteristics and Health Status in the Working Area of Godean 2 Health Center Yogyakarta," *JarFisMu*, vol. 2, no. 2, 2022.
- 15) R. Ramadhan and R.Hayati, "Effectiveness of Group Counseling Modeling Techniques for Students' Moral Behavior, Character and Respect for Teachers," *COUNSELING PSYCHOLOGY*, vol. 19, no. 2, 2021, doi: 10.24114/konseling.v19i2.30441.
- 16) E.Digdoyo, "RUMAH PUSPO CULTURE NUSANTARA AS A CENTER FOR DEVELOPMENT OF CHARACTER EDUCATION THROUGH NUSANTARA DANCE," *Integralistik*, vol. 30, no. 1, Aug. 2019, doi: 10.15294/integralistik.v30i1.20778.
- 17) A. Latifah, "Role Environment and Parenting Patterns on Early Childhood Character Formation," (*JAPRA*) *Raudhatul Athfal Education Journal (JAPRA)*, vol. 3, no. 2, 2020, doi: 10.15575/japra.v3i2.8785.
- 18) N.Hasanah, "Therapist Strategy in Educating Independence in Autistic Children at the Sri Soedewi Masjchkun Sofwan Sofwan Special School (SLB) Jambi City," *JIGC (Journal of Islamic Guidance and Counseling)*, vol. 1, no. 1, 2018, doi: 10.30631/jigc.v1i1.5.
- 19) ANPSRMMa'rifah, "PARENTS' COPING STRATEGIES FOR AUTISM CHILDREN AND PARENTING PATTERNS," *Journal of Health Sciences*, vol. 11, no. 2, pp. 1–9, 2020.
- 20) NDAsrifa, MD Nurmala, and AS Prabowo, "The Relationship between Parental Support and Anxiety in Students Who Are Writing Their Thesis," *Journal of Islamic Guidance Counseling*, vol. 2, no. 1, 2021.
- 21) N.Anggraeni, "Description of Anxiety Levels in Third Level D-III Nursing Students Facing Competency Tests at Indonesian Education Universities," *INDONESIAN JOURNAL OF NURSING EDUCATION*, vol. 1, no. 2, p. 131, Jan. 2018, doi: 10.17509/jpki.v1i2.9752.
- 22) ADHernawan, A. Diningrum, SN Jati, and M. Nasip, "Risk Factors of Autism Spectrum Disorder (ASD)," *Unnes Journal of Public Health*, vol. 7, no. 2, 2018, doi: 10.15294/ujph.v7i2.20565.
- 23) R. , I. & YR Dewi, "Parents' experiences in caring for autistic children in Banda Aceh City. ," *Psychoislamedia Psychological Journal*, vol. 3, no. 2, pp. 288–301, 2018.
- 24) DRPrihanto, E. Tari, and HAE Lao, "Service Strategy for Autistic Children in the Kupang Autism Service Center, East Nusa Tenggara," *Selaras Journal: Guidance Study...*, vol. 2, no. 1, 2021.



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Effectiveness of Lemongrass Warm Compress Intervention in Pediatric Meningoencephalitis Patients with Signs of Hyperthermia in the Picu Room Rsud Aji Muhammad Parikesit Tenggarong Hospital



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ABSTRACT: Meningoencephalitis is an inflammation that causes symptoms such as fever, severe headaches, convulsions, impaired consciousness and even death if not treated properly. One of the symptoms experienced by meningoencephalitis patients is an increase in body temperature. This body temperature can be treated with compresses. One compress that can be done is to use lemongrass or lemongrass (*Cymbopogon citratus*).

Objective: To intervene with warm lemongrass compresses to reduce body temperature.

Method: Quantitative descriptive with pre-test and post-test. The sample used was 1 child patient who was diagnosed with meningoencephalitis with signs of hyperthermia.

Research Results: After the intervention of giving warm lemongrass compresses for 3 days, significant results were obtained, namely a decrease in body temperature to 36.1°C.

Conclusion: Warm lemongrass compress is effective in reducing body temperature in meningoencephalitis patients.

KEYWORDS: Pediatric Patients, Meningoencephalitis, Warm Compress, Lemongrass, Reducing Body Temperature.

I. INTRODUCTION

Meningoencephalitis is an inflammation of the brain and meninges that can occur in children[1]. This condition requires immediate medical treatment, as it can cause serious long-term complications[2]. Common treatments for children with meningoencephalitis include administering antibiotics or antivirals, intravenous fluid therapy, and symptomatic treatment to reduce symptoms.[3]. However, the number of cases of meningoencephalitis in children is still quite high, including in Indonesia[4].

Various recent studies have been carried out in a similar field, especially in an effort to reduce the number of cases of meningoencephalitis in children[5]. The World Health Organization (WHO) estimates that there are 1.3 million new cases of meningitis with tuberculosis in children every year worldwide.[6]. The death rate due to bacterial meningitis itself can reach 2-30% depending on the bacteria causing it. Although more common in developing countries, meningitis is also a serious health problem for children in Indonesia[7]. Riskesdas survey data (2018) shows that meningitis is still a significant infectious disease in children in Indonesia. The incidence of meningitis in children aged 0-4 years reaches 1.6 per 1000 child population. This indicates that meningitis remains a health problem that needs to be treated seriously in Indonesia[8]. Based on survey results in 2022 in East Kalimantan, there were 150 cases of meningoencephalitis in children. These cases consisted of 85 cases in boys and 65 cases in girls[9]. The majority of cases occur in children aged 1-5 years, followed by children aged 6-10 years and 11-15 years. At Aji Muhammad Parikesit Tenggarong Regional Hospital, 3 cases of meningoencephalitis were also recorded from 118 patients treated in the PICU room during the period July-December 2023[10].

In treating meningoencephalitis, one of the symptoms that needs to be treated is fever. One treatment method that can be used to relieve fever is by using a warm lemongrass compress[11]. Lemongrass contains compounds such as citronellal, geraniol, and myrcene which have been shown to have the effect of reducing inflammation and fighting infection.[12]. However, it is important to note that the use of warm lemongrass compresses is only a supportive treatment and should be used in conjunction with other medical treatments[13].

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In previous research,[14]found that using warm lemongrass compresses could significantly reduce body temperature in pediatric patients who had fever.[15]also found that the use of warm lemongrass compresses was effective in reducing fever in adult patients. Thus, warm lemongrass compresses can be an effective and natural choice for treating fever in children and adults. The aim of this study was to test the effectiveness of the lemongrass warm compress intervention in reducing body temperature in pediatric meningoencephalitis patients.

II. METHODOLOGY

This research uses the nursing clinical practice analysis method to obtain data regarding the use of the innovative lemongrass warm compress intervention to reduce body temperature in pediatric meningoencephalitis patients in the PICU room at Aji Muhammad Parikesit Tenggara Regional Hospital.[16].

This research is a descriptive observational study with a cross-sectional approach with the data taken being child health clinic practice data for meningoencephalitis patients in the PICU room at Aji Muhammad Parikesit Tenggara Regional Hospital. The population of this study was 1 child patient with a diagnosis of meningoencephalitis who was treated in the PICU room at Aji Muhammad Parikesit Tenggara Regional Hospital for 3 days of treatment. The sample for this study was 1 child patient diagnosed with meningoencephalitis[17].

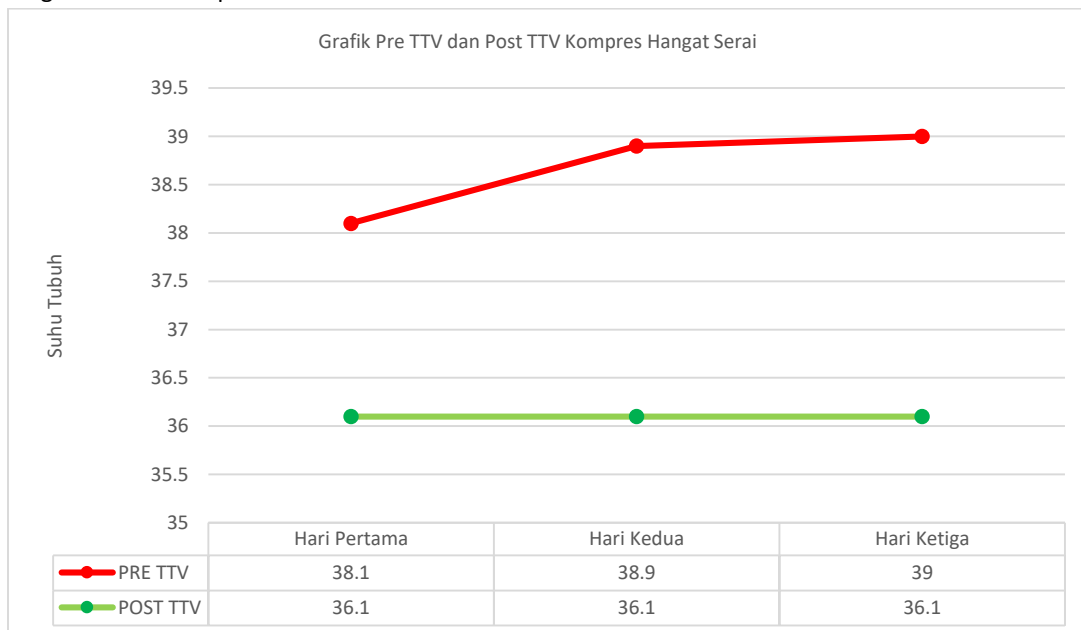
Data will be collected using direct observation of pediatric patients in providing warm lemongrass compress interventions. The data collected included patient demographic data, body temperature data before and after the intervention, as well as clinical practice documentation which included the time of the intervention and techniques for using warm lemongrass compresses.

The intervention used in this study was a warm lemongrass compress which was made by boiling lemongrass with warm water and then placed on parts of the body such as the neck and both axillae of the patient to reduce body temperature. This intervention is carried out for approximately 20-30 minutes and is stopped when the child patient's body temperature returns to the normal range[18].

The data obtained will be analyzed using quantitative descriptive methods with pre-test and post-test to calculate the average decrease in body temperature after the lemongrass warm compress intervention. Apart from that, researchers will also analyze clinical practice documentation to see the frequency and timing of interventions carried out[19].

III. RESULTS AND DISCUSSION

Based on research conducted on pediatric patients with meningoencephalitis in the PICU room at Aji Muhammad Parikesit Tenggara Regional Hospital, warm lemongrass compress intervention has been proven to be effective in reducing body temperature. The results of the study showed that pediatric patients who received the lemongrass warm compress intervention experienced a significant decrease in body temperature of 2-4°C for 3 days of intervention. This shows that this intervention is effective in reducing body temperature in patients with meningoencephalitis. In addition, there were no significant side effects during the lemongrass warm compress intervention.



Effectiveness of Lemongrass Warm Compress Intervention in Pediatric Meningoencephalitis Patients with Signs of Hyperthermia in the Picu Room Rsud Aji Muhammad Parikesit Tenggara Hospital

This study shows the important relevance of the lemongrass warm compress intervention in clinical nursing practice in pediatric meningoencephalitis patients. On the first day of intervention, the body temperature was 38.1°C decreased to 36.1°C for 25 minutes, the second day the body temperature was 38.9°C decreased to 36.1°C for 22 minutes and on the third day the body temperature was 39.0°C decreased to 36.1°C for 19 minutes.

IV. CONCLUSIONS

Based on the research results, it can be concluded that warm lemongrass compress intervention is effective in reducing body temperature in pediatric meningoencephalitis patients. This research reveals the importance of using innovative interventions in nursing clinical practice to improve the quality of patient care and prevent serious complications such as seizures and brain tissue damage.

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REFERENCES

- 1) R. Li He, Y. Liu, Q. Tan, and L. Wang, "The rare manifestations in tuberculous meningoencephalitis: a review of available literature," *Annals of Medicine*, vol. 55, no. 1. 2023. doi: 10.1080/07853890.2022.2164348.
- 2) K. Williams, L. Fielding, J. Davis, and D. Martirosyan, "The blockade of Artsakh causing long-term food, nutrition shortage and starvation: How functional food education can help resolve health related conditions," *Functional Foods in Health and Disease*, vol. 13, no. 3, 2023, doi: 10.31989/ffhd.v13i3.1081.
- 3) S. Leuci, N. Coppola, T. Cantile, E. Calabria, L.L. Mihai, and M.D. Mignogna, "Aseptic Meningitis in Oral Medicine: Exploring the Key Elements for a Challenging Diagnosis: A Review of the Literature and Two Case Reports," *International Journal of Environmental Research and Public Health*, vol. 19, no. 7. 2022. doi: 10.3390/ijerph19073919.
- 4) HM Nataprawira et al., "Treatment Outcomes of Childhood Tuberculous Meningitis in a Real-World Retrospective Cohort, Bandung, Indonesia," *Emerg Infect Dis*, vol. 28, no. 3, 2022, doi: 10.3201/eid2803.212230.
- 5) JJ Park et al., "Estimating the global and regional burden of meningitis in children caused by *Haemophilus influenzae* type b: A systematic review and meta-analysis," *J Glob Health*, vol. 12, 2022, doi: 10.7189/jogh.12.04014.
- 6) PJ Dodd et al., "The global burden of tuberculous meningitis in adults: A modeling study," *PLOS Global Public Health*, vol. 1, no. 12, 2021, doi: 10.1371/journal.pgph.0000069.
- 7) UY Madaki, A. Shu'aibu, and MI Umar, "Mathematical model for the dynamics of bacterial meningitis (Meningococcal meningitis): a case study of Yobe State Specialist Hospital, Damaturu, Nigeria," *Gadua Journal of Pure and Allied Sciences*, vol. 2, no. 2, 2023, doi: 10.54117/gjpas.v2i2.19.
- 8) ZH Tharwani et al., "Infant & Child Mortality in Pakistan and its Determinants: A Review," *Inquiry (United States)*, vol. 60. 2023. doi: 10.1177/00469580231167024.
- 9) K. Taux, T. Kraus, and A. Kaifie, "Mercury Exposure and Its Health Effects in Workers in the Artisanal and Small-Scale Gold Mining (ASGM) Sector—A Systematic Review," *International Journal of Environmental Research and Public Health*, vol. 19, no. 4. 2022. doi: 10.3390/ijerph19042081.
- 10) C. Eet et al., "Factors Associated with the Death of Children Aged 0 to 15 Years with Bacterial Meningitis in the Pediatric

Effectiveness of Lemongrass Warm Compress Intervention in Pediatric Meningoencephalitis Patients with Signs of Hyperthermia in the Picu Room Rsud Aji Muhammad Parikesit Tenggarong Hospital

Department of Donka National Hospital," Journal of Biomedical Research & Environmental Sciences, vol. 4, no. 2, 2023, doi: 10.37871/jbres1672.

- 11) J.Figoni et al., "Lyme borreliosis and other tick-borne diseases. Guidelines from the French Scientific Societies (I): prevention, epidemiology, diagnosis," *Medicine et Maladies Infectieuses*, vol. 49, no. 5. 2019. doi: 10.1016/j.medmal.2019.04.381.
- 12) mQneibi et al., "A Comprehensive Review of Essential Oils and Their Pharmacological Activities in Neurological Disorders: Exploring Neuroprotective Potential," *Neurochemical Research*. 2023. doi: 10.1007/s11064-023-04032-5.
- 13) E.JPanakkal, P. Tantayotai, AA Adediran, T. Phusantisampan, and M. Sriariyanun, "Chemical Profiles of Herbal Compress and Their Persistence Affected by Steaming and Storage Time," *J Chem*, vol. 2021, 2021, doi: 10.1155/2021/2743855.
- 14) JR et al. Smith, "The Effect of Warm Lemongrass Compress on Fever Reduction in Pediatric Patients," *Journal of Pediatric Nursing*, Volume 25, Issue 3, pages 123-129., 2018.
- 15) HW et al Chen, "A Comparative Study on the Use of Warm Lemongrass and Cold Compresses in Fever Management," *Journal of Integrative Medicine*, Volume 15, Issue 6, pages 432-439, 2020.
- 16) AAGNes, J. Zlamal, SCW Linnerud, SA Steindal, and MT Solberg, "A Technology-Supported Guidance Model to Increase the Flexibility, Quality, and Efficiency of Nursing Education in Clinical Practice in Norway: Development Study of the TOPP-N Application Prototype," *JMIR Hum Factors*, vol. 10, 2023, doi: 10.2196/44101.
- 17) J. Ghosh, S. Dasgupta, and J.Konar, "A cross-sectional study to estimate the serum level of C-reactive protein among pediatric meningitis with bacterial etiology," *Natl J Physiol Pharm Pharmacol*, no. 0, 2022, doi: 10.5455/njppp.2023.13.11527202216112022.
- 18) V.Bommakanti et al., "An Overview of Herbal Nutraceuticals, Their Extraction, Formulation, Therapeutic Effects and Potential Toxicity," *Separations*, vol. 10, no. 3. 2023. doi: 10.3390/separations10030177.
- 19) D.Widyastuti et al., "Literature Review: Warm Compress with Medicine Plants to Reduce Joint Pain in the Elderly," *Proceedings of the International Conference on Nursing and Health Sciences*, vol. 2, no. 2, 2021, doi: 10.37287/picnhs.v2i2.933.



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The Influence of Celebrity Endorser Credibility on Purchase Intention Mediated By Brand Love and BGBC



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ABSTRACT: This research aims to analyze purchase intention in the influence of celebrity endorser credibility and mediated by brand love and belief in global brand citizenship. The population of this research is Tokopedia marketplace users. with a total sample of 194. The data analysis method uses Structural Equation Model-Partial Least Square (SEM-PLS). The research results found that celebrity endorser credibility has a significant impact on brand love, celebrity endorser credibility has a significant impact on belief in global brand citizenship BGBC, brand love has a significant impact on purchase intention, belief in global brand citizenship BGBC has a significant impact on purchase intention, celebrity endorser credibility has a significant impact on purchase intention. Brand love mediates celebrity endorser credibility on purchase intention. However, BGBC's belief in global brand citizenship, which mediates celebrity endorser credibility, has no influence on purchase intention. This implications of this research are discussed in the article

KEYWORDS: Celebrity Endorser Credibility, Brand Love, Belief in Global Brand Citizenship, Purchase Intention, Marketplace.

I. INTRODUCTION

Along with the development of technology, business, and economic systems in this increasingly advanced era, everyone is innovating to gain profits. With the ease of accessing the internet, buying and selling transactions have increased in use online, resulting in an impact on the daily lives of business owners and consumers. Based on survey results from the Indonesian Internet Service Providers Association (APJII), internet users in Indonesia reached 215.63 million people in the 2022-2023 period, an increase compared to the pre-pandemic 2019-2020 period of 196.71 million people. Source: (Nurhanisah, 2023) Increase This internet penetration is in line with restrictions on community activities during the pandemic caused by Coronavirus Disease 19 or Covid-19.

Various work, study, and shopping activities are increasingly carried out by utilizing digital technology from home. In line with the massive digital acceleration caused by the coronavirus Virus 19 or the COVID-19 pandemic, the number of internet users in Indonesia has increased, including changes in MSME business models and repeat purchases by consumers thereby making the digital world market more promising. When COVID-19 spread to all countries, including Indonesia, the economic ecosystem was paralyzed. Many buying and selling transactions further developed the economy through the latest innovations in digital marketing on all platforms so that the developed businesses could survive and develop. This increase in penetration is still driven by the use of the internet, which is increasingly becoming a necessity for society, resulting in online shopping activities through various e-commerce. People can shop to fulfill their needs without going to a shop but by accessing it via smartphone from home and then waiting for the goods to be sent home.

Judging from the growth in the number of monthly visitors, during the pandemic, three marketplaces grew the largest in Indonesia. This is indicated by the largest growth in e-commerce visitors, namely Shopee which reached 129 million, Tokopedia 114 million, and Bukalapak 38 million. In online stores, it is certainly more difficult than in offline stores, there is no longer COVID-19/Covid 19 pandemic or PPKM is no longer enforced so you have to compete tightly between online and offline stores to attract consumers' attention, then in online or E-Commerce stores consumers can only look at a product in the photo but cannot touch and see the quality of the product directly. Starting from a simple website, now marketplaces in Indonesia continue to compete to develop various features that can be offered so that they can continue to compete for consumers' attention.

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The Tokopedia marketplace is of particular concern because it has succeeded in endorsing well-known artists such as BTS as its brand ambassadors, Tokopedia's various ways of e-commerce competition are getting tougher, in increasing consumer purchase intention, including celebrity-endorsed credibility, celebrity endorser credibility refers to famous figures or celebrities employed by Tokopedia to promote their brands, one of which is currently loved by young people, namely BTS. BTS, an abbreviation of Bangtan Sonyeon and "Beyond the Scene", is a boy band from South Korea, BTS has become a global superstar who has managed to break countless world records, they also provide a positive influence through activities such as the LOVE MYSELF campaign and the 'Speak speech Yourself' at the UN.

This campaign makes the boy band influence in terms of their influence and ability to create positive change in society globally cannot be ignored, for this reason, Tokopedia is looking at the boy band BTS because it is hoped that they will have an impact on social and the environment at a global level. Tokopedia announced that the South Korean boy group, BTS, will officially become brand ambassadors in 2019. Tokopedia chose BTS as a brand ambassador for a reason, namely that according to William Tokopedia's co-founder and CEO, BTS, with its positive messages that they consistently convey, is in line with Tokopedia's vision. However, in 2020 Tokopedia was in second place after Shopee, and in the first quarter of 2019 Tokopedia was in first place with 137 million visitors, then in the first quarter of 2020, Tokopedia was still in second place with 68.8 million visitors (Dave Tzeliang, 2021).

The decline in visitors after using BTS as Tokopedia brand ambassadors shows that there needs to be a better alignment between expectations or what should happen and what is happening in the field. The research context of celebrity endorser's credibility in the E-Commerce industry is specifically discussed from a branding perspective which focuses on emotional aspects. Then, according to the previous managerial description, the phenomenon generally discussed in previous research is purchase intention. Brand love or love of a brand is a concept that refers to the extent to which consumers feel attached to, have an emotional affiliation with, and are loyal to a brand. This is an important factor in building long-term relationships between brands and customers (Hwang & Kandampully, 2012), brand love is a powerful emotional experience both in terms of interpersonal relationships and the relationship between consumers and brands.

II. LITERATURE REVIEW AND RESEARCH DEVELOPMENT

Based on the stated research objective, namely to determine the influence of celebrity endorser credibility on purchase intention mediated by brand love and belief in global brand citizenship (bgbc). This research uses one independent variable, one dependent variable, and two mediating variables. The theories used in this research are stimulus, organism, and response. Stimulus organism responsive (S-O-R) theory, according to Wu and Li (2018) This theory explains how organisms mediate the relationship between stimulus and response through affective and cognitive mediation mechanisms. The organism is represented by an intermediate state that reflects the psychological processing of environmental cues.

A. The Influence of Celebrity Endorse Credibility on Brand Love

Based on research conducted by (Burnasheva & Suh, 2022) Celebrity Endorse Credibility has a positive and significant effect on brand love. In line with (Trivedi & Sama, 2021) it also shows that celebrity-endorsed credibility has a positive and significant effect on brand love. Based on this statement then

H1: Celebrity Endorse Credibility has a positive and significant influence on Brand Love.

B. The Influence of Celebrity Endorse Credibility on Belief in Global Brand Citizenship (BGBC)

The results (Zhou et al., 2020) show that celebrity-endorsed credibility has a positive and significant effect on belief in global brand citizenship (BGBC). Based on this statement. propose the following hypothesis:

H2: Celebrity-endorsed credibility has a positive and significant influence on Belief in Global Brand Citizenship (BGBC).

C. The Influence of Brand Love on Purchase Intention

Based on the results of research conducted by (Navaneethakrishnan & Sathish, 2020), show that Brand Love has a positive and significant effect on Purchase Intention. In line with research conducted by (Trivedi & Sama, 2021) shows that Brand Love has a significant and influential effect on Purchase Intention. Based on this statement, propose the following hypothesis:

H3: Brand Love has a positive and significant influence on Purchase Intention.

D. The Influence of Belief in Global Brand Citizenship (BGBC) on Purchase Intention

Based on the results of research conducted by (Burnasheva & Suh, 2022), shows that BGBC has a positive and significant effect on Purchase Intention. Based on this statement, we propose the following hypothesis:

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H4: *Belief in Global Brand Citizenship (BGBC) has a positive and significant influence on Purchase Intention.*

E. The Influence of Celebrity Endorse Credibility on Purchase Intention

Based on the results of research conducted by (Wang et al., 2017), shows that celebrity-endorsed credibility has a positive and significant effect on purchase intention. In line with research conducted by (Rodrigues & Rodrigues, 2019) shows that celebrity-endorsed credibility has a significant and influential effect on purchase intention. Based on this statement, we propose the following hypothesis:

H5: *Celebrity endorsement credibility has a positive and significant influence on Purchase Intention.*

F. The Influence of Celebrity Endorse Credibility on Purchase Intention Mediated by Brand Love

Studies show that brand love can mediate this, supported by research conducted by (Rodrigues & Rodrigues, 2019) showing that brand love strengthens purchase intention. Based on this statement, we propose the following hypothesis:

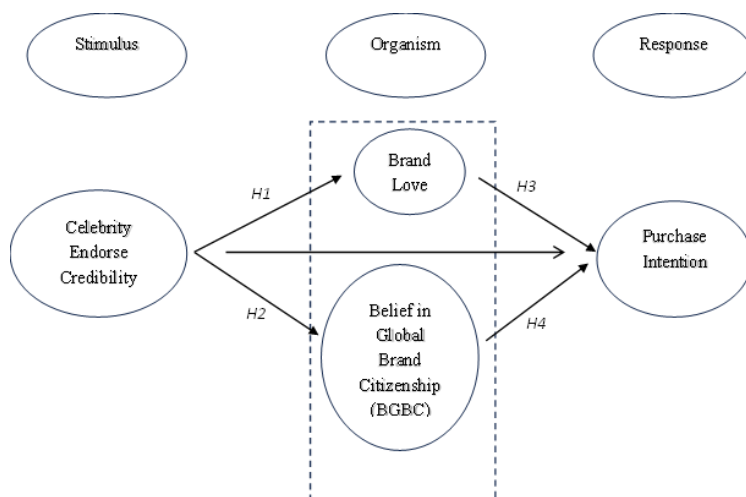
H6: *Brand love mediates celebrity endorsement credibility on Purchase Intention.*

G. The Influence of Celebrity Endorse Credibility on Purchase Intention Mediated by Belief in Global Brand Citizenship (BGBC)

Studies show that belief in global brand citizenship (BGBC) can be a mediator, this is supported by research conducted by (Zhou et al., 2020) showing that belief in global brand citizenship (BGBC) strengthens purchase intention. Based on this statement, we propose the following hypothesis:

H7: *Belief in Global Brand Citizenship (BGBC) mediates celebrity endorsement credibility on Purchase Intention.*

Conceptual Framework



III. METHOD

This research uses quantitative methods with an associative approach, involving a population of active marketplace users with a sample of 270 respondents. Data was collected through an online questionnaire and analyzed using Partial Least Square-Structural Equation Modeling (PLS-SEM), with the evaluation of the outer model, inner model, direct hypothesis test, and mediation test.

IV. RESULT AND DISCUSION

A. Identify of Respondents

Respondent identity is a summary of the objects that are respondents in the research. Before distributing the questionnaire, respondents who used the Tokopedia marketplace were screened so that respondents could get answers that were in line with the objectives of this research. Regarding research identity, respondents were then divided into different categories based on gender, monthly income, age, education, occupation, and domicile. The data in Table 1 below of the respondents in this study is dominated by male respondents, namely 75 respondents and 119 female respondents. monthly income of 4,000,000 to 8,000,000, respondents in this study were dominated by those aged 24 years to 39 years, education level was dominated by undergraduate (S1), namely 71 respondents, followed by Diploma education with 47 respondents. The work is dominated by private employees, namely 69 respondents, and this research conducted a survey of people on the island of Java, including Bekasi 33 respondents, Bogor 21 respondents, Depok 20 respondents, Tangerang 23 respondents, Jakarta 19 respondents, Bandung 25 respondents, Surabaya 16 respondents, Semarang 24 respondents, Yogyakarta 13 respondents.

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Table 1: Identity Of Respondents

Respondent	Sum	Percentage
Information		
Gender		
Man	75	38,7%
Woman	119	61,3%
Total	194	100%
Income		
Less than 4 Million	36	18,6%
4 – 8 Million	66	34,0%
9 – 13 Million	55	28,4%
14 – 18 Million	25	12,9%
19 – 22 Million	10	5,2%
More than 23 Million	2	1,0%
Total	194	100,0%
Age		
15 – 23	43	22,2%
24 – 39	91	46,9%
40 – 55	51	26,3%
Above 55	9	4,6%
Total	194	100,0%
Education		
SMP	5	2,6%
SMA	50	25,8%
Diploma (D1-D4)	47	24,2%
Bachelor (S1)	71	36,6%
Magister (S2)	18	9,3%
Doctor (S3)	3	1,5%
Total	194	100,0%
Work		
Student	27	13,9%
Housewife	8	4,1%
Employee	1	0,5%
Government employees (PNS)	22	11,3%
Government employees	1	0,5%
Private employees	69	35,6%
Retired	4	2,1%
Self-employed	61	31,4%
Entrepreneur	1	0,5%
Total	194	100,0%
Domicile		
Bekasi	33	17,0%
Bogor	21	10,8%
Depok	20	10,3%
Tangerang	23	11,9%
Jakarta	19	9,8%
Bandung	25	12,9%
Surabaya	16	8,2%
Semarang	24	12,4%
Yogyakarta	13	6,7%
Total	194	100,0%

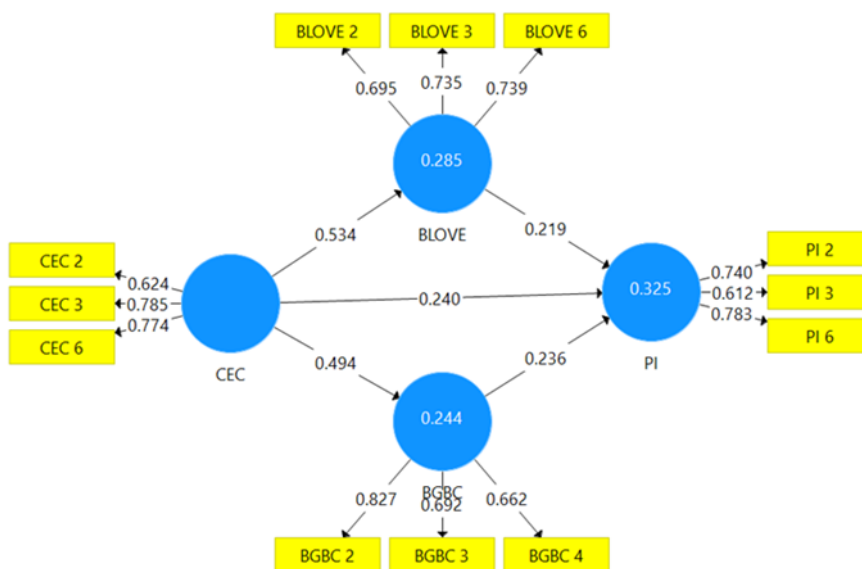
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B. Outer Model Test

Factor Loading

According to Hair et al. (2017), the factor loading value of an indicator is above 0.7 for the targeted construct. However, factor loading values between 0.4 and 0.7 are still acceptable, whereas if the indicator has a factor loading value below 0.4 then it is not accepted and must be removed from the model.

Indicator	Factor Loading	Information
BGBC 2	0.827	Passed Test
BGBC 3	0.692	Passed Test
BGBC 4	0.662	Passed Test
BLOVE 2	0.695	Passed Test
BLOVE 3	0.735	Passed Test
BLOVE 6	0.739	Passed Test
CEC 2	0.624	Passed Test
CEC 3	0.785	Passed Test
CEC 6	0.774	Passed Test
PI 2	0.74	Passed Test
PI 3	0.612	Passed Test
PI 6	0.783	Passed Test



Output PLS Algorithm

Convergent Validity

Convergent Validity relates to the principle that the measures of a construct should be highly correlated. Convergent validity occurs if the scores obtained from two different instruments measuring the same construct have a high correlation (Jogiyanto & Abdillah, 2019). An Average Variance Extracted (AVE) value of 0.5 or more indicates that the average of a construct explains more than the variance of its indicators (Hair et al., 2017). The following are the convergent validity results:

Average Variance Extracted (AVE)

	CEC	BLOVE	BGBC	PI
AVE	0,535	0,523	0,534	0,512

Based on the table above, it shows that each indicator has a factor loading value that matches the recommended value, so it can be declared valid.

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Discriminant Validity

Discriminant Validity tests the extent to which a construct is truly different from other constructs. Discriminant validity can be done through the Fornell-Larcker Criterion, namely comparing the root of the AVE with the correlation between variables. (Ananto et al., 2022). The following are the test results for discriminant validity.

Fornell-Larcker Criterion

	BGBC	BLOVE	CEC	PI
BGBC	0.731			
BLOVE	0.498	0.723		
CEC	0.494	0.534	0.731	
PI	0.463	0.464	0.473	0,715

Based on the table above, it shows that in each category the square root of the AVE for each construct is greater than the correlation between one construct and the other constructs. So it can be stated that it has met the discriminant validity criteria.

C. Inner Model Test

R-Square Test (R²)

	Result
BGBC	0.244
BLOVE	0.285
PI	0.325

Based on the table above, it shows that the variables in each category can be said to be weak. Because according to Ghazali & Latan (2020) a value of 0.75 in R² means good, while a value of 0.50 in R² means moderate and a value of 0.25 in R² means weak. However, Hair et al. (2017) said that an R² value of 0.20 is considered high in scientific disciplines.

Effect Size Test (f²)

Hubungan	f ²	Effect Size
BGBC → CEC	0,323	Big
BLOVE → CEC	0,399	Big
PI → CEC	0,055	Small

Based on the complete category table above, the f² value for the relationship between Belief in Global Brand Citizenship (BGBC) and celebrity endorsed credibility is 0.323, which means it has a large effect size, the f² value between Brand Love (BLOVE) and celebrity endorsed credibility is 0.399, which means it has an effect. large size, while the relationship between purchase intention and celebrity endorsed credibility, the f² value is 0.055, which means it has a small effect size.

Hipotesis Test

Hipotesis	Hubungan	Path Coefficient	Standard Deviation (STDEV)	T-statistics	P-Value	Conclusion
H1	CEC BLOVE	0.534	0.079	6.733	0.000	Accepted
H2	CEC BGBC	0.494	0.105	4.692	0.000	Accepted
H3	BLOVE PI	0.219	0.089	2.457	0.014	Accepted
H4	BGBC PI	0.236	0.104	2.267	0.023	Accepted
H5	CEC PI	0.240	0.102	2.347	0.019	Accepted

Based on the results of the table above, it can be concluded that several direct hypothesis test results are:

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1. Based on hypothesis testing in this research, the T-statistics value was 6.733, the p-value was 0.000, and the path coefficient was 0.534. The T-statistics value is greater than the T-table value of 1.96, the p-value is in accordance with what is recommended, namely less than 0.05, and the path coefficient value shows a positive value. These results indicate that celebrity endorsed credibility (CEC) has a positive and significant effect on brand love (BL) so that **H1 is accepted**.

2. Based on hypothesis testing in this research, the T-statistics value was 4.692, the p-value was 0.000, and the path coefficient value was 0.494. The T-statistics value is more than the T-table value of 1.96, the p-value is in accordance with the recommended value, namely less than 0.05, and the path coefficient value shows a positive value. These results indicate that celebrity endorsement credibility (CEC) has a positive and insignificant effect on belief in global brand citizenship (BGBC) so that **H2 is accepted**.

3. Based on hypothesis testing in this research, the T-statistics value was 2.457, the p-value was 0.014, and the path coefficient value was 0.219. The T-statistics value is more than the T-table value of 1.96, the p-value is in accordance with the recommended value, namely less than 0.05, and the path coefficient value shows a positive value. These results indicate that brand love (BL) has a positive and significant effect on purchase intention (PI) so that **H3 is accepted**.

4. Based on hypothesis testing in this research, the T-statistics value was 2.267, the p-value was 0.023, and the path coefficient value was 0.236. The T-statistics value is more than the T-table value of 1.96, the p-value is in accordance with the recommended value, namely less than 0.05, and the path coefficient value shows a positive value. These results indicate that belief in global brand citizenship (BGBC) has a positive and significant effect on purchase intention (PI) so that **H4 is accepted**.

5. Based on hypothesis testing in this research, the T-statistics value was 2.347, the p-value was 0.019, and the path coefficient value was 0.240. The T-statistics value is greater than the T-table value of 1.96, the p-value is in accordance with what is recommended, namely less than 0.05, and the path coefficient value shows a positive value. These results indicate that celebrity endorsed credibility (CEC) has a positive and significant effect on purchase intention (PI) so that **H5 is accepted**.

Mediation Test

Hipotesis	Hubungan	Path Coefficient	Standard Deviation (STDEV)	T-statistics	P-Value	Conclusion
H6	CEC -> BLOVE -> PI	0.117	0.051	2.299	0.022	Accepted
H7	CEC -> BGBC -> PI	0.116	0.063	1.835	0.067	Rejected

Based on the results of the table above, it can be concluded that several results of the moderation hypothesis test are:

1. Based on hypothesis testing in this research, the T-statistics value was 2.299, the p-value was 0.022, and the path coefficient value was 0.117. The T-statistics value is greater than the T-table value of 1.96, the p-value is following what is recommended, namely less than 0.05, and the path coefficient value shows a positive value. These results indicate that there is a mediating effect of brand love (BLOVE) between celebrity-endorsed credibility (CEC) on purchase intention (PI) so that **H6 is accepted**.

2. Based on hypothesis testing in this research, the T-statistics value was 1.835, the p-value was 0.067, and the path coefficient value was 0.116. The T-statistics value is greater than the T-table value of 1.96, the p-value does not match the recommended value, namely more than 0.05, and the path coefficient value shows a positive value. These results indicate that there is no mediating effect of belief in global brand citizenship (BGBC) between celebrity-endorsed credibility (CEC) on purchase intention (PI) so **H7 is rejected**.

D. DISCUSSION

The Influence of Celebrity Endorse Credibility on Brand Love

Based on the results of hypothesis testing in this research, it shows that Celebrity Endorse Credibility has a positive and significant effect on Brand Love. The results of this research are in line with research conducted by (Zhang et al., 2020) where the research results show that Celebrity Endorse Credibility has a positive and significant effect on Brand Love. This is because choosing a celebrity endorser who is considered trustworthy, knowledgeable and experienced, the aim is to attract the brand and strengthen consumers' love for the brand.

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The Influence of Celebrity Endorse Credibility on Belief in Global Brand Citizenship

Based on the results of hypothesis testing in this research, it shows that Celebrity Endorse Credibility has a positive and significant effect on Belief in Global Brand Citizenship. The results of this research are in line with research conducted by (Zhou et al., 2020) where the research results show that Celebrity Endorse Credibility has a positive and significant effect on Belief in Global Brand Citizenship. This shows that very popular stars have strong market appeal at the global consumer level in the context of global consumer culture convergence. This also shows the influence of brands introduced by international stars in this case providing a strong endorsement effect on the brand.

The Influence of Brand Love on Purchase Intention

Based on the results of hypothesis testing in this research, it shows that Brand Love has a positive and significant effect on Purchase Intention. The results of this research are in line with research conducted by (Navaneethakrishnan & Sathish, 2020) where the research results show that Brand Love has a positive and significant effect on Purchase Intention. This is because emotional consumers or consumers who are emotionally connected tend to be influenced by love for a brand, thereby forming a strong purchase intention towards a particular brand.

The Influence of Belief in Global Brand Citizenship on Purchase Intention

Based on the results of hypothesis testing in this research, it shows that Belief in Global Brand Citizenship has a positive and significant effect on Purchase Intention.

The Influence of Celebrity Endorse Credibility on Purchase Intention

Based on the results of hypothesis testing in this research, it shows that Celebrity Endorse Credibility has a positive and significant effect on Purchase Intention. The results of this research are in line with research conducted by (Wang et al., 2017) where the research results show that Brand Love has a positive and significant effect on Purchase Intention. This is because emotional consumers or consumers who are emotionally connected tend to be influenced by love for a brand, thereby forming a strong purchase intention towards a particular brand.

The Influence of Celebrity Endorse Credibility on Purchase Intention mediated by Brand Love

Based on the hypothesis test in this research, it shows that there is a mediating effect of Brand Love between Celebrity Endorse Credibility and Purchase Intention.

The Influence of Celebrity Endorse Credibility on Purchase Intention mediated by Belief in Global Brand Citizenship

Based on the hypothesis test in this research, it shows that there is no mediating effect of Belief in Global Brand Citizenship between Celebrity Endorse Credibility and Purchase Intention.

V. CONCLUSION

Based on the analysis and discussion, the following conclusions can be drawn:

1. The significant influence of Celebrity Endorse Credibility on Brand Love shows that the influence of celebrities, in this case K-Pop BTS, has an impact on consumers because the presence of credible celebrities is a key element in forming strong emotional bonds with brands.
2. The significant influence of Celebrity Endorse Credibility on Belief in Global Brand Citizenship, this shows that consumers tend to believe more in the global social responsibility of a brand when the chosen celebrity endorser is considered credible. This creates a huge opportunity for companies looking to strengthen their brand image as responsible global citizens.
3. The significant influence of Brand Love on Purchase Intention, shows that a high level of Brand Love positively and significantly influences the intention to make a purchase. Respondents who feel a strong emotional bond with a brand tend to be more inclined to consider and involve themselves in purchasing transactions. This illustrates the importance of building positive and meaningful relationships between consumers and brands to stimulate purchasing behavior.
4. The significant influence of Belief in Global Brand Citizenship on Purchase Intention, consumer awareness of the brand's social and environmental initiatives has a positive impact on their purchasing decisions. Therefore, companies can utilize marketing strategies that reinforce their commitment to global social responsibility to increase trust and motivate consumers to contribute through purchases.
5. The significant influence of Celebrity Endorse Credibility on Purchase Intention, shows that consumers tend to be more inclined to consider and buy products or services endorsed by celebrities who are considered credible. Therefore, companies can view the selection of celebrity endorsers as a strategic investment in motivating consumers to participate in purchasing activities.

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6. The significant influence of Celebrity Endorse Credibility on Purchase Intention in brand love mediation, shows that consumer trust in celebrity credibility not only creates a direct emotional connection with the brand but also forms purchase intentions through the Brand Love mediation mechanism.
7. There is no influence of Celebrity Endorse Credibility on Purchase Intention as mediated by belief in global brand citizenship

REFERENCES

- 1) Alamsyahbana, M. I., Gizta, A. D., Novrina, P. D., Sarazwati, R. Y., Fauzar, S., Meifari, V., Chandra, R. F., Kusumah, S., Santoso, N. K., Fauzi, Nasution, U. O., Saputra, N. C., Shindy, G. T., & Tahir, I. B. (2023). METODOLOGI PENELITIAN KUANTITATIF DAN KUALITATIF (S. Bahri, Ed.). MEDIA SAINS INDONESIA.
- 2) Albert, N., Merunka, D., & Valette-Florence, P. (2008). When consumers love their brands: Exploring the concept and its dimensions. *Journal of Business Research*, 61(10), 1062–1075. <https://doi.org/10.1016/j.jbusres.2007.09.014>
- 3) Burnasheva, R., & Suh, Y. G. (2022). The moderating role of parasocial relationships in the associations between celebrity endorser's credibility and emotion-based responses. *Journal of Marketing Communications*, 28(4), 343–359. <https://doi.org/10.1080/13527266.2020.1862894>
- 4) Catharina Clara. (2023). Celebrity Endorsements And Its Brand Love On Purchase Intention At E-Marketplace. *Jurnal Manajemen*, 27(1), 41–61. <https://doi.org/10.24912/jm.v27i1.1078>
- 5) Chandra, T., & Priyono. (2022). *Statistika Deskriptif*. CV. Literasi Nusantara Abadi.
- 6) Cho, W. C., Lee, K. Y., & Yang, S. B. (2019). What makes you feel attached to smartwatches? The stimulus–organism–response (S–O–R) perspectives. *Information Technology and People*, 32(2), 319–343. <https://doi.org/10.1108/ITP-05-2017-0152>
- 7) Dave Tzeliang. (2021). Pengaruh Pesan Iklan Tokopedia #DiRumahAjaDulu terhadap Minat Beli Followers Instagram Tokopedia Selama Pandemi Covid19:(Survei pada Followers Instagram Tokopedia) (Doctoral dissertation, Universitas Multimedia Nusantara).
- 8) Ferreira, P., Rodrigues, P., & Rodrigues, P. (2019). Brand Love as Mediator of the Brand Experience-Satisfaction-Loyalty Relationship in a Retail Fashion Brand. *Management and Marketing*, 14(3), 278–291. <https://doi.org/10.2478/mmcks-2019-0020>
- 9) Gammoh, B. S., Koh, A. C., Okoroafo, S. C., & ELSamen, A. A. (2015). Antecedents of Belief in Global Citizenship: A Two-Country Empirical Investigation. *Journal of Global Marketing*, 28(1), 52–66. <https://doi.org/10.1080/08911762.2014.959630>
- 10) Ghozali, I., & Latan, H. (2020). *Partial Least Squares: Konsep, Teknik, dan Aplikasi Menggunakan Program SmartPLS 3.0* (2nd Ed). Badan Penerbit - UNDIP.
- 11) Gusti, I., Febriati, A. U., Nyoman, N., & Respati, R. (2020). The Effect of Celebrity Endorser Credibility and Product Quality Mediated by Brand Image on Purchase Intention. In *American Journal of Humanities and Social Sciences Research* (Issue 3). www.ajhssr.com
- 12) iPrice. (2023). *Persaingan Toko Online di Indonesia*. IPrice. <https://iprice.co.id/insights/mapofecommerce/>
- 13) Jogiyanto, & Abdillah, W. (2019). *Konsep dan Aplikasi PLS (Partial Least Square) Untuk Penelitian Empiris* (Edisi Pertama). BPFE.
- 14) Julia, A., Matunni'mah, K., Yulianti, N. S., & Hardini, R. (2022). Cinta itu Membutakan: Moderasi Mediasi Pengaruh Sosial dan Brand Ambassador pada Brand Love dan Niat Membeli. *Oikonomia: Jurnal Manajemen*, 18(2), 109. <https://doi.org/10.47313/oikonomia.v18i2.1556>
- 15) Kim, H. , S. K. S. and L. U. K. (2013). "Effects of collaborative online shopping on shopping experience through social and relational perspectives. *Information and Management*, 50, 169–180.
- 16) Kristen Petra, U., & Irena Suriyadi, F. (2021). PENGARUH PERCEIVED INFORMATION QUALITY, DAN ENDORSER CREDIBILITY TERHADAP PURCHASE INTENTION DENGAN BRAND TRUST SEBAGAI VARIABEL INTERVENING; PRODUK SCARLETT WHITENING.
- 17) Lin, C., & Lekhawipat, W. (2014). Factors affecting online repurchase intention. *Industrial Management & Data Systems*, 114(4), 597–611. <https://doi.org/10.1108/IMDS-10-2013-0432>

The Influence of Celebrity Endorser Credibility on Purchase Intention Mediated By Brand Love and BGBC

- 18) Mai Nguyen, Q., Minh City, C., Van Bao, N., Vap District, G., Chi Minh City, H., Nam Thi Phuong Thanh Nguyen, V., Nguyen Dinh Chieu, C., & Nam, V. (2020). Develop Brand Love for Fashion Brands in Viet Nam. *International Journal of Management (IJM)*, 11(6), 1336–1346. <https://doi.org/10.34218/IJM.11.6.2020.122>
- 19) Mulyawati, S., Baiq, H. R., & Sudiartha, H. (2020). The International Journal of Social Sciences World The Relationship between Celebrity Endorsement, Brand Experience, Brand Love, and Brand Emotional Value of Nature Republic Cosmetics. <https://doi.org/10.5281/zenodo.3900126>
- 20) Narimawati, U., Sarwono, J., Affandi, A., & Priadana Sidik. (2020). Ragam Analisis dalam Metode Penelitian Untuk Penulisan Skripsi, Tesis dan Disertasi (R. I. Utami, Ed.). CV ANDI OFFSET.
- 21) Navaneethakrishnan, K., & Sathish, A. S. (2020). It's all about brand love- expressing through purchase intention, brand trust and brand attitude. In *Journal of Critical Reviews* (Vol. 7, Issue 4, pp. 314–318). Innovare Academics Sciences Pvt. Ltd. <https://doi.org/10.31838/jcr.07.04.58>
- 22) Nurhanisah, Y. (2023). Pengguna Internet di Indonesia Makin Tinggi. *Indonesiabaik*. <https://indonesiabaik.id/infografis/pengguna-internet-di-indonesia-makin-tinggi>
- 23) NurulAndini, P., & Tri Lestari, M. (2021). ENGARUH BRANDAMBASSADOR DAN BRAND IMAGE TERHADAPMINAT BELI PENGGUNAAPLIKASI TOKOPEDIA. *E-Proceeding of Management*, 8, 2074–2082.
- 24) Riset, I. (2023). Persaingan Toko Online di Indonesia. *Iprice*. <https://iprice.co.id/insights/mapofecommerce/>
- 25) Rocha-Vallejos, K. H., Rabanal-Altamirano, S. N., Robles-Fabian, D. A., & Cordova-Buiza, F. (2022). Does brand love strictly increase purchase intention? The case of Linio. *Innovative Marketing*, 18(4), 36–47. [https://doi.org/10.21511/im.18\(4\).2022.04](https://doi.org/10.21511/im.18(4).2022.04)
- 26) Rodrigues, C., & Rodrigues, P. (2019). Brand love matters to Millennials: the relevance of mystery, sensuality and intimacy to neo-luxury brands. *Journal of Product and Brand Management*, 28(7), 830–848. <https://doi.org/10.1108/JPBM-04-2018-1842>
- 27) Sallam, M. A. (2014). The Effects of Brand Image and Brand Identification on Brand Love and Purchase Decision Making: The Role of WOM. *International Business Research*, 7(10). <https://doi.org/10.5539/ibr.v7n10p187>
- 28) Selular. (2023). Kota Paling Banyak Jumlah Pembelanja Online . Selular. <https://selular.id/2018/06/5-kota-ini-paling-banyak-jumlah-pembelanja-online/>
- 29) Sihombing, P. R., & Arsani, A. M. (2022). Analisis SmartPLS Untuk Statistisi Pemula (Pertama). DewanggaPublishing.
- 30) Sugiyono. (2019). Metode Penelitian Kuantitatif, Kualitatif, dan R&D. Alfabeta.
- 31) Trivedi, J. (2020). Effect of corporate image of the sponsor on brand love and purchase intentions: The moderating role of sports involvement. *Journal of Global Scholars of Marketing Science: Bridging Asia and the World*, 30(2), 188–209. <https://doi.org/10.1080/21639159.2020.1717978>
- 32) Trivedi, J., & Sama, R. (2021). Determinants of consumer loyalty towards celebrity-owned restaurants: The mediating role of brand love. *Journal of Consumer Behaviour*, 20(3), 748–761. <https://doi.org/10.1002/cb.1903>
- 33) Verma, P. (2021). The Effect of Brand Engagement and Brand Love upon Overall Brand Equity and Purchase Intention: A Moderated –Mediated Model. *Journal of Promotion Management*, 27(1), 103–132. <https://doi.org/10.1080/10496491.2020.1809591>
- 34) Wang, S. W., Kao, G. H. Y., & Ngamsiriudom, W. (2017). Consumers' attitude of endorser credibility, brand and intention with respect to celebrity endorsement of the airline sector. *Journal of Air Transport Management*, 60, 10–17. <https://doi.org/10.1016/j.jairtraman.2016.12.007>
- 35) Wisnu Wardhana, H., Wahab, Z., & Saggaff Shihab, M. (2021a). Coopetition : Jurnal Ilmiah Manajemen Pengaruh Electronic Word Of Mouth (E-Wom) Dan Celebrity Endorsement Terhadap Minat Beli Konsumen Pada E-Commerce Zalora dengan Brand Image Sebagai Variabel Mediasi. *Jurnal Ilmiah Manajemen*. www.Zalora.co.id,
- 36) Wisnu Wardhana, H., Wahab, Z., & Saggaff Shihab, M. (2021b). Coopetition : Jurnal Ilmiah Manajemen Pengaruh Electronic Word Of Mouth (E-Wom) Dan Celebrity Endorsement Terhadap Minat Beli Konsumen Pada E-Commerce Zalora dengan Brand Image Sebagai Variabel Mediasi. www.Zalora.co.id,
- 37) Wu, Y. L., & Li, E. Y. (2018). Marketing mix, customer value, and customer loyalty in social commerce: A stimulus-organism-response perspective. *Internet Research*, 28(1), 74–104. <https://doi.org/10.1108/IntR-08-2016-0250>
- 38) Yasin, M., & Shamim, A. (2018). Brand Love: Mediating Role in Purchase Intentions and Word-of-Mouth. In *IOSR Journal of Business and Management (IOSR-JBM)* (Vol. 7, Issue 2). www.iosrjournals.org

The Influence of Celebrity Endorser Credibility on Purchase Intention Mediated By Brand Love and BGBC

- 39) Zhang, H., Xu, H., & Gursoy, D. (2020). The effect of celebrity endorsement on destination brand love: A comparison of previous visitors and potential tourists. *Journal of Destination Marketing and Management*, 17. <https://doi.org/10.1016/j.jdmm.2020.100454>
- 40) Zhou, F., Mou, J., Su, Q., & Jim Wu, Y. C. (2020). How does consumers' Perception of Sports Stars' Personal Brand Promote Consumers' brand love? A mediation model of global brand equity. *Journal of Retailing and Consumer Services*, 54. <https://doi.org/10.1016/j.jretconser.2019.102012>



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Evaluation of School Health Effort Program in Kapanewon Jetis Bantul Elementary School



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ABSTRACT: In general, this research aims to determine the evaluation of context, input, process and product in the Infirmary Program in the elementary schools located in Jetis District, Bantul Regency.

The research would be conducted by using the CIPP evaluation method (context, input, process, and product). The research instrument was an observation sheet and a questionnaire. The research subjects were the school principals, infirmary nurses, and the students of elementary schools located in Jetis District, Bantul Regency. The method of data analysis used a statistical descriptive technique with percentage formula.

The results of the research on the contextual evaluation conclude that the problem at the elementary schools located in Jetis District, Bantul Regency show that there are still students who do not apply clean and healthy living behaviors and the infirmary room which is not completed with medicines, the infirmary room does not yet have a management structure. the infirmary program is about health education, health services, improving the quality of personnel, procuring facilities and infrastructure, and fostering a healthy school environment. The results of the research on Input Evaluation can be concluded that it is clear that all schools already have an infirmary facility, yet from the findings it shows that the facilities and equipment are still very minimal and the role of the teacher has not been fully maximized. The results of the process evaluation conclude that the evaluation of the Infirmary Program based on the school principal state that it is very good, as the evaluation of the infirmary program based on the supervisor states that it good, the evaluation of the infirmary program based on students states that it is very good. The results of the product evaluation conclude that the elementary school infirmary program in the elementary schools located in Bantul Regency covers 3 (three) aspects: health education, health services and fostering a healthy environment.

KEYWORDS: Evaluation of the Infirmary Program, Elementary Schools located in Jetis District, Bantul Regency.

I. INTRODUCTION

Schools are educational institutions that strive to improve the quality of Indonesian human beings. Rahmawaty (2019: 29) states that schools are basically a fundamental organization that has an impact not only on education, but also provides opportunities to improve the health of its students to be able to participate in society.

School-based health efforts have a potential impact on improving health through a health promoting school concept. Simovska (2012: 84) states that the idea of "health promoting schools" has been used for more than 30 years. The idea emerged in Europe in the early 1980s and was further elaborated at the World Health Organization (WHO) Health Promoting Schools Symposium in Scotland in 1986 as well as a few years later in a publication entitled The Healthy School.

School-based health promotion in Indonesia is implemented in the School Health Effort (UKS). School health effort is an integrated cross-program and cross-sector effort to improve the ability to live a healthy life and subsequently form healthy and clean living behaviors for students and school residents (Hidayat & Argantos, 2020). UKS serves as the main channel of health coaching for students (Prasetyo, 2014).

The importance of UKS for improving the health status of students has not been followed by efforts to implement it optimally. This is generally the case in many schools. Valois (2015: 270) summarizes the opinions and results of previous research that although research shows that learners' health status and academic achievement are "closely related", many school administrators and government agencies are not yet convinced that improving learners' health status can lead to improved academic success, or they see too many barriers to implementation. Scarce resources and an increased focus on school academic accountability have forced many administrators to narrow curricula and limit services.

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Nurochim & Nurochim (2020: 85) reviewed various previous studies, stating that there are still problems related to the implementation of UKS. This is mainly related to children's understanding of health, the concept of healthy living and the concept of understanding nutritious food that is not good; the incomplete facilities and infrastructure of the UKS; and the poor understanding of teachers about the importance of UKS.

The suboptimal implementation of UKS has an impact on the formation of good health behavior in students. This is as revealed by the results of research by Nguyen et al. (2016) on the implementation of school health promotion on oral health, has not improved the oral health behavior of school children.

The non-optimal implementation of UKS was also found in several elementary schools in Kapanewon Jetis. The results of a preliminary study conducted by researchers on August 11, 2022 in several elementary schools found that schools have not paid more attention to the implementation of UKS. UKS managers are teachers and some are sports teachers. The UKS functions more as a place of rest and or first aid for students who experience pain while participating in learning at school. Therefore, the researcher wants to examine the "Evaluation of the Implementation of the School Health Effort Program at the Elementary School Level in Kapanewon Jetis Bantul".

II. METHOD

This research will use the CIPP evaluation method (context, input, process, and product). The use of the CIPP method is determined because this method is in accordance with the research problem and is aimed at managers who have authority over the sustainability of the program. Context evaluation is an evaluation that assesses the overall perspective of the program. Input evaluation will assess the human resources appointed or mandated as administrators of the School Health Business program. Process evaluation assesses the implementation process. Product evaluation is about healthy lifestyle habits applied by students.

The place and time of implementation in elementary schools in Kapanewon Jetis Bantul Regency. The samples in this study were five public schools and two private schools. SDN Barongan 1, SDN Barongan 2, SDN 1 Patalan, SDN 1 Sumber Agung, SDN Bakulan, SD Muh Blawong 1 and SD Muh Blawong 2.

Table 1. research sample

Sample	Role
Barongan 1 State Elementary School	Principal Teacher coach Three upper grade students
Barongan 2 State Elementary School	Principal Teacher coach Three upper grade students
Patalan 1 State Elementary School	Principal Teacher coach Three upper grade students
Sumber Agung 1 State Elementary School	Principal Teacher coach Three upper grade students
Bakulan 1 State Elementary School	Principal Teacher coach Three upper grade students
Muhammadiyah Blawong 1 Elementary School	Principal Teacher coach Three upper grade students
Muhammadiyah Blawong 2 Elementary School	Principal Teacher coach Three upper grade students

The techniques used are questionnaire techniques and interviews only as supporting factors. Quantitative Analysis Based on Sugiyono (2017: 29), quantitative analysis serves to describe or describe the object to be studied through sample or population

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data as it is, without analyzing and making general conclusions. If all the data has been collected, the next step is to analyze the data so that the data can be drawn a conclusion with category calculations.

Calculation of data analysis by finding the relative frequency percentage. With the following formula (Sudijono, 2015: 40):

$$P = \frac{F}{N} \times 100\%$$

Description:

P = Percentage sought (Relative Frequency)

F = Frequency

N = Number of Respondents

The success criteria for quantitative data, namely from each aspect of context, input, process and product are in the good and very good categories.

Table 2. Table of Success Criteria

No	Interval	Criteria
1	3,26 – 4,00	Very Good
2	2,51 – 3,25	Good
3	1,76 – 2,50	Less
4	1,75 – 1,0	Very Less

III. RESEARCH RESULT

The evaluation research of the School Health Effort program at the primary school level in Kapanewon Jetis Bantul Regency was conducted using interviews and questionnaires as data sources. The results of this study can be explained as follows: The context evaluation program includes descriptions and specifications about the program environment, unmet needs, characteristics of the population and sample of individuals served, and the objectives of the program itself. In the evaluation research of the primary school health effort program in Kapanewon Jetis, Bantul Regency, it was found that some primary schools in the area still have students who have not implemented clean and healthy living behaviors. The program evaluation showed that most students responded well to the program, but some schools still had shortcomings in terms of complete medicines and a clear UKS management structure. In Bantul, based on the students, 10 children (47.62%) stated that it was very good, 10 children (47.62%) stated that it was good, and 1 child (4.76%) stated that it was lacking in some schools that had a UKS room. The UKS supervisors in some primary schools are sports teachers and they have difficulties in running the UKS program due to the lack of awareness of some teachers and the absence of UKS management. To evaluate the UKS activity program,

Primary schools in Kapanewon Jetis Bantul Regency hold coordination meetings and evaluate existing programs. The UKS program itself includes health education, health services, improving the quality of personnel, procuring facilities and infrastructure, and fostering a healthy school environment, as mentioned by the Ministry of Education and Culture.

In the input evaluation, researchers evaluated the resources available in the school, including students, teachers, and teaching and learning facilities and infrastructure. This research focuses on the state of facilities and infrastructure as well as the role of the primary school community in Kapanewon Jetis, Bantul Regency. Although all primary schools in Kapanewon Jetis Bantul Regency have a UKS room, it was found that the facilities and equipment in the UKS are still very minimal. Some schools did not even have weight and height measuring instruments or adequate medicine. The evaluation of human resources showed the lack of role of UKS coaches and the absence of UKS management, which impacted on the performance of UKS in schools.

At the Evaluation stage, the aim is to assess the implementation of the program in real activities in the field. The focus of this research is on teacher activities, learner activities, teaching processes and assessments conducted by teachers in the UKS program. Researchers conducted observations and assessments from the school principal, UKS coach, and several students regarding the implementation of the UKS program. The process evaluation was conducted by giving questionnaires to principals, UKS coaches, and some students to provide information related to the evaluation of the UKS program in elementary schools in Kapanewon Jetis Bantul Regency.

The results of the process research, the UKS program in primary schools in Kapanewon Jetis Bantul Regency, based on the opinion of the principal showed that 4 principals (57.14%) stated very good, and 3 principals (42.85%) stated good. Based on the opinion of the UKS coach, 5 teachers (71.43%) stated good, and 2 teachers (28.57%) stated very good. Meanwhile, based on the opinion of upper grade students, 10 children (47.62%) stated very good, 10 children (47.62%) stated good, and 1 child (4.76%) stated less.

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I will present the following based on the table:

a. School Principal

The results of the research on the evaluation of the school health effort program at the primary school level in Kapanewon Jetis Bantul Regency based on the opinion of the school principal in this study are described as follows:

Table 3. Description of Research Results on Evaluation of the UKS Program (Principal)

Interval	Category	Total	Percent (%)
3,26 – 4,00	Very Good	4	57,14286
2,51 – 3,25	Good	3	42,85714
1,76 – 2,50	Less	0	0
1,0 – 1,75	Very Less	0	0
Total		7	100

The results of the evaluation of the school health effort program at the primary school level in Kapanewon Jetis Bantul Regency were 4 principals (57.14%) categorized as very good, as many as 3 principals (42.85%) stated good.

2. UKS coach

The results of the research data on the evaluation of the school health effort program at the primary school level in Kapanewon Jetis Bantul Regency based on the opinion of the UKS coach can be seen in the table below:

Table 4. Description of Research Results of UKS Program Evaluation (UKS Supervisor)

Interval	Category	Total	Percent (%)
3,26 – 4,00	Very Good	2	28,57143
2,51 – 3,25	Good	5	71,42857
1,76 – 2,50	Less	0	0
1,0 – 1,75	Very Less	0	0
Total		7	100

Based on the results of the evaluation of the school health effort program at the primary school level in Kapanewon Jetis Bantul Regency based on the opinion of the UKS coach as many as 5 teachers (71.43%) categorized as good, as many as 2 teachers (28.57%) stated very good.

b. Upper grade students

The results of research on the evaluation of school health effort programs at the primary school level based on several students in Kapanewon Jetis Bantul Regency in this study are described as follows:

Table 5. Description of Research Results on Evaluation of the UKS Program (students)

Interval	Category	Total	Percent (%)
3,26 – 4,00	Very Good	10	47,62
2,51 – 3,25	Good	10	47,62
1,76 – 2,50	Less	1	4,76
1,0 – 1,75	Very Less	0	0
Total		21	100

The results of the evaluation of the school health effort program at the primary school level in Kapanewon Jetis Bantul Regency based on students obtained as many as 10 children (47.62%) stated very good, as many as 10 children (47.62%) stated good, and as many as 1 child (4.76%) stated less.

Discussion

School Health Effort (UKS) is a government program that is highly prioritized in the health sector. Through the implementation of UKS from an early age, students are expected to be able to practice a healthy lifestyle from an early age. The UKS program is very good and necessary in educational institutions to provide health education from an early age. In the UKS program there is a TRIAS program (L. M. Sari, 2020).

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Primary schools in Kapanewon Jetis already have a UKS room and implement the UKS program. However, there are still schools that run the UKS program poorly. Based on the evaluation results, only 10 students were categorized as good and 1 student was lacking. The evaluation of the UKS coach showed that 71.43% of schools were categorized as good and 28.57% as very good, while the evaluation of the school principal showed that there were four very good schools and three good schools.

The UKS program is very important to be implemented in schools. The program includes health education, health services and a healthy school environment. It helps students understand that health is an important factor that must be maintained and improved, especially after the Covid-19 pandemic. Health is a real investment for the future. Although the UKS program has been well implemented in Kapanewon Jetis Primary School, there are still some obstacles and problems in its implementation.

The context evaluation shows that some primary schools in Kapanewon Bantul Regency have established a UKS program quite well. However, some schools still do not have a clear and good UKS program. The UKS program is to check the general health of students and school residents, provide counseling on disease symptoms, conduct First Aid for Accidents (P3K), and supervise school hygiene.

The results of the input evaluation show that the role of the UKS coach has not been maximized, the facilities and infrastructure are not adequate, and the role of students is still not optimal. The UKS coach is still not optimal in implementing the UKS program that has been made, while some of the implementations carried out include health checks and providing First Aid for Accidents (P3K). Inadequate facilities and infrastructure support is also an obstacle in implementing the UKS program.

Health checks were carried out by primary schools in Kapanewon, Bantul Regency in collaboration with the school. The funds for the examination were obtained from the Education, Youth and Sports Office of Yogyakarta Province, but were not always available, causing the implementation of the examination to be irregular and often stopped. The inspection funds were obtained by the school from the DIY Provincial Education, Youth and Sports Office. However, the funds are not always available, causing the implementation of the inspection to not run regularly and temporarily stop. In addition, the Healthy School Environment Development consists of conducting school cleaning activities by doing community service and making a picket schedule for each class, arranging the yard, doing shading or greening by planting trees in the school environment, and also making a live pharmacy.

The evaluation process of UKS activities showed good results based on the opinions of the school principal, UKS coach, and students. In the researcher's observation, the facilities that support the implementation of the UKS are mostly in good condition and functioning properly. The majority of students involved in UKS activities are members of health extracurricular activities such as the Youth Red Cross and the Center. Students consider the UKS as a place of referral when they are sick, and they feel many benefits when involved in UKS activities. However, the implementation of a comprehensive UKS program requires a partnership with parents for maximum results.

Evaluation of UKS products is very important to determine the success of the program. However, the school has not set a time for evaluation this year so there is little information obtained by researchers. A product, such as UKS, will not function properly without proper follow-up. The UKS program in primary schools in Kapanewon Jetis, Bantul Regency cannot be successful if it is not implemented properly.

IV. CONCLUSIONS

The results of the research evaluation of the school health effort program in Kapanewon Jetis Bantul Regency are:

Evaluation of context: It was found that there were still students who did not apply clean and healthy living behavior as many as 10 children (47.62%) stated very good, as many as 10 children (47.62%) stated good, and as many as 1 child (4.76%) stated less. The UKS room is also not equipped with medicines, and does not have a management structure. The UKS program includes health education, health services, improving the quality of personnel, procuring facilities and infrastructure, and fostering a healthy school environment.

Evaluation of inputs: All schools in Kapanewon Jetis already have a UKS, but there is still a lack of facilities and equipment in the UKS, with only hansaplas, betadine, and some schools do not even provide these medicines. The role of teachers is also not fully optimized.

Process evaluation: The evaluation of the Health Business Program based on the school principal stated that it was very good, the evaluation of the Health Business Program based on the UKS coach stated that it was good, and the evaluation of the School Health Business Program based on students stated that it was very good. UKS coaches as many as 5 teachers (71.43%) categorized as good, as many as 2 teachers (28.57%) stated very good.

%) stated very good.

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Product evaluation: The School Health Effort Program at the primary school level in Kapanewon Jetis Bantul Regency includes 3 aspects, namely health education, health counseling, and healthy environment development.

REFERENCES

- 1) Apriani, L., & Gazali, N. (2018). Pelaksanaan trias usaha kesehatan sekolah (UKS) di sekolah dasar. *Jurnal Keolahragaan*, 6(1), 20–28. <https://doi.org/10.21831/jk.v6i1.14456>
- 2) Factsheet, S. H. E. (2013). promotion: evidence for effective action Acting for better schools, leading to better lives. 1–7. *Psychiatry*, 50(9), 866–875
- 3) Hidayat, K., & Argantos. (2020). Peran Usaha Kesehatan Sekolah (UKS) Sebagai Proses Prilaku Hidup Bersih dan Sehat Peserta Didik. *Jurnal Patriot*, 2(2), 627–639.
- 4) Indraswari, R., dkk. (2018). Pelaksanaan Trias Usaha Kesehatan Sekolah pada Tingkat Sekolah Dasar di Wilayah Tembalang Kota Semarang. *Jurnal Kesehatan Masyarakat*, Volume 6, Nomor 1, Januari 2018.
- 5) Kemendikbud. (2012). Pedoman Pelaksanaan UKS di Sekolah. Dirjen Pendidikan Dasar, Kemendikbud.
- 6) Kemendikbud. (2014). Pedoman Pelaksanaan UKS di Sekolah. Jakarta: Kementerian Pendidikan dan Kebudayaan Direktorat Jenderal Pendidikan Dasar.
- 7) Kemenkes RI. (2018). Petunjuk Teknis Pelaksanaan Sekolah/ Madrasah Sehat Tingkat SD/MI. Jakarta: Kementerian Kesehatan RI Direktorat Jenderal Kesehatan Masyarakat.
- 8) Kurnia, R. (2017). Pedoman Usaha Kesehatan Sekolah. Jakarta: Bee Media Pustaka Lifson, S. S. (2015). Introduction to Health Education. *American Journal of Public Health and the Nations Health*, 39(4), 538–539. <https://doi.org/10.2105/ajph.39.4.538-b>
- 9) Ministry of Health and Medical Services. (2021). Health Promoting School Setting Implementation Guideline (Issue May).
- 10) Nguyen, T. T., Nguyen, B. B. T., Nguyen, M. S., Olak, J., & Saag, M. (2016). Effect of School Oral Health Promotion Programme on Dental Health and Health Behaviour in Vietnamese Schoolchildren. *Pediatric Dental Journal*, 26(3), 1– 7. <https://doi.org/10.1016/j.pdj.2016.09.001>
- 11) Noya, P. (1983). Primary School Health Teacher Guidelines. Jakarta: PT Rorakarya. [8]
- 12) Nugroho, E., Mentari, T. S., Nastiti, G. S. S., & Lambang, A. P. (2018). Evaluation of Health Program Using Fresh Instruments As An Effort to Make A Friendly School for Children In Semarang City. The 4th International Seminar on Public Health Education (ISPHE 2018), 12, 1–6. <https://doi.org/10.2991/isphe-18.2018.1>
- 13) Nurochim, S. N., & Nurochim. (2020). Sosialisasi Pentingnya Usaha Kesehatan Sekolah (UKS) di Sekolah Berbasis Pesantren di Wilayah Jabodetabek. *RESWARA: Jurnal Pengabdian Kepada Masyarakat*, 1(2), 84–90. <https://doi.org/10.46576/rjpk.v1i2.572>
- 14) Organization, W. H. (2021). WHO guideline on school health services. Rahmawaty, E. (2019). Evaluasi Program Usaha Kesehatan Sekolah (UKS) pada
- 15) Sekolah Lanjutan Tingkat Atas. Quality : *Jurnal Kesehatan*, 13(1), 28–35. <https://doi.org/10.36082/qjk.v13i1.59>
- 16) Santoso, P., & Setyowati, N. (2020). Hubungan tingkat pengetahuan masyarakat dengan tindakan preventif covid-19. *Jurnal Keperawatan Jiwa*, 8(4), 565– 570.
- 17) Sari, H., Jafar, N., & Malasari, S. (2017). Healthy Environment Development in School Health Units of Public Primary Schools in Bontobahari Bulukumba. *Indonesian Contemporary Nursing Journal*, 1(2), 76–85. <https://doi.org/10.20956/icon.v1i2.3448>
- 18) Sari, L. M. (2020). Pengaruh Program Usaha Kesehatan Sekolah (Uks) Dalam Menciptakan Lingkungan Sehat Di Sman 3 Banjarbaru Tahun 2020. 031.
- 19) Silvia, E., Sari, N., & Chusnatayaini, A. (2019). Program Implementation Analysis of School Health Unit Program in SD Negeri 3 Kepanjen. *Journal of Global Research in Public Health*, 4(2), 212–221.
- 20) Susanto, T., Sulistyorini, L., Wuryaningsih, E. W., & Bahtiar, S. (2016). School Health Promotion: A Cross-Sectional Study on Clean and Healthy Living Program Behavior (CHLB) among Islamic Boarding Schools in Indonesia. *International Journal of Nursing Sciences*, 3(3), 291–298. <https://doi.org/10.1016/j.ijnss.2016.08.007>
- 21) Taylor, R. D., Oberle, E., Durlak, J. A., & Weissberg, R. P. (2017). Promoting positive youth development through school-based social and emotional learning interventions: A meta-analysis of follow-up effects. *Child Development*, 88(4), 1156–1171
- 22) Undang-Undang RI Nomor 23 Tahun 1992 tentang Kesehatan.

Evaluation of School Health Effort Program in Kapanewon Jetis Bantul Elementary School

- 23) Wahengbam, P.P.; Kshetrimayum, N.; Wahengbam, B.S.; Nandkeoliar, T.; Lyngdoh, D. Assessment of oral health knowledge, attitude and self-care practice among adolescents—A state wide cross- sectional study in Manipur, North Eastern India. J. Clin. Diagn. Res. 2016, 10, ZC65–ZC70.



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The Exponential-based Carbon Credit Cap in Carbon Cap-and-Trade Markets



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ABSTRACT: The concept of carbon markets as developed in 1997 by the Kyoto Protocol was a good idea whose adoption and implementation by all counties and states would have significantly reduced the rate of emission of greenhouse gases into the atmosphere. The Carbon markets were proposed to be based on cap-and-trade whose forces of supply and demand would discourage the increase or steady emission of greenhouse gases and force companies to, gradually, revert to the use of clean energy in production. This would promote the net zero carbon emission target. The carbon markets were designed to have a cap whose nature is a specific number for all entities. The number represents the carbon quantity whose regulator would keep reducing until the net zero carbon is achieved. This nature of the cap encourages large emitters of greenhouse gases to shift to other jurisdictions that have soft regulations. It also encourages restructuring into smaller companies whose net emissions could be almost the same or more than before. In this paper, we have proposed an exponential-based cap that would leave little or no room for such market strategies. We have also demonstrated how the proposed cap can be implemented.

KEYWORDS: carbon credit, carbon markets, exponential-based cap, cap-and-trade, global warming

I. INTRODUCTION

The adverse effects of climate change are now here with us. It is mostly felt by the countries in the topical regions. There has been a decrease in agricultural production, an increase in sea level displacing people living near the shores of major water bodies, and adverse effects on the economic situation of people living in developing countries. Animals living in tropical regions have also been affected. See [6,7,8]. All these effects among others affect the livelihoods of humans as well as those of animals and plants which we depend on. A move by the Third Conference of Parties (COP 3) of the United Nations Framework Convention on Climate Change (UNFCCC) to develop the Kyoto Protocol that initiated the concept of carbon trading intending to reduce global warming was the best move in the right direction in salvaging the current worse situation. See [1]. The conference resolutions led to the birth of Carbon markets whose aim was to reduce global warming by reducing the emission of carbon dioxide and other global warming gases into the atmosphere. The carbon market gained traction and most jurisdictions adopted the Idea and passed policies that would see them regulate carbon emissions. Even the major carbon emitters like China and the United States of America adopted the Idea and benefited economically in terms of their GDP and domestic decarbonization. See [5]. This reduced the quantity of emission of gases by some margin and companies changed to low-carbon emission technologies. See [4].

Despite Carbon trading being a milestone towards the reduction in emission of global warming it faced a lot of challenges. Some of them were carbon leakage and prolonged negotiations that delayed implementation. See [2]. There has also been a lack of sound policies, regulations, and laws to support the system. Some jurisdictions experienced a lack of professionals and understanding of carbon finance to push the carbon market agenda. See [9]. The report by the Kyoto Protocol too had some loopholes that would hamper efficient regulation and reduction of emission of carbon into the atmosphere. The possibility of having questionable carbon claims and false self-reporting of emissions is one of them. Another key loophole is one that was created by the nature of carbon markets, cap-and-trade. The cap was supposed to be a specific number that the companies or rather countries have to buy and sell their carbon credits within the given quantity. This type of cap gives the players room to redistribute their investments and explore other areas where the carbon policies are not strict. They would also disintegrate large companies and operate as several small companies with the ability to get a lot of carbon credits. Eventually, the amount of carbon emitted into the atmosphere would remain the same or increase. For this reason, this paper proposes an exponential cap that would not only discourage the redistribution of investment into other territories but also ensure that low emitters cut their

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emission and revert towards green energy as well. The cap would also require the leading emitters to cut their emission by a bigger margin compared to the least carbon emitter.

II. THE EXPONENTIAL-BASED CAP MODEL

In this section, we will provide a general model and then illustrate how we can apply the model to a relevant dataset.

A. General Model

The exponential-based model is generated from the most recently collected data having amounts of greenhouse gas emissions by various entities. The entities could be individual companies, countries, or regions defined by a regulator. The model is based on the following assumptions:

- The entities reporting carbon emissions are grouped and their emissions reported to a regulator
- There is accuracy and honesty in reporting the number of greenhouse gasses emitted
- There is a regulator governing several entities
- The entities are arranged in descending order

The exponential function is given by

$$y(x) = ab^x \dots \dots \dots (2.1)$$

where $a > 0$ is a constant determined by the quantity of greenhouse gases emitted by the largest emitter and $b > 0$ is a base. To generate the model, we first linearize it using the logarithmic transformation. We then apply logarithm functions on $y(x) = y = ab^x$ to get $\ln y = \ln a + x \ln b$. The linear equation becomes

$$Y = A + Bx \dots \dots \dots (2.2)$$

where $Y = \ln y$, $A = \ln a$ and $B = \ln b$. We apply the model to a dataset composed of the name or identity number of the entity and the amount of greenhouse gases being emitted during a specific period. Data is then arranged in descending order. Thereafter, the position of the entity minus 1 is used as a code to represent its corresponding value of x -variable. For instance, the value of the x -variable of the first, second, and third second largest emitters of greenhouse gasses would be 0, 1 and 2 respectively. Using an appropriate tool, the data is fitted to a linear model, the parameters $A = \ln a$ and $B = \ln b$ read and the model in equation (2.1) is generated after a few algebraic manipulations. This model can then be used to create a cap for the carbon credit.

B. Implementation of the Model

To implement the cap, a small shift parameter, h , is added to the function to get

$$g(x) = ab^x + h \dots \dots \dots (2.3)$$

where $h > 0$. The function (2.3) defines the initial cap that is set by the regulator. The successive caps are determined by varying the parameters k and s in the function

$$C(x) = k \cdot ab^x + (h - s) \dots \dots \dots (2.4)$$

where $0 < k < 1$ and $s > 0$.

The parameter k ensures that the leading emitters of greenhouse gases reduce their emission by a relatively bigger margin than the rest while the parameter s ensures that the smallest emitters of carbon reduce their emissions as well. Once the initial cap defined by function (2.3) is created, the regulator will be varying the values of k followed by s leading to a reduction in the level of carbon credits for each entity after each regulation cycle. This kind of cap does not encourage the division of companies emitting larger quantities of greenhouse gases into smaller ones in other jurisdictions because the credit seal is almost closer to everyone in the market.

C. Application of the Model

We have used the data on greenhouse gas emissions by country from the Emissions Database for Global Atmospheric Research of the European Commission. See [3]. For the sake of the application of the model, we used the data on the emission of gases by country for the year 2022.

The data was pre-processed by removing all columns other than the country and the year 2022 columns. Aggregated rows were also removed. The quantities of emissions were then arranged in descending order. The top 5 countries were China, the USA, India, Russia and Brazil. Their emissions were about 15684 megatonnes (Mt), 6017Mt, 3943Mt, 2579Mt and 1310Mt respectively. See [3]. Their corresponding position which was used as the independent variable, x , was 0,1,2,3 and 4 respectively. The corresponding emissions are used as the dependent variable, y . The data was transformed using functions $Y = \ln y$ and then fitted into a linear function (2.2) using Python's Scikit-learn, Numpy, and Pandas libraries. The function was

$$Y = 9.2694 - 0.42906x \dots \dots \dots (2.5)$$

Using the transformations, $A = \ln a$ and $B = \ln b$ where $A \approx 9.2694$ and $B \approx -0.42906$, the values of a and b are computed; $a \approx 10608.33$ and $b \approx 0.6511174$. The fitted exponential function is as follows:

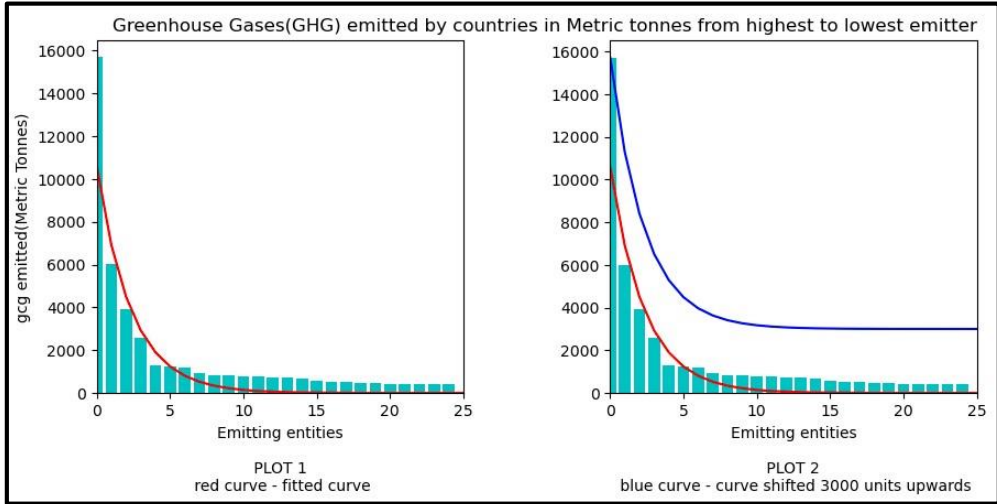
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$$y = 10608.33(0.6511174)^x \dots \dots \dots (2.6)$$

The function (2.6) will vary from one regulator to another based on the quantity of greenhouse gasses emitted by the entities under that regulator. The fitted curve and the amount the greenhouse gasses emitted by the first 25 countries are shown in plot 1 of Figure A.

Having set the basic cap function, (2.6), the regulator will set the first cap by varying the variable h and k of function (2.4). At this point, $s = 0$. For illustration purposes, we have set $h = 3000$ and $k = 1.2$. The resultant graph after a shift of 3000Mt up is shown in plot 2 of Figure A. The graph is in blue. The new function becomes

$$y = 1.2 \cdot 10608.33(0.6511174)^x + 3000 \dots \dots \dots (2.7)$$



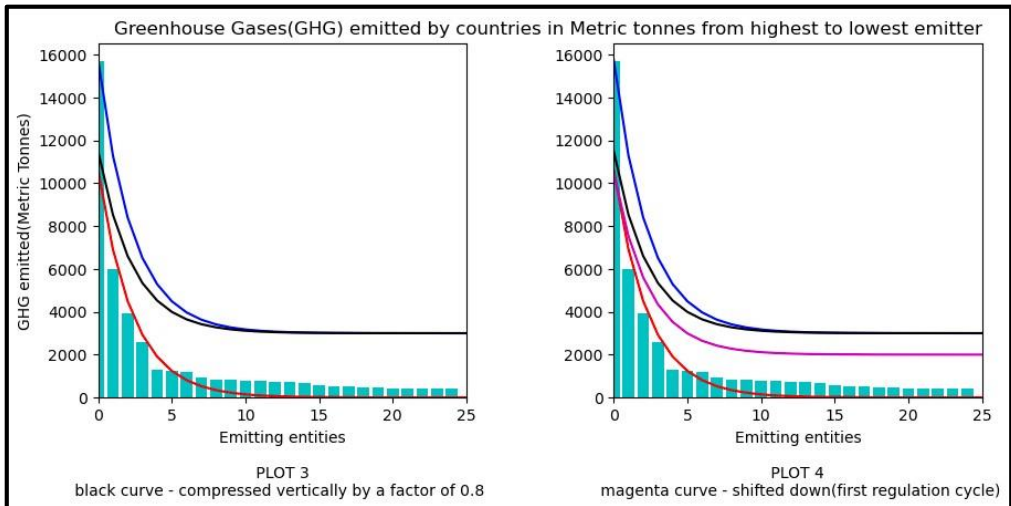
A. Greenhouse gas emission with the cap being set by the blue curve in plot 2. Plot 1 shows the emission by the first 25 countries and the initial fitted exponential curve.

The vertical shift ensures that all entities emitting greenhouse gasses especially, those that that emit the smallest quantity can trade carbon credits.

To create the first regulatory cycle, the regulator suitably alters the constant k of the function in equation (2.4) by reducing it. This is achieved by increasing the value of s . In our case, the new value of k is 0.8 while the new value of s is 1000. The black curve in plot 3 of Figure B highlights the effect when the value of k is decreased while the magenta curve in plot 4 of Figure B shows the changes when a vertical shift of 1000Mt is applied to the black curve. The new function becomes

$$y = 0.8 \times 10608.33(0.6511174)^x + (3000 - 1000). \dots \dots \dots (2.8)$$

The new value of k ensures that the largest emitters of carbon decrease their emission by a larger margin than others while the new value of s ensures that the low emitter of carbon also decreases their emission or their carbon credit. The regulator can then have several cycles of regulation till it becomes expensive for greenhouse gas emitters to continue using their current technologies. They gradually shift to green energy due to the high cost of operation with minimal operation brought about by the reduction of carbon credit. Eventually, zero net carbon is achieved.



B. Greenhouse gas emission with the first cycle of regulation set by the magenta curve in block 4 after a vertical compression shown by a black curve in plot 3 and vertical shift downwards by 1000 Mt shown by the magenta curve

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III. CONCLUSION

In this paper, we have described the significance of carbon markets and highlighted its challenges by reviewing the existing literature. We have also proposed an exponential-based cap that addressed the possible problem of disintegration of larger greenhouse emitting entities into smaller ones and migration to other jurisdictions with soft regulations. We have also illustrated how the exponential cap can be generated and used by regulators to control the carbon markets.

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REFERENCES

- 1) Boon, F. K., 1998, The Third Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change-Kyoto, Japan 1-10 December 97. *Sing. J. Int'l & Comp. L.*, 2, 191.
- 2) Cong, J., Wang, H., Hu, X., Zhao, Y., Wang, Y., Zhang, W., & Zhang, L., 2023, Does China's Pilot Carbon Market Cause Carbon Leakage? New Evidence from the Chemical, Building Material, and Metal Industries, *International Journal of Environmental Research and Public Health*, 20(3), 1853
- 3) IEA-EDGAR CO₂, a component of the EDGAR (Emissions Database for Global Atmospheric Research) Community GHG database version 8.0 including or based on data from IEA, 2023, Greenhouse Gas Emissions from Energy, www.iea.org/data-and-statistics, as modified by the Joint Research Centre.
- 4) Kossoy, A., & Guigon, P., 2012, State and trends of the carbon market.
- 5) Li, A. F., Qu, C. F., & Zhang, X. L., 2023, Exploring US–China Climate cooperation through linked carbon markets, *Advances in Climate Change Research*, 14(1), 145-155.
- 6) Şekercioğlu, Ç. H., Primack, R. B., & Wormworth, J., 2012, The effects of climate change on tropical birds, *Biological conservation*, 148(1), 1-18.
- 7) Stevanović, M., Popp, A., Lotze-Campen, H., Dietrich, J. P., Müller, C., Bonsch, M., & Weindl, I., 2016, The impact of high-end climate change on agricultural welfare, *Science advances*, 2(8), e1501452
- 8) Tol, R. S. J., 2009, The economic effects of climate change, *Journal of economic perspectives*, 23(2), 29-51.
- 9) Zhou, K., & Li, Y., 2019, Carbon finance and carbon market in China: Progress and challenges, *Journal of Cleaner Production*, 214, 536-549.



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Mobilization and Interaction: A Case Study of Rural Social Organizations Participating In Rural Governance in Ningxia



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ABSTRACT

Purpose: In this section identified the real factors of which are doing the governance in rural areas of Ningxia. How the governance making goals of development with the help of social organization. This study founds the problems which social organizations are facing and people are doing interaction to them and participating in government activities.

Design/ Methodology/ Approach: Here qualitative design was used with convenient sampling which used in Ningxia region. A semi- structured in depth interview was conducted in selected areas. Researcher used the thematic analysis and standers questionnaires for the quality of research in selected region. Require respondents were the part of research with convenient sampling approach in selected region.

Findings: Ningxia rural social organizations' participation in rural governance as the entry point. This is based on the practical cases of Ningxia rural areas in selected areas. This paper found rural social organizations' participation in rural governance with low interest. Result concluded that understanding and grasping the practical problems of rural governance in northwest China in the new era and exploring the valuable practices of rural social organizations' participation in rural governance.

Implications /Value/Originality: For the community development it is needed that local people's participation in governance is compulsory. While governance organization should take serious actions for the rural areas of Ningxia. Policy makers and government agents need to focus on these areas for the welfare and development.

KEY WORDS: mobilization, interaction, rural social organization, rural governance

INTRODUCTION

Rural governance is a product of contemporary influences and the economic, social and political history of a particular rural area. It is often a mixture of locally-driven governance processes and the impact of regulatory decisions made at higher administrative levels. To realize the modernization of social governance requires the participation of multiple subjects in society. The active participation of social organizations in rural social governance is an important way to help rural social governance, vigorously promote the strategy of rural revitalization, and solve the last mile problem of grassroots social governance. From the perspective of the predicament of rural social governance, in China's rural society, the village and the two committees have long been the main force of rural social governance. However, with the emergence of new situations and challenges such as great changes in rural society and the continuous promotion of rural revitalization strategy, the village and the two committees cannot fully meet the needs of rural social governance. At the same time, due to extensive urbanization, unprecedented urbanization, complex marketization, farmers' part-time employment and accelerated modernization process, higher requirements are put forward for rural governance, and more hardcore governance forces are needed to intervene, so as to relieve the pressure of rural social governance. (Yan Zhanding, 2011)

Overall background of promoting the rural revitalization strategy, dig deep into the internal driving force of grassroots

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governance subjects, fully mobilize the enthusiasm of farmers, guide farmers to participate in rural social governance, carry forward the spirit of farmers as masters of the rule of law in the rule of morality and autonomy, and effectively let social organizations play their due role. There are two important concepts in this study, namely rural governance and rural social organization. Mr. He Xuefeng believes: "Rural governance refers to how to manage China's villages, or how Chinese villages can manage themselves, so as to achieve the orderly development of rural society." (He Xuefeng, 2007). Among them, rural governance includes two interrelated levels: one is self-governance at the village level (i.e., villager autonomy); Second, rural governance at the national and social levels. "The Dual Transformation of Rural Governance and Villagers' Autonomy. (He Xuefeng, 2005).

Rural social governance is an extension of villagers' autonomy

Which requires the combination of moral governance; autonomy and rule of law to better achieve the goal of rural governance, co-construction, co-governance and shared benefits? (Zhang Caihua, 2017). Therefore, it is required to broaden the channels of participation of the main body of rural governance, expand the circle of governance, innovate the way of governance, and invigorate the governance field. In the final analysis, the fundamental purpose of rural governance is to achieve good governance. It can be seen that the concept of rural social organizations mainly refers to the government's guidance, adherence to the leadership of the Party, voluntary participation of farmers, to meet the needs of farmers in economic construction, political construction, social construction, cultural construction and ecological civilization construction. (Li Yonghua, 2015).

Operation mechanism of rural social organization growth in Ningxia:

Research data show that the speed, scale and quality of the development of social organizations in Ningxia have been greatly improved, and their coverage is relatively high, with an average of 6.28 social organizations per 10,000 people, higher than the national average of 3.69 social organizations per 10,000 people. There were 5,751 social organizations in Ningxia in 2016, 6,548 in 2017, and 6,300 in 2018. 18,521 in 2019, 5,753 in 2020, and 5,282 in 2021, making important contributions to building a beautiful new Ningxia featuring economic prosperity, ethnic unity, a beautiful environment and people's prosperity. Then, how rural social organizations in Ningxia participate in rural social governance, its logical structure, morphological characteristics and organizational structure, mobilization strategy, social interaction mode, etc., are due meanings of the topic of this study.

(1) Organic organizational structure perspective:

According to Max Weber, the legitimate authority of organizations comes from three sources: custom, personal charm, and legal reason. Max Weber performed extraordinary work in social interaction as well social development in social sciences. (Emile Durkheim, 2017 translated by Qu Jingdong) French sociologist Emile Durkheim divided social solidarity into mechanical solidarity and organic solidarity according to the different foundations of social integration. It is pointed out that in the "homogeneous" society with low degree of civilization; it is maintained by "mechanical solidarity". In modern society of division of labor, heterogeneity is enhanced, and society relies on "organic solidarity" of division of labor, and the development of society is a process in which organic solidarity gradually replaces mechanical solidarity. Social Division of Labor, Life, Reading, New Knowledge Sanlian Bookstore, and 2017 Edition elaborated that organic organizations has strong open organizational environment and obvious organizational instability. (Zheng Hangsheng, 2013)

Vertically, the organization program structure is not standardized, personnel setting flexible outstanding, horizontally, the organization of job scope, responsibilities, rights and other simple and easy to operate. However, the division of labor in rural social organizations is random, the structure is loose, there is no obvious rank order, and the emphasis is on negotiation rather than top-down management. Organic solidarity fits the development situation of rural social organizations, which provides beneficial enlightenment for this study. The rural social organization structure of Ningxia presents a "concentric circle" organizational structure model with the characteristics of sustainability and stability, forming the core layer composed of the elderly association, handicrafts association, cultural courtyard, etc., while the scientific research team, training institutions, media, etc., constitute the edge layer. The circle large and small adjusts them according to the development of the social organization, effectively improving the circle structure model. (Long Taijiang, 2004)

The core layer is the central position of social organizations and the inner strength of social organizations in the process of growth and development. It has a clear understanding of the development plan, prospects, objectives, operation processes and

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values of rural social organizations. It has a strong willingness to participate from participation to participation, from being involved to taking the initiative, from daily work to taking the initiative to discuss and make decisions. The core layer is crucial to the success or failure of a social organization. In the specific operation process, the core level will hold formal or informal meetings to study specific matters, and the backbone of the organization will take the initiative to communicate with the villagers, formulate feasible solutions, and then feedback to relevant personnel to urge the staff to implement. The marginal layer is the external push for the sustainable development of social organizations. It is mainly composed of "outsiders" who have participated in organizational activities for many times but are not formal members of organizations at present. Affected by subjective and objective factors such as time and space, willingness, etc., members of the marginal layer cannot take social organizations as their home and make a living from organizational undertakings like backbone forces. (Du F Q, 2014)

Members of the marginal layer have a strong desire to participate in rural social organizations, and their sense of value of the community of rural social organizations is enhanced, such as expert teams of colleges and universities, scientific research teams, volunteer service teams, teachers, social practice groups, architectural design and research companies, etc. In terms of village planning, market environment analysis, strategic positioning, optimizing territorial space, innovative industrial development, improving infrastructure, beautifying living environment, perfecting rural governance, and implementing safeguard measures, it has an increasing influence on rural social organizations and plays an important role in intellectual support and guarantee. (Xue Zhengchang, 2019)

(2) "Concentric circles" organizational structure characteristics

Organization membership is flexible. Flexibility in the composition of organization members is a reasonable adjustment to the members of rural social organizations in the process of operation due to the temporal and spatial position and realistic conditions of rural social organizations. The concrete manifestation is that the members of the organization are not stable, and the time and location of the service objects are not stable, so they will show flexibility. The marginal layer will concentrate on the implementation of organizational activities in their free time, with relatively concentrated time, high activity density, and relatively prominent efficiency. The coordination and cooperation among various social organizations is also the manifestation of the flexibility of social organization members.

Organization operation process open and working methods are in real shape. Rural social organizations in Ningxia do not have clear membership restrictions, and villagers can choose to participate according to their own conditions. In order to achieve better development, various social organizations must cooperate well with each other. Intellectuals give play to the function of cultural transmission and knowledge transfer in the form of lectures, and senior citizens' groups and handicraft associations enrich rural cultural life by singing opera, embroidery and playing chess. Each organization plays its role in close cooperation with other organizations, forming a pattern of mutual cooperation, co-governance and sharing. This openness is also reflected in the struggle for social power, such as funds, materials, technology, planning and other aspects. (Fan Jianrong, 2019)

The organizational structure is flat. The structure of rural social organizations is simple, with the core layer playing the main role and the edge layer playing the auxiliary role, which profoundly reflects the acquaintance relationship of rural society. The flat organizational structure does not emphasize the maximization of interests, but outputs emotions. It builds an emotional community with temperature, and makes villagers feel this form of social organization is the extension of family functions and the expansion of family affection community. (Zhang Caihua, 2017)

3. Social mobilization and social interaction of rural social organizations in Ningxia:

The term social interaction was put forward by Georg Simmel, a German sociologist, and influenced George Mead, Brummer, Kuhn and others, making due contributions to the development of social interaction theory. Social Interaction, as the basic analysis unit of sociology, is the most common phenomenon in society. Social interaction, also known as "social interaction", refers to the mutual communication and interaction among social subjects based on the needs of various information transmission, and the interdependent social behavior process in economy, politics, culture and society. (Zheng Hangsheng, 2013). In the process of participating in rural governance, rural social organizations inevitably interact with the grass-roots government, the village two committees, villagers, rural society and other parties in various forms and degrees, which promote effective rural governance from both positive and negative functions. To carry out various organizational and practical activities, rural social

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organizations need not only the guarantee of government policies at all levels, but also the strong support of social resources, and more importantly, the joint participation of farmers and other social forces. Since rural social organizations are public welfare, service and mutual assistance, and have no distinct coercive power, it is necessary to adopt active and flexible mobilization strategies in order to achieve the expected goals of the organizations in order to mobilize all social forces to actively participate in the rural social organizations. The social mobilization used in this study is closer to the sociological concept, focusing on the expression that mobilization is mobilized by the society, that is, the organization, publicity, education and other activities of the object carried out by the subject of mobilization in order to achieve specific goals, so as to influence the process of mobilizing the object to make it consciously participate in the activity. The social mobilization of rural social organizations in Ningxia mainly propagandizes guides and organizes farmers to participate in social organizations. (Long Taijiang, 2004).

LITERATURE REVIEW

As rural revitalization becomes more and more popular, scholars have conducted extensive exploration into the elements and mechanisms that promote effective governance. Existing research mainly focuses on stimulating the intrinsic motivation of villagers to participate, promoting the connection between rural governance elites and rural society. It establishing rural collective economic innovation models, cultivating sustainable "localized" rural lifestyle and culture, and strengthening rural integration. Industries and new technologies to achieve innovation in rural governance framework. (Brown, D.L.; Schafft, K.A, 2011).

The primary task of rural governance is to involve the people actively and participate in it. Through the application of participatory rural development, successful interactions between governance subjects can promote endogenous activation based on local networks, mobilize villagers' autonomy, and empower farmers with decision-making power. (Scoones, I, 2009). 15The key role of rural areas today is elite participation in steering the path to sustainable development by actively involving farmers. Rural organizations play an important role in setting up local industries and promoting rural development. Research shows that establishing villagers' autonomous organizations focusing on rural social development can encourage grassroots participation and consolidate local village organizations. This kind of village organization integrates local and external resources and connects villagers, rural elites and society. (Gao, J. and Wu, B, 2017)

(Triste, L et al 2018). Recommended to transform small farmers into family farms, develop rural collective economies across administrative regions, and explore the transformation of leading agricultural enterprises into a new rural collaborative economy. Further they said that at present, the collective economy mainly consists of township enterprises, rural industrial cooperatives and other groups that utilize rural resources.

RESEARCH DESIGN

Research Method:

Qualitative Comparative Analysis (QCA), using Boolean algebra and Fuzzy Sets, Similarities and differences between disagreement data sets, Unlike causal reasoning techniques. For example, randomized controlled trials or regression analysis, QCA is a mixed study. The methods combine qualitative and quantitative study for the implication in whole study. This method highlights the complexity but give the proper results. The nature of social science problems, exploring precedents and the resulting interactions with specific Conditions. This study aims to study the causes and pathways that affect governance and Efficiency of organizations. The importance of influencing variables and drive directions making the successful governance in selected areas.

In this study, we used fuzzy set qualitative comparative analysis (fsQCA) to assign individual variables. Basic steps include identifying research questions and analytical frameworks, selecting case sets, identifying results and dependent variables, creating truth tables, performing unit essential anus, performing combined analysis, and discussing results.

Data Source:

This data is taken directly from the field except previous introduction and history is taken from primary source. All data is available on Ningxia Government website. Interviews of the respondents were taken from direct field which is also with the

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permission of local institutions as well public issuing letters.

Variable Assignment:

The variable allocation process in this study is divided into two stages: the first step. Intervention defines the meaning and scope of the variable according to the analytical framework. The second step is to encode and validate variables that are rooted in their definitions and dimensions, as shown in case data. Two measures were used as indicators. Progress to date: (i) Media coverage of rural governance models, and (ii) Copy. Rural governance models in other regions. The time lag in the effect is taken into account. In the area of governance, this analysis will take into account media coverage and villages. Simulation for a three-year period (June 2022 to June 2023).

Measurements:

Basic measurements of the research according all international and national were used in this paper. The conceptualizing and measurements are important for research and valuable data McGhee & Andereck McGhee and Andereck. They were also agreed that qualitative method is more clear and comprehensive for social issues. (Cheng, L. K, 2016) stated that valid questions can give more clear answers if language and symbols are clear.

Data Analysis Procedure:

Data analysis can be easy if thematic analysis approach can apply on study which is more suitable for research. (Clarke and Braun, 2013) This approach can be carefully designed thematic analysis in this way, identifying, analyzing and reporting the way in data. This coding program, semantics, induction and descriptive techniques to explain data and keep data remains reliable. The sensing TA is still based on data, not any other existing theory. Semantic TA focuses on the obvious true meaning of the field, and finally describes the descriptive TA explains the summary of the data and the exact meaning of the detailed data.

RESULTS AND DISCUSSION

1. Backbone forces for social mobilization:

The social mobilization of rural social organizations in Ningxia is mainly accomplished by the backbone of the rural elite, who become rich with their own hands through hard work. After a long time of wealth accumulation and the pursuit of a happy life, they have a certain influence among the villagers, who care about the spiritual needs of farmers and pay attention to local customs. Taking Zhao Hong, villager of Group 8 North Funing Village in Minning Town and head of cultural compound, as an example, the author has conducted in-depth interviews for many times.

Q: "When you started the cultural compound, did any other villagers work with you?"

Answer: "Yes, but truth is that my village life is good, there are better or as good for me, maybe their mind is different, other villagers do not have the ability to do this thing, everyone is willing but unable to perform like me. I also like to sing, so I want to give the old people's home."

Q: "It seems that the purpose of your cultural compound is to serve the elderly people in the village. The subsequent development needs funds to maintain. Have you ever thought of making a profit?"

A: "It is really to make the leisure time of the elderly meaningful, the development of the cultural compound will certainly need financial support, but at the beginning I did not think so much, I think that everyone is interested in participating in the easy to do, otherwise you have a cultural compound, no one to participate in it, it is not interesting. Making money or gaining profit was impossible. I don't think it seems any profit or source of earning for me."

Q: "You just talked about the participation of villagers. Are people highly motivated to participate?"

A: "Gao, as long as the old people have time to come, especially like the opera, more enthusiasm, later developed well, we have a troupe, to the next village also perform, everyone recognized, there are many people outside the village to listen to the opera. We put on a lot of performances, and we have experts and experts to guide us, which makes the performance of the troupe, improve a lot."

Q: "In this case, you need to spend more time to maintain the cultural compound, are you busy?"

A: "Since I founded the Cultural Compound, I have devoted my time and energy for it. Now it is developing very well, but I am

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facing many problems like managing the time and earning. The good thing is that the old folks who join the cultural compound are very active, and if they can do it, they will do it seriously, because there is no leadership in it. It is a thing for people with common interests to get together and keep warm."

Q: "According to the current operation of the Cultural compound, the overall feeling is very good. What is your plan for the future development of the Cultural compound?"

A: "It can be said that now the cultural compound has taken interesting shape. I was also an extra actor in the TV series' Mountain and Sea Situation '. The crew and other actors recognized and supported the cultural compound. I am devoted with my culture and want to give more time without any cost."

Q: "New Age farmers? Can you be more specific?"

A: "Ha ha, OK, I will say it as we understand it. People's living standards had improved. It is rare for them to think about a meal of meat for half a day. The main problem is that the villagers are better off. When I lived in the countryside, I saw some young people come back to play mahjong. There were other people who did not do their jobs. They worked hard for a year and came back for a few days. And we farmers themselves deeply hate, but cannot get around a point is the problem of customs, weddings and funerals, sky-high betrothal price cannot afford to get married, people after death, this is not in line with the Times. At the beginning, I hoped that our cultural courtyard would be a place for the elderly to sing and play. Now, I hope that our cultural courtyard can do something in this regard. At present, some young people join in the courtyard and also perform very well, which is full of positive energy. When you have a good life, you should also have a good mind."

Giving full play to the subject consciousness of the backbone of social organizations is the basis for the better development of social mobilization. The establishment of rural social organizations especially needs the founder's subject consciousness. First of all, the main body consciousness of the backbone of rural social organizations in Ningxia is manifested as paying attention to the basic needs of villagers, taking the initiative to communicate and negotiate with villagers, and boldly carrying out practical activities. Secondly, the backbone of social organizations pays attention to village style, village appearance and neighborhood relations. The realization of good governance in rural social governance is inseparable from good neighborly relations. Villages also need to exchange and learn from each other and promote each other. Thirdly, the personality charm of the backbone of social organizations is an important guarantee for social mobilization. In the process of the development of social organizations, Zhao Hong has the possibility to obtain social resources extensively. He often deals with the media, communicates and learns from universities and teams, and learns from other social organizations. To some extent, he also takes on important tasks of social organizations. In this process, his personal ability was improved and his influence gradually increased. (Kong Xiangzhi, 2018)

(2) Specific strategies for social mobilization:

In the development process of rural social organizations in Ningxia, government policies, laws and regulations play a very important role. On the one hand, relevant government departments have banned some illegal social organizations according to law, strengthened positive publicity and guidance, and created a good atmosphere for the healthy development of social organizations. On the other hand, social organizations actively publicize and expand their influence by holding offline activities and accepting interviews. For example, the "Spring Festival" peasant opera and art show held by Mining Town in 2019 in the Comprehensive Cultural Service Center of Mining Town was hosted by the Publicity Department of Yongning County Party Committee, undertaken by Mining Town government and county Bureau of Culture and Sports, with the participation of main members of the cultural courtyard. (Shen Haiyan, 2011) Through online publicity and mobilization through we communicated with public accounts and media, the visibility of rural social organizations has been greatly improved. Traditional word of mouth is also an important means of publicity. When some members of social organizations participate in social organizations, their personal ability, vision and thinking are improved, which plays a positive role in the change of the family. In the process of the development of rural social organizations in Ningxia, the backbone of society gives full play to the consciousness of individual subject, expands the influence of social organizations, and forms a good development path of "mobilization and participation". The mobilization strategy adopted is simple, practical and effective, which accords with the reality of rural society and the will of villagers. It can be seen that the development of rural social organizations not only needs the backbone to play the leading role,

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but also needs the participation of the whole society, so that social organizations can continue to grow and run continuously.

(3) Social interaction of rural social organizations in Ningxia:

(Robert D. Putnam, 2001) argued: "Social organization plays an important role in the functioning of democracy, or effectively guarantees self-government. Not only because they have an 'internal' effect with their members, but also because they have an 'external' effect with their environment." (Li Yonghua, 2018) stated that Making Democracy is good for the welfare of human's society. Jiangxi reported that rural social organizations in Ningxia are an important carrier for farmers or different groups to carry out cooperation, collective activities and mutual help, which cultivate the collective sense of identity of farmers and maintain the effective operation of social organizations. On this basis, rural social organizations further actively interact with the outside world and obtain more social resources. Rural social organizations carry out various social activities, interact with other social interaction subjects, and effectively absorb social resources, which is the process of constantly building social network pattern. Rural social organizations in Ningxia are mainly social relations networks based on industrial ties, geographical ties and blood ties, which are in line with the characteristics of strong homogeneity in rural society. Which had limited ways and channels to obtain social resources, and in line with the temperament of rural society.

Subject of internal interaction: The internal interaction of social organizations is embedded in the local acquaintance society. It is naturally generated and has strong emotions. Because rural social organizations participate in the main body is farmers, social organizations internal interaction subject is farmers, and the object of service is also farmers. Rural society is an acquaintance society. In rural acquaintance society, the neighbors are constantly connected by blood and geographical ties. Everyone lives in the same area and knows each other's stories. Neighbors are based on blood ties and geographical ties, and "a small household can solve many problems". Compared with the society of strangers, rural social interaction has low cost and high efficiency, and social organizations are formed spontaneously by farmers, so it is the common aspiration of farmers to run their own affairs well. For example, in some rural societies, old people's associations, fathers' associations, square dance associations, Qinqiang Opera associations, basketball associations and so on have been established. These associations have effectively solved some problems in rural areas through internal interaction.

External interaction subject: The first is the interaction with the township government, the village two committees, this aspect is particularly outstanding the mode of cooperation. Township governments and village committees give rural social organizations more financial support, policy guarantee and resource care. On the one hand, rural social organizations have solved many problems that grassroots governments try to solve but cannot as their demand, such as publicizing policies, educating the masses, and organizing farmers to participate in various activities. There are all kinds of talented people in rural social organizations. They compose the Party's policies, folk customs, local customs and customs into allegro, skits, and dramas that are easy for farmers to understand in a way that is pleasing to them, so as to achieve good publicity effects. On the other hand, in the process of development of rural social organizations, if they encounter difficulties in funding, planning and development, the township government and village committees will also take the initiative to coordinate and help the sustainable development of rural social organizations. It is worth mentioning that the operation process of rural social organizations maintains a certain degree of independence.

DISCUSSIONS AND IMPLICATIONS

Rural governance is a complex process that requires cooperation and coordination from all parties. Participation of multiple stakeholders such as government officials, farmers, and social organizations in rural elite. Human factors such as attitudes, awareness, behavior and interactions, Play an important role in this process. The vigorous development of the rural collective economy has ensured a stable economic environment, encouraged social participation, and provided strong support for effective rural development and governance. Strengthen the construction of rural grassroots organizations and promote the rural collective economy operates efficiently. By building a well-functioning rural social organizations and farmer cooperatives can effectively integrate rural resources and integration, thereby enhancing competitiveness and sustainable development of collective economy. (Iqbal, K, 2018)

Meanwhile, activating effective human subjects in rural governance requires collaboration and coordination among various

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stakeholders. Develop healthy collectives' economy, solve the lack of rural elites and give villagers autonomy. All are basic elements of effective rural governance and lack of interactions. By prioritizing these aspects, rural Communities can promote sustainable development, inclusive decision-making and improvement quality of Life. The effectiveness of rural governance is affected by a variety of factors.

There are different options for promoting effective rural governance through different means interactions between human and non-human actors. This study shows that a variety of factors promote effective rural governance in a variety of ways. Local governments do not need integrate all elements under different resource constraints but can be mobilized strategically rural resources achieve optimal results based on their own resource endowments.

CONCLUSION

(Max Weber, 2015 translated by Yan Kewen) Marxist philosophy, especially historical materialism, tells us that the essence of human society is the organic unity of the objectivity of laws and the initiative of human activities, that is to say, people can give play to their enthusiasm, initiative and creativity on the basis of scientific grasp of social laws, and only in this way can they present their due value. In terms of human value, Marxism believes that there are two main kinds of human value. One is personal value or self-value, that is, a person's role, influence and utility to his own survival, development and perfection. One is the social value of a person, that is, the role, influence and utility of a person to the society. The embodiment of personal value is how people through their own actions, practice to improve their own ability, to meet their needs, to realize their own value; The social value of human highlights how people obtain various conditions and guarantees provided by society for the realization of their value because of their role, contribution and responsibility to society. However, in the view of Marxism, the social value of human is more important, because human as a social person, human activities are also social activities, and the conditions and materials needed for activities are provided by the society. Therefore, the realization of personal value is not only affected by the internal causes of the subject, but also affected by the relevant objective environment. In particular, it cannot be separated from the social support given by objective conditions. Therefore, when a person realizes his self-value, that is, when he meets social needs, social value and social needs form and complement each other. In China's rural society, the fundamental direction of the interactive relationship between rural social organization, the independent variable, and rural governance, the dependent variable, is to continuously strengthen and innovate social governance, and to strengthen and innovate social governance, we must better realize social mobilization and fundamentally realize the benign interaction between people and social organizations. This is the essential meaning of building a beautiful society featuring comprehensive, progressive and joint contribution.

LIMITATIONS

However, the research in this article has certain limitations. First, Due to the limited number of conditional variables considered in this study, it was not possible to reveal all factors and drivers of effective governance. Secondly, in terms of research methodology, the QCA method requires transforming qualitative textual content into measurable quantitative variables. This data calibration process relies heavily on the researcher's understanding of existing research and cases, somewhat subjective and requires further verification. While drawing general conclusions.

When conducting a multiple case study, it is important to focus on the specificities of individual cases. Go deep comprehensive case study of effective governance practices conduct further validation studies and provide detailed insights. Go through targeting these areas of improvement, future research could overcome the following limitations. This study expands the scope of analysis and enhances the validity and applicability of the study Findings.

REFERENCES

- 1) DU F Q. The impact of marriage residence Reform on fertility concept and pension model -- A study on the 30 years of marriage Residence reform in Gengzhuang Village, Dengfeng City [J]. Journal of Shandong Women's University, 2014(5).
- 2) He Xuefeng, Dong Leiming, Chen Baifeng. The present situation and prospect of rural governance research [J]. Learning and Practice, 2007(8).

Mobilization and Interaction: A Case Study of Rural Social Organizations Participating In Rural Governance in Ningxia

- 3) Shen Haiyan. Reflections on the effect of Rural Social organization Development on the Rule of Law in China [J]. Journal of Northwest A & F University (Social Science Edition), 2011(5).
- 4) Li Yonghua, Research on Rural Community Governance [M], People's Publishing House, 2018.
- 5) Yan Zhanding. Study on the Participation of Rural Social Organizations in Rural Governance [D]. Huazhong Agricultural University, 2011.
- 6) Zhang Caihua. Research on the model of Village Mutual Care Home for the Aged: from the perspective of Supportive Social Structure [D]. China Agricultural University, 2017.
- 7) Xue Zhengchang, Hongsipu Immigration History, [M], the Commercial Press, 2019.
- 8) Fan Jianrong, Ecological Migration Strategy and Regional Coordinated Development: Theory and Practice in Ningxia, Social Sciences Academic Press, 2019.
- 9) Li Yonghua, The Dual Transformation of Rural Governance and villager Autonomy, Zhejiang Social Sciences, Issue 12, 2015.
- 10) Zheng Hangsheng, A New Introduction to Sociology, China Renmin University Press, the Fourth edition, 2013, page 136.
- 11) Max Weber, [De], translated by Yan Kewen, Max Weber's Sociology Collection, People's Publishing House, 2015 edition.
- 12) Emile Durkheim, [Fa], translated by Qu Jingdong, Social Division of Labor, Life, Reading, Sanlian Bookstore, 2017.
- 13) Long Taijiang, Social Mobilization and Crisis Management, Journal of Huazhong University of Science and Technology (Social Science Edition), 2004.
- 14) Putnam, Robert D. [American], Trans. Wang Li, Lai Hailong, Making Democracy Work: The Civic Tradition of Modern Italy, Jiangxi People's Publishing House, 2001.
- 15) Iqbal, K. Securing CPEC: Challenges, responses and outcomes. In Securing the Belt and Road Initiative; Springer: Berlin/Heidelberg, Germany, 2018; pp. 197–214.
- 16) McGehee, N.G.; Andereck, K.L. Factors predicting rural residents' support of tourism. J. Travel Res. 2004, 43, 131–140. [CrossRef]
- 17) Cheng, L.K. Three questions on China's "belt and road initiative". China Econ. Rev. 2016, 40, 309–313. [CrossRef]
- 18) Clarke, V., & Braun, V. (2013). Successful Qualitative Research: A Practical Guide for Beginners. London: Sage.
- 19) Triste, L.; Debruyne, L.; Vandenabeele, J.; Marchand, F.; Lauwers, L. Communities of practice for knowledge co-creation on sustainable dairy farming: Features for value creation for farmers. Sustain. Sci. 2018, 13, 1427–1442. [CrossRef]
- 20) Gao, J.; Wu, B. Revitalizing traditional villages through rural tourism: A case study of Yuanjia Village, Shaanxi Province, China. Tour. Manag. 2017, 63, 223–233. [CrossRef]
- 21) Scoones, I. Livelihoods perspectives and rural development. J. Peasant. Stud. 2009, 36, 171–196. [CrossRef]
- 22) Brown, D.L.; Schafft, K.A. Rural People and Communities in the 21st Century: Resilience and Transformation; Polity: Cambridge, UK, 2011.
- 23) He Xuefeng, Three Themes of Rural Governance Research, Social Science Front, 1st issue, 2005.
- 24) Kong Xiangzhi. The Development and Innovation of Farmers' Cooperative Economic Organizations in China (1978-2018) [J]. Journal of Nanjing Agricultural University (Society Science Edition), 2018(6).



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Institutional Projects of Diversity Attention *versus* Regular Didactic Methodology Adapted to Students with Autism Spectrum Disorder



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SUMMARY: The teaching and learning of students with Autism Spectrum Disorder (ASD) requires the design of diversity projects at the different institutional levels of the educational centre. However, if these projects are not well adapted to the specific needs of the students, they will not achieve the expected effective results. In a study conducted with a total of 145 participants from different schools, it was shown that the presence of specific institutional educational projects was not a sufficient condition to respond effectively to the needs of the participants, whose curricular and social improvements were not shown to be significant (sig: .66). Even in the absence of these high-scale projects, when the usual methodology was well adapted to the specific needs of students with ASD, the improvements found in the academic and social, that's coded as dependent variable (DV): improving, domains were highly significant (sig: .00) in terms of the use of meaningful didactics based on the creation of networks of relationships between informative content or highly meaningful learning. Now, the interactive *constant* of both components, i.e. the intersection of a project design when these have been appropriately adapted to the particular needs, then both variables became the explanatory variance of the academic and social of DV of students with ASD (*constant t* for the sum of nodal relationships + project: 3.70 (sig: .00), to which was added the explanatory variance of the students' age intervals (*constant t* for the sum of nodal relationships + project + age: 4.07, sig: .00): 3.70 (sig: .00), to which was also added the explanatory variance of the students' age intervals (*constant t* for the sum of nodal relationships + project + age: 4.07, sig: .00). 70 (sig: .00), to which the explanatory variance of the students' age intervals were also added (*constant t* for the sum of nodes + project + age: 4.07, sig: .00). In conclusion, the design of general institutional projects, even if they cover all levels of education, are not effective on their own unless they are specifically tailored to the particular needs of the target student's variable: "improving".

KEYWORDS: Autism spectrum disorder. Significant learning. Educational projects. Adapted regular teaching.

INTRODUCTION

From a conceptual perspective, the Autism Spectrum Disorder (ASD) (American Psychiatric Association (APA), 2013), constitutes a neurodevelopmental disorder, the prevalence rate of which, according to extensive statistical analyses, has been reported by McFarland et al. (2019) y Maenner, Shaw & Baio (2020), is approximately 1/54 children born. The disorder is characterized by a neurological perceptual-cognitive processing, which is based on a cyclical propositional process, the theoretical hypothesis of which has been put forward by Ojea (2023), which partially corroborates earlier perceptual theories (Caron, Mottron, Berthiaume & Dawson, 2006; Frith, 1989; 2004, Happé, 1999; Happé & Frith, 2006); however, the new cyclical theory presents some very significant specific peculiarities. Firstly, the perceptual analysis level between the ASD group and the neurotypical group shows some global-semantic content, although a weaker semantic level has been found in the ASD group, which they compensate for in a second analysis of the stimulus.

Thus, psychoneurological processing as a whole along the sensory- perceptual- cognitive process is systematically focused on the interaction of neural networks. Deficits in the development of neural relations are related to the flexibility in the transition of information, so that there are important nodal limitations in relating new information from the outside to the content previously stored in permanent memory, which affects the set of basic human psychological processes. But, besides, the perceptual inputs or conceptual units must be conceptually categorized in broad hierarchies that facilitate the working memory

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to carry out the process of accessing such information in the permanent memory, which is also deficient due to the limitations for the development of significant nodal relationships between the informative contents. In this sense, the propositional hypothesis of autism is maintained on the basis of the relational limitations between the perceived new stimuli, as well as between the previously stored information, if it doesn't count in an effective way with the meaningful attributions carried out during the learning process.

For this reason, the understanding of the functioning of people with ASD has to rely on executive processing and mediated regulation processes between information contents, with the aim of progressively fostering self-regulation of the nodal creation between these contents, in order to facilitate increasingly active learning, which, in wheel, will enable the subsequent retrieval of information when necessary.

Hence, this executive process is not only related to academic curricular development, but also, above all, to the tasks of regulation and self-regulation of thought, social behaviour and, especially, to motivational processes, which will constitute the basic pillar of active participation in learning (Boekaerts y Cascallar, 2006; Dembo & Eaton, 2000; Hattie & Timperley, 2007; Vaughn, Wanzek & Murray, 2012).

That's a fundamental task that learning and development of people with ASD be complemented with highly meaningful associations that facilitate the relationships between the proposed psycho-socio-educational objectives, otherwise, learning will have an excessively mechanical component that will impede the development of higher order executive processes, such as problem solving and the execution of deductive and synthetic elements. Therefore, it is necessary to promote a complementary associated learning to facilitate the creation of nodes that are not automatically generated in people with ASD, whose ultimate purpose is the hierarchisation of categories in the semantic memory with significant related links or key elements of access to long-term memory, which, in turn, will get for the subsequent recovery of information (Aracı, Melekoğlu & Çetin, 2023; Baddeley, 1999; Dunn & Miller, 2016; Gore, 2010; Selçuk, 2018). When this is done, it is possible to facilitate the higher-order executive elements, within which, as said Cioca & Nerisanu (2020), personal creativity is the main element of cognitive processing, as has been demonstrated in studies based on mnemonic memory and information remember strategies (Boon Urton, Grünke & Rux, 2019; Lubin & Polloway, 2016).

The process of relational development involves a highly structured and very well tiered system of mediation, in which the basis of the new concept must be highly proximate to the previously codified concept, which implies an earlier process of conceptual categorization. In this sense, the State Education Agencies (SEA) and the Local Education Agencies (LEA) use the terminology "MTSS" regarding this highly meaningful, stepwise system of content integration specific support (Zhang, Martella, Kang & Yenioglu, (2023), in order to complement the specific learning process, according to the particular needs of each student, based on the student's strengths of support to progressively continue the support mediated process, both curricular, psycho-socio-emotional and behavioural, as has been empirically shown in the Center on Multi-Tiered Systems of Support (2022).

Hence, the descriptors- mediators of the teaching-learning process must include a relationship of individual learning with all the interrelated factors at the social level which, as indicated by the Council of Europe (2018), regarding language learning, it should must include the continuous interrelation of all the intervening factors in the mediated learning process, whose end aim is to facilitate the efficiency and effectiveness about, which is related to what Cook & Cook (2013) and Reichow & Volkmar (2011) have been called Evidence Based Practices (EBP). Indeed, EBPs have been shown to be highly effective in the area of meaningful associated learning in the ambit of mediated intervention for people with ASD (Cook & Odom, 2013; Cook, Cook & Collins, 2016; Mursi & Sulaimani, 2022; Ziviani et al., 2015), which, as Spencer et al. (2012) through the National Autism Center, have shown, it relate the theoretical process with its practical functional content, facilitating interrelated intervention in an active way, with the aim of creating highly significant learning, both in the curricular field and in the psycho-social area.

In this sense, Morin, Sam, Tomaszewski, Waters & Odom (2021) affirm to the empirical development of different projects have been built on the basis of a meaningful-functional orientation of learning for students with autism, which have given rise to different types of educational practices that foster a theoretical-practical relationship that serves, in turn, as a meaningful component of the related educational process, which are complemented by current relevant specific technological advances (Odom, Collet-Klinenberg, Rogers & Hatton, 2010; Wong et al., 2015), to enable professionals to implement meaningful teaching methods adapted to the specific needs of each country (Larkan-Skinner & Shedd, 2021; Liu et al., 2018; Mandinach, 2012; Yamamoto & Alverson, 2023).

All these studies lead to the conclusion that it is necessary for schools and institutions to have specific support plans that are properly structured to meet the specific educational support needs of people with ASD. In this sense, attempts have been made

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to develop comprehensive responses focused on these needs, such as the development of the CSESA Project (Comprehensive Programme with Focus on Specific Learning Needs) adapted for students with autism in secondary schools, with the aim of improving the curricular-academic development of students with autism (Carter et al., 2014; Fleury et al., 2014; Hume et al., 2014; Test, Smith & Carter, 2014). This project is based on the use of a wide range of methods of interrelated support, both between the children themselves, through cooperative learning, and within teachers, supported by specific training programmes, and ultimately enclosing all the social factors involved in the educational process, including families and social services. For this reason (Frost et al., 2020), the interactive aid programme HIIYH, which includes the programme's core support components ESDM, implies of learning based on five main components: 1) real-time information for teachers, 2) continuous training for teachers according to the needs generated in real time, 3) training for families at the same time as for teachers and according to the same parameters, 4) processes of independent learning for families through the HIIYH, through the use of videos and other interactive didactic materials, and 5) the student- led learning process based on the interaction between teachers and families, in accordance with the basic training hypotheses and according to each specific need. This project has been designed on the basis of four clearly differentiated modules: 1) enhancement of attention-perceptual development, 2) development of social-communicative processes, 3) repetition of the development of learning through systematic routine through shared relational activities, and 4) the A-B-C behavioural improvement system (antecedents - consequents - outcomes).

However, if these or other specific interactive and interrelated projects are supported in the development of meaningful relationships in the learning process, their effectiveness will have a very relative impact on the expected results. Thus, despite the existence of specific support processes elaborated in schools by specialised teaching staff and specific didactic methodologies of complementary support, in terms of pedagogical reinforcement or curricular adaptation, the results may not be fully satisfactory if the basis is not supported by a theoretical foundation of the creation of meaningful relational networks between curricular and social contents, in which people with ASD are very deficient.

Therefore, the main aims of this research have been: 1) to analyse whether support based on the provision of specialist teaching staff is necessary to facilitate the successful psychosocial and educational development of students with ASD, 2) to identify the need for methodological and didactic measures tailored to the specific needs of students with ASD, and 3) to analyse the importance of developing relationships or relational nodes during the process of academic and social development of students with ASD. Furthermore, the study attempts to identify the hierarchy of such measures when they are partially applied during the curricular and/or social development of the targeted students with ASD.

METHOD

Research design

The research design is based on the application of an ad hoc questionnaire applied to different schools in Spain where students with ASD attend school, with different levels of ASD and different age groups, making a total of 145 students with ASD who participated in the study.

Variables and codes

The variables coded for the study and their corresponding codes are as follows:

1. The currently existing levels of ASD (APA, 2013, op cit.), whose code is "level".
2. The age intervals of the study participants: "age", which corresponds to four age intervals: 3-6 years, 6.1-9 years, 9.1-12 years, and 15.1-18 years.
3. The type of support, referring both to specialized human factors, to the adapted methodologies applied, such as educational reinforcement or curricular adaptation, and to the adaptation of special temporary environments for the implementation of support or its realization within the regular classroom, whose code is "support".
4. The design of a specific methodology based on the creation of neural networks between the informative contents merged within the regular didactic environment or with the previous support indicated in point 3, coded as "nodes".
5. The improvement in the overall development, both educational and psycho-social in the students from the perspective of the professionals who have answered the questionnaire, coded as "improving".

Procedure

Once the ad hoc questionnaire was developed, it was sent to different schools with students with ASD. The variable "support" consisted of the calculation of different questions related to the support procedure that was carried out in the educational center: provision of specialist teachers, special methodological adaptations, training processes, interactions between teachers

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and/or families and associations/ specific intervention centers. Once this variable had been calculated, the subsequent statistical analysis was carried out.

Data analysis

Results analysis have been found throughout a statistical procedure treated with the SPSS programme, considering the variable “improving” as DV, while all the other variables of the study as factorial components that, in terms of variability, influence their variance on this DV.

RESULTS

Participants

A total N: 145 students with ASD have been participated in this study, of which its distribution according to ASD level and age intervals, it has been analyzed by statistical contingency test is shown in Table 1.

Table 1: level * age Crosstabulation.

		age					Total
		3-6 y-o	6.1-9 y-o	9.1-12 y-o	12.1-15 y-o	15.1-18 y-o	3-6 yo
level	level-1	31	35	10	26	4	106
	level-2	14	5	2	2	0	23
	level-3	4	7	1	3	1	16
Total		49	47	13	31	5	145

In synthesis, a total of 145 participants with ASD have participated in this study, 106 correspond to level 1, 23 to level 2 and 16 to level 3. 49 students correspond to the 3-6 y-o interval, 47 to the 6.1-9 y-o interval, 13 to the 9.1-12 y-o group, 31 to the 12.1-15 y-o group and finally 5 to the 15.1-18 y-o interval.

General descriptive

As a first preliminary observation, the most important general statistics for the dynamic variables of the study are presented, referring to the minimum (min.), maximum (max.) values, the statistical mean found (μ), the total sum (Σ), the standard deviation of the different scores for each variable (σ) and the explanatory variance of each one (σ^2), which can be observed in Table 2.

Table 2: General Statistics (N: 145).

	Min.	Max.	μ	Σ	σ	σ^2
support	.00	5.00	2.46	358.00	1.47	2.18
nodes	.00	5.00	3.57	518.00	1.43	2.06
improving	.00	5.00	3.68	534.00	1.44	2.07

Initially, it is important to highlight that the sum and mean scores are not equal for the following variables “support” and “nodes”, there being significant differences, both for the μ statistic (“support”: 2.46) with respect to the variable “nodes” (3.57), as well as in the global sum, being for “support”: 358.00 and for “nodes”: 518. Therefore, it is necessary to consider whether these differences also differentially affect the DV: “improving”, in order to consider the corresponding conclusions about.

Dependent Variable Explanatory Analysis

The explanatory analysis of the DV by the study factors was carried out using the univariate general linear model, by means of the test of between-subjects effects (see Table 3).

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Table 3: Tests of Between-Subjects Effects.

DV: "improving"

Source		Σ Squares	df	μ ²	F	Sig.
Intercept	Hypothesis	8.44	1	88.41	26.21	.00
	Error	17.06	5.060	3.37(a)		
level	Hypothesis	.56	1	.56	14.75	.00
	Error	4.56	120	.03(b)		
age	Hypothesis	2.74	1	2.74	72.20	.00
	Error	4.56	120	.03(b)		
support	Hypothesis	1.62	5	.32	.65	.66
	Error	6.15	12.378	.49(c)		
nodes	Hypothesis	132.51	5	26.50	68.69	.00
	Error	5.01	12.989	.38(d)		
support * nodes	Hypothesis	7.35	12	.61	16.10	.00
	Error	4.56	120	.03(b)		

a) .10 MS (support) + .12 MS (nodes) - .07 MS (support * nodes) + .84 MS (error).

b) MS (error).

c) .79 MS (support * nodes) + .20 MS (error).

d) .60 MS (support * nodes) + .39 MS (error).

The univariate analysis test, which has been preceded by the Leven's test of equality of error variance, indicates that contrasts are not equal, with each variable factor indicating a different variability of the explanatory variance with respect to the study DV (F: 16.05, df₁: 22, df₂: 122, sig: .00). It is therefore possible to analyse the data resulting from the study with the prior hypothesis of rejecting a hypothesis of equality of the explanatory variances on the DV. Indeed, as can be seen, the intersection of all the factors, which is the weighted sum of all the variables that have an impact on the DV: "improving" shows a highly significant data (sig: .00, μ²: 88.44), which explains why the interactive set of all the factors analyzed significantly influences the variability found in the variable "improving". However, when the data are analyzed individually, highly significant inter- variables differences can be observed. Thus, the fixed variables "level" and "age" show critically significant data (sig: .00), the hypothesis for the variable "level" being (μ²: .56) and to "age" variable (μ²: 2.74).

However, what is most striking is the difference between the dynamic factors. Thus, the "support" variable shows a squared explanatory hypothesis (μ²: .32), showing a critical level of non-significance (sig: .66) to F: .65. This is very important because it means that support, when not based on the cognitive performance of neural networks or nodes, does not have positive effects on the psychosocial development of people with ASD when measured separately. However, the isolated "nodes" measure, with or without the support measures captured by the "support" variable, shows a high explanatory level (μ²: 26.50), which indicates a significant critical level (sig: .00), to F: 68.69.

This consideration prioritises the elaboration of neural networks between information contents during the didactic process over the presence of specific support aids. Thus, the presence of supports without the propositional consideration of the elaboration of meaningful relations between learning contents will not be effective despite the adapted methodological process; however, when such relations are developed, they are manifestly effective with or without organisational structural support. However, the interaction of the two variables "support" and "nodes" are again significant explanatory components of the variability found in the variable "improving", the explanatory hypothesis being: .61 (sig: .00, F: 16.10).

The plot of the residuals of heterogeneity of variances clearly shows the relationship between the predicted values and the typed residuals (see Figure 1).

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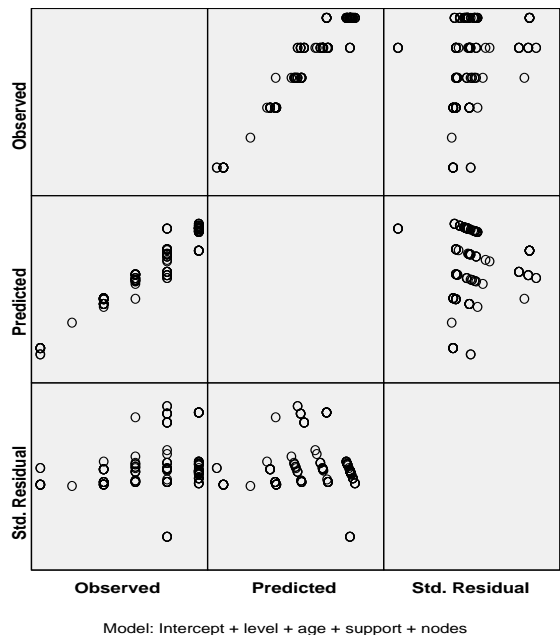


Figure 1: Residual Graph

Indeed, the above graph does not show homogeneity in the point cloud corresponding to the typed residuals across all predicted values, confirming the different variances between the predictor variables in relation to the DV.

These results have been confirmed by the ANOVA regression analysis for the factors influencing DV: "improving" (see Table 4).

Table 4: ANOVA(d) of Regression Analysis.

Model		Σ^2	df	μ^2	F	Sig.
nodes	Regression	277.51	1	277.51	1813.14	.00(a)
	Residual	21.88	143	.15		
	Total	299.40	144			
support	Regression	278.52	2	139.26	947.04	.00(b)
	Residual	20.88	142	.14		
	Total	299.40	144			
age	Regression	279.10	3	93.03	646.21	.00(c)
	Residual	20.30	141	.14		
	Total	299.40	144			

- a) Predictors: (Constant), nodes.
- b) Predictors: (Constant), nodes, support.
- c) Predictors: (Constant), nodes, support, age.
- d) Dependent Variable: improving.

As can be seen, the variable "nodes" is the first predictor variable to be included in the stepwise regression model and indicates the percentage of mean variance (μ^2 : 277.51, sig: .00). This core variable is added the second step, that includes the variable "support", which also interacts to be significant (sig: .00) to broaden the level of explanation: μ^2 : 139.26. Finally, the regression model also includes the variable "age" as a predictor in its intersection with "nodes" and "support" variables, whose level of contribution to the model is μ^2 : 93.03 (sig: .00).

The variable "nodes" stands out in its influence on "Improving" the psychosocial and academic development process, which interacts strongly with the variable "support", but the latter factor alone does not exert a decisive influence on the explanatory variance of the study's DV, which is largely confirmed by the analysis of the coefficients of the regression analysis (see Table 5).

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Table 5: Coefficients(a).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.23	.08		2.66	.00
	nodes	.96	.02	.96	42.58	.00
2	(Constant)	.37	.10		3.70	.00
	nodes	.96	.02	.96	43.36	.00
	support	-.05	.02	-.05	-2.61	.01
3	(Constant)	.42	.10		4.07	.00
	nodes	.96	.02	.96	43.76	.00
	support	-.04	.02	-.04	-2.02	.04
	age	-.05	.02	-.04	-2.00	.04

a) DV: improving.

As indicated, the origin of the regression line, expressed by the typed regression coefficients (Beta), is clearly defined by the importance of the occurrence of the variable “nodes”, which define the core prediction of the DV of the analysis (Beta: .96, t: 45.581, sig: .00). For the constantly interacting “nodes”, in the second step (Beta: .96) and “support” (Beta: -.05), whereas in the third step the constant is formed by the interaction of the “nodes” (Beta: .96), “support” (Beta: -.04) and “age” (Beta: -.04), for the t-analyses testing the hypotheses of population differential variances, significant critical levels were maintained in all cases.

DISCUSSION

Undoubtedly, the institutional and organisational process of support, from a systemic and systematic perspective, constitutes an important component in responding to the educational needs of students with specific characteristics, more specifically in relation to students with ASD, who make up the sample population of this study. The support projects must address all those involved in this process by facilitating a continuous and intensive application, according to the type and level of cognitive processing, in relation to the properly regulated executive neuropsychological process, for the purpose of progressive self-regulation, regarding the students for whom these supports are intended, within the framework of ordinary inclusive educational environments.

The framework of these supports must address the different areas of development:

1. The institutional legislative level, which is in line with the most recent measures in terms of conceptual development under the most recent empirical assumptions.
2. The level of school organisation, from the level of project development at school level to the level of the ordinary classroom and/or, where appropriate, the special environment that may be needed temporarily.
3. The area of specific curricular development, based on educational reinforcement, curricular adaptation or those specific organisational curricular measures of a greater dimension, such as diversification programmes or basic vocational training programmes.
4. The methodological-didactic delimitation of the support processes, both at the level of the school organisation and with regard to the time of execution.
5. The level of collaboration between the teachers involved and the relationships between them, their families and/or the social services that may intervene during the educational functional process.
6. The whole process should be followed by an on-site training process based on the initial approach with the participation of all factors involved in the initiated process.
7. The ongoing process of reviewing previous initial projects in accordance with evaluation plans that allow for the continuation or modification, in whole or in part, of the initial support proposals.

However, this whole interlinked process can be frustrated if it is not adapted to the basic principles of the specificity of people with ASD, i.e. it is not accompanied by a methodological specificity based on the continuous creation of informational relational networks between curricular and/or social contents within the planned didactic projects, so that any teaching-learning model must explicitly include a strategy of creating neural nodes or links between the target knowledge, facilitating the creation of meaningful conceptual categories that allow the working memory to fulfil its fundamental task, which is to facilitate the access

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of these categorized contents to the permanent memory, where they will remain until they need to be retrieved according to the socio-educational requirements. Otherwise, the new material perceived at the initial sensory level, with or without the existence of the previous supports, will simply be lost due to the limitations of people with ASD to autonomously create those relationships that allow them to give semantic meaning to the new content with the help of previously learned related content.

In this way, higher order executive processes such as conceptual categorical hierarchies, processes of deduction and problem solving, and their theoretical application to functional practice in new situations, can be progressively granted (Fuchs et al., 2003), Otherwise, learning will be limited to automatic, mechanical or repetitive processes that do not involve higher-level applied cognitive work (Baker, Gersten & Lee, 2002; Biancarosa & Snow, 2004; Gersten et al., 2009; Vaughn, Gersten, & Chard, 2000).

These basic assumptions require at least the following strategic points to be taken into account in a series of steps during the teaching-learning process:

1. Check and build on each student's cognitively assimilated prior knowledge.
2. Analyse the best organisational strategy for extending the new content associated with the key corresponding to the previously assessed learning.
3. Incorporate the new strategy into a process of personal self-instruction to promote the autonomous functioning of intrinsic learning.
4. Establish a strategy of systematic, highly predictable steps in the learning process for the acquisition of new curricular and/or social content.
5. Perform repeated functional practices on the associated new theoretical construction within the conformation of acquired conceptual categories.
6. Facilitate along the functional process the self-regulation of the acquired learning process itself, so that it performs a functional and active work within the semantic memory system.
7. Control the new acquisition through a systematic process of continuous evaluation.

CONCLUSION

The discussion of the results is duly supported by the findings of this study. While it is true that such a general support system is necessary, and indeed there were individual cases where the support system led to partial success in curriculum development, although the specific score on semantic networking was relatively low, in general the support system alone will not address the improvement of the academic and psychosocial development of students with ASD if it is applied arbitrarily without taking into account the specific needs of this group.

Indeed, there are scores where there is hardly any specific complementary human or didactic support related to the presence of reinforcement, while when a highly meaningful didactic strategy was followed, the data on the improvement of academic and functional learning were evident. However, when there is interaction between the two components, i.e. the intersection of a properly systematised support project with didactics based on the development of meaningful neural nodes between curricular and social content, and when they are also practised in a functional way, semantic networks are built up in the permanent memory that not only facilitate integral development, but also serve as links or keys to retrieve this information for its application in solving similar or even new situations that may be proposed.

Conceptual units must be categorized by working memory so that the unit is not lost in a matter of seconds, for which the appropriate relationships between new stimuli and previous learning must be immediately established, whereupon working memory facilitates access to permanent memory in the form of new categories, which can then be re-connected through relational neural nodes so that learning can take place effectively.

In this way, the elaboration of networks creates a semantic field available for the elaboration of higher executive processes, whose intensity and executive quality (problem solving, creativity, imagination, fiction, deduction-induction, synthesis) will logically depend on the specific characteristics of each participant, but above all on the adjustment of didactic process, properly adapted.

REFERENCES

- 1) American Psychiatric Association (APA) (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Publishing. <https://www.psychiatry.org/psychiatrists/practice/dsm>

Institutional Projects of Diversity Attention versus Regular Didactic Methodology Adapted to Students with Autism Spectrum Disorder

- 2) Aracı, N., Melekoğlu, M. A., & Çetin, M. E. (2023). Impact of a mnemonic strategy on learning science concepts for middle school students with specific learning disabilities. *Learning Disabilities: A Contemporary Journal* 2(1), 69–85. <https://psycnet.apa.org/record/2024-32302-005>
- 3) Baddeley, A. D. (1999). *Essentials of human memory*. Washington: Psychology Press. <https://psycnet.apa.org/record/1999-02729-000>
- 4) Baker, S., Gersten, R., & Lee, D. (2002). A synthesis of empirical research on teaching mathematics to low-achieving students. *The Elementary School Journal*, 103, 51–73. https://www.researchgate.net/publication/249134736_A_Synthesis_of_Empirical_Research_on_Teaching_Mathematics_to_Low-Achieving_Students
- 5) Biancarosa, G., & Snow, C. E. (2004). *Reading next. A vision for action and research in middle and high school literacy: A report to Carnegie Corporation of New York*. Washington, DC: Alliance for Excellence in Education. https://media.carnegie.org/filer_public/b7/5f/b75fba81-16cb-422d-ab59-373a6a07eb74/ccny_report_2004_reading.pdf
- 6) Boekaerts, M., & Cascallar, E. (2006). How far have we moved toward the integration of theory and practice in self-regulation? *Educational Psychology Review*, 18(3), 199–210. https://www.researchgate.net/publication/227279167_How_Far_Have_We_Moved_Toward_the_Integration_of_Theory_and_Practice_in_Self-Regulation
- 7) Boon, R. T., Urton, K., Grünke, M., & Rux, T. A. (2019). Mnemonic strategies in mathematics instruction for students with learning disabilities: A narrative review. *Learning Disabilities: A Multidisciplinary Journal*, 24(1), 49–62. <https://doi.org/10.18666/LDMJ-2019-V24-I2-9901>
- 8) Caron, M. J., Mottron, L., Berthiaume, C., & Dawson, M. (2006). Cognitive mechanisms, specificity and neural underpinnings of visuospatial peaks in autism. *Brain*, 129, 1789–802. <https://pubmed.ncbi.nlm.nih.gov/16597652/>
- 9) Carter, E. W., Common, E. A., Sreckovic, M. A., Huber, H. B., Bottema-Beutel, K., Gustafson, J. R., ... & Hume, K. (2014). Promoting social competence and peer relationships for adolescents with autism spectrum disorders. *Remedial and Special Education*, 35(2), 91–101. <https://doi.org/10.1177/07419332513514618>
- 10) Center on Multi-Tiered Systems of Support. (2022). *Implementation*. <https://mtss4success.org/implementation>
- 11) Cioca, L., & Nerisanu, R. A. (2020). Enhancing creativity: Using visual mnemonic devices in the teaching process in order to develop creativity in students. *Sustainability*, 12(5), 1985. <https://doi.org/10.3390/su12051985>
- 12) Cook, B., & Cook, S. (2013). Unravelling evidence-based practices in special education. *The Journal of Special Education*, 47(2), 71–82. <https://doi.org/10.1177/0022466911420877>
- 13) Cook, B., & Odom, S. L. (2013). Evidence-based practices and implementation science in special education. *Exceptional Children*, 79(2), 135–144. <https://doi.org/10.1177/001440291307900201>
- 14) Cook, B., Cook, S. C., & Collins, L. W. (2016). Terminology and evidence-based practice for students with emotional and behavioral disorders: Exploring some devilish details. *Beyond Behavior*, 25(2), 4–13. <https://doi.org/10.1177/107429561602500202>
- 15) Council of Europe. (2018). *CEFR companion volume with new descriptors*. https://www.researchgate.net/publication/338178234_Council_of_Europe_2018_Common_European_Framework_of_Reference_for_Languages_Learning_Teaching_Assessment_Companion_Volume_with_New_Descriptors_Strasbourg_Council_of_Europe_Publishing_Authors_B_North_E
- 16) Dembo, M. H., & Eaton, M. J. (2000). Self-regulation of academic learning in middlelevel schools. *Elementary School Journal*, 100(5), 473–490. <https://www.jstor.org/stable/1002280>
- 17) Dunn, M., & Miller, D. (2016). Improving story writing: Integrating the story mnemonic strategy with iPad apps for art and keyboarding. *International Journal for Research in Learning Disabilities*, 3(1), 11–28. <https://www.semanticscholar.org/paper/Improving-Story-Writing%3A-Integrating-the-Story-with-Dunn-Miller/d9444d49593320391a1127fade56be4843b6e323>
- 18) Fleury, V. P., Hedges, S., Hume, K., Browder, D., Thompson, J., Fallin, K., El Zein, F., Reutebuch, C., & Vaughn, S. (2014). Addressing the academic needs of adolescents with autism spectrum disorder in secondary education. *Remedial and Special Education*, 35(2), 68–79. <https://doi.org/10.1177/0741932513518823>
- 19) Frith, C. (2004). Is autism a disconnection disorder? *The Lancet Neurology*, 3(10), 577. [https://doi.org/10.1016/s1474-4422\(04\)00875-0](https://doi.org/10.1016/s1474-4422(04)00875-0)
- 20) Frith, U. (1989). *Autism: Explaining the enigma*. Oxford: Blackwell.

Institutional Projects of Diversity Attention versus Regular Didactic Methodology Adapted to Students with Autism Spectrum Disorder

[https://www.scirp.org/\(S\(lz5mqp453edsnp55rrgjt55\)\)/reference/referencespapers.aspx?referenceid=1268296](https://www.scirp.org/(S(lz5mqp453edsnp55rrgjt55))/reference/referencespapers.aspx?referenceid=1268296)

- 21) Frost, K. M., Brian, J., Gengoux, G. W., Hardan, A., Rieth, S. R., Stahmer, A., & Ingersoll, B. (2020). Identifying and measuring the common elements of naturalistic developmental behavioral interventions for autism spectrum disorder: Development of the NDBI-Fi. *Autism*, 24(8), 2285–97. <https://doi.org/10.1177/1362361320944011>.
- 22) Gersten, R., Chard, D., Jayanthi, M., Baker, S., Morphy, P., & Flojo, J. (2009). *A meta-analysis of mathematics instructional interventions for students with learning disabilities: A technical report*. Los Alamitos, CA: Instructional Research Group.
- 23) Gore, M. C. (2010). *Inclusion strategies for secondary classrooms: Keys for struggling learners*. Corwin Press: SAGE. <https://doi.org/10.4135/9781483350424>
- 24) Happé, F. G. (1999). Autism: Cognitive deficit or cognitive style? *Trends in Cognitive Sciences*, 3(6), 216–222. Doi: 10.1016/s1364-6613(99)01318-2
- 25) Happé, F., & Frith, U. (2006). The weak central coherence account: Detail- focused cognitive style in autistic spectrum disorders. *Journal of Autism and Developmental Disorders*, 36, 5–25. <https://pubmed.ncbi.nlm.nih.gov/16450045/>
- 26) Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, 77, 81–112. <https://journals.sagepub.com/doi/abs/10.3102/003465430298487>
- 27) Hume, K., Odom, S. L., Steinbrenner, J. R., DaWalt, S., Hall, L. J., Kraemer, B. ... & Bolt, D. M. (2022). Efficacy of a School-Based Comprehensive Intervention Program for Adolescents with Autism. *Exceptional Children*, 88(2), 23–240. DOI:10.1177/00144029211062589. <https://pubmed.ncbi.nlm.nih.gov/33449225/>
- 28) Larkan-Skinner, K., & Shedd, J. M (2021). Real-Time Data and Predictive Analytics: Where Does IR Fit? *New Directions for Institutional Research*, 2020(185-186), 11–24. DOI:10.1002/ir.20326. <https://onlinelibrary.wiley.com/doi/abs/10.1002/ir.20326>
- 29) Liu, A. Y, Lacoé, J., Lipscomb, S., Halmson, J., Johson, D. R., Thurlow, M. ... & Silverberg, M. (2018). *Preparing for life after high school: The characteristics and experiences of youth in special education. Findings from the national longitudinal transition study 2012*. Vol. 3: Comparisons over Time (Full Report) (NCEE 2018-4007). Washington, DC: U.S. Department of Education, Institute of Education Sciences. <https://files.eric.ed.gov/fulltext/ED580934.pdf>
- 30) Lubin, J., & Polloway, E. A. (2016). Mnemonic instruction in science and social studies for students with learning problems: A review. *Learning Disabilities: A Contemporary Journal*, 14(2), 207–224. <https://www.semanticscholar.org/paper/Mnemonic-Instruction-in-Science-and-Social-Studies-Lubin-Polloway/e2eb55c26e0cde6a31c33ead248288def86625f4>
- 31) Maenner, M. J., Shaw, K. A., & Baio, J. (2020). Prevalence of autism spectrum disorder among children aged 8 years autism and developmental disabilities monitoring network, 11 sites, United States, 2016. *MMWR Surveillance Summaries*, 69(4), 1–12. <https://doi.org/10.15585/mmwr.ss6904a1>
- 32) Mandinach, E. B. (2012). A perfect time for data use: Using data-driven decision making to inform practice. *Educational Psychologist*, 47(2), 71–85. DOI: 10.1080/00461520.2012.667064.
- 33) McFarland, J., Hussar, B., Zhang, J., Wang, X., Wang, K., Hein, S. ... & Barmer, A. (2019). *The condition of education 2019 (NCES 2019-144)*. IES. National Center for Education Statistics. <https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2019144>
- 34) Morin, K. L., Sam, A., Tomaszewski, B., Waters, V., & Odom, S. L. (2021). Knowledge of evidence-based practices and frequency of selection among school-based professionals of students with autism. *The Journal of Special Education*, 55(3), 143–152. DOI: 10.1177/0022466920958688. [journalofspecialeducation.sagepub.com](https://journals.sagepub.com/doi/abs/10.1177/0022466920958688)
- 35) Mursi, N. B., Sulaimani, M. F. (2022). Influence of context related factors on Saudi special education teacher's understanding of evidence, evidence- based, and evidence- based practices. *Problems of Education in the 21st Century*, 80(4), 588–600. <https://doi.org/10.33225/pec/22.80.588>
- 36) Odom, S. L., Collet-Klinenberg, L., Rogers, S., & Hatton, D. (2010). Evidence-based practices in interventions for children and youth with autism spectrum disorders. *Preventing School Failure: Alternative Education for Children and Youth*, 54, 275–282. <https://www.tandfonline.com/doi/full/10.1080/10459881003785506>
- 37) Ojea, M. (2023). Autism: New conceptual propositional hypothesis. *European Journal of Theoretical and Applied Sciences*, 1(6), 115–124. <https://ejtas.com/index.php/journal/article/view/437>
- 38) Reichow, B., & Volkmar, F. R. (2011). Evidence-based practices in autism: Where we started. In B. Reichow, P. Doehring, D. V. Cicchetti, & F. R. Volkmar (Eds.), *Evidence-based practices and treatments for children with autism* (pp. 3–10). Springer. <https://psycnet.apa.org/record/2010-25555-001>

Institutional Projects of Diversity Attention versus Regular Didactic Methodology Adapted to Students with Autism Spectrum Disorder

- 39) Selçuk, Z. (2018). *Eğitim psikolojisi [Education Psychology]*. Nobel Akademi.
https://www.academia.edu/36316637/E%C4%9Fitim_Psikolojisi
- 40) Spencer, T., Detrich, R., & Slocum, T. A. (2012). Evidence-based practice: A framework for making effective decisions. *Education and Treatment of Children, 35*(2), 127–151. <https://doi.org/10.1353/etc.2012.0013>
- 41) Test, D. W., Smith, L. E., & Carter, E. W. (2014). Equipping youth with autism spectrum disorders for adulthood: Promoting rigor, relevance, and relationships. *Remedial and Special Education, 35*(2), 80–90.
<https://doi.org/10.1177/0741932513514857>
- 42) Vaughn, S., Gersten, R., & Chard, D. J. (2000). The underlying message in LD intervention research: Findings from research syntheses. *Exceptional Children, 67*, 99–114. <https://psycnet.apa.org/record/2001-00001-007>
- 43) Vaughn, S., Wanzek, J., Murray, C. S. (2012). *Intensive interventions for students struggling in reading and mathematics. A Practice Guide*. Portsmouth, NH: Center on Instruction at RMC Research Corporation.
<https://files.eric.ed.gov/fulltext/ED531907.pdf>
- 44) Wong, C., Odom, S. L., Hume, K., Cox, A. W., Fetting, A., Kucharczyk, S. ... & Schultz, T. R. (2015). Evidence based practices for children, youth, and young adults with autism spectrum disorder: A comprehensive review. *Journal of Autism and Developmental Disorders, 45*, 1951–1966. <https://doi.org/10.1007/s10803-014-2351-z>
- 45) Yamamoto, S. H., & Alverson, C. Y. (2023). Post-high school outcomes of students with autism spectrum disorder and students with intellectual disability: Utilizing predictive analytics and state data for decision making. *Journal of Intellectual Disabilities, 27*(3) 633–647. DOI: 10.1177/17446295221100039. journals.sagepub.com/home/jid
- 46) Zhang, J., Martella, R. C., Kang, S., & Yenioglu, B. Y. (2023). Response to Intervention (RTI)/ Multi-Tiered Systems of Support (MTSS): A nationwide analysis. *Journal of Educational Leadership and Policy Studies, 7*(2), 1–26.
<https://files.eric.ed.gov/fulltext/EJ1396417.pdf>
- 47) Ziviani, J., Wilkinson, S., Hinchliffe, F., & Feeney, R. (2015). Mapping allied health evidence-based practice: providing a basis for organisational realignment. *Australian Health Review, 39*(3), 295–302. <https://doi.org/10.1071/AH14161>



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Development of Physical Education Learning Media for Football Material for Junior High School Class VII Students on Smartphones Based on Android Applications



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ABSTRACT: This study aims to (1) produce a product development of Physical Education Sports And Health learning media for soccer material on android application-based smartphones for Junior High School students, (2) determine the feasibility of Physical Education Sports And Health learning media development products for soccer material on android application-based smartphones for Junior High School students, and (3) determine the level of practicality Physical Education Sports And Health learning development products for soccer material on android application-based smartphones for Junior High School students. This research is a development research with the ADDIE approach model, namely: analyse, design, develop, implement, and evaluate. The subjects of this study were a small-scale trial of 7 students in class VII SMP N 2 Sewon, a large-scale trial subject of 30 students in class VII SMP N 2 Bantul, expert validation including material experts and media experts. The results showed that Physical Education Sports And Health learning media product of soccer material on smartphones based on android applications had a very good / very feasible level of feasibility. The level of product feasibility based on material expert validation reached an average of 90% with a very feasible category, media expert validation reached 86.6% with a very feasible category, small-scale trials reached an average of 92.3% with a very good / very feasible category, large-scale trials reached an average of 90.2% with a very good / very feasible category.

KEYWORDS: media development, football, android application

INTRODUCTION

Technological progress is a stage of development that always goes hand in hand with advances in science, so its progress is inevitable (Pansera & Fressoli, 2021). Technological advances in the present always increase and experience development every year, therefore technological progress is a demand that must always be addressed and improved in order to facilitate every human activity in their daily activities. Now there are mobile phones, video call media, sending electronic mail or email, and so on. The world of education certainly cannot be separated from technology (Islam, 2019). Technology and science are a symbiotic mutualism that is evident in education and everyday life (Coccia, 2019). The relationship between technology and science certainly has an impact on the learning process in education. The utilisation of media in an educational process, especially technology, is an advancement in the world of education to help achieve learning objectives (Ahmadi, 2018). With the media, technology can have a role in the learning process, for example if students want to read books related to learning at school, students now do not need to go out of the house or go to the library because now there are many applications that support students to read books online, so there is no need to go out of the house and can be accessed anywhere using a smartphone, laptop, or computer owned by the student. With this media, teachers or lecturers can explain the material to be conveyed without having to bother writing on the blackboard.

Research conducted by (Zulfritria et al., 2020) stated that the benefits of technology and the internet as a source of information that is relatively fast both in terms of time of receiving and updating data, relatively cheap costs, information that is global in the sense that it comes from all over the world, and is interactive and flexible. The existence of information technology media can simplify and minimise costs, energy and time to achieve a learning goal. Smartphone is a current technological development that has many users, almost all of whom have smartphones. The high connection to smartphones is a potential that must be considered and developed in the world of education as a learning medium. From this, it shows that the attractiveness and dependence on smartphones is very influential on the lifestyle of adolescents or students, so that the need for special control

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and attention so that smartphones can be used or utilised optimally in positive activities, especially in the world of education. Smartphones that are widely used today are android-based. As an educator, you must be good at utilising technological advances so that students' interest in smartphones can be useful in learning.

The need for learning media development so that the learning process is more varied and captures the interest of students in participating in learning and makes it easier for students to understand the material being taught (Puspitarini & Hanif, 2019). (Nurrita, 2018) stated the need for learning media that can improve student learning outcomes, with the existence of learning media: the teaching and learning process becomes easy and interesting so that students can understand and understand learning easily, student learning efficiency can increase because it is in accordance with learning objectives, helps student learning concentration because learning media is interesting and in accordance with student needs, increases student learning motivation because of the comprehensive experience in learning so that students can understand the material in real terms from the material provided more understand the material as a whole, students are involved in the learning process and students have the opportunity to do creativity and develop their potential.

Teaching and learning aids in schools have been influenced by advances in science and technology. Learning activities must also be adapted to the development of technology itself. However, there are still many obstacles that must be resolved by teachers and students so that education is even more advanced (Chowdhury, 2018). The existence of these problems, the lack of interest of students in receiving the delivery of Physical Education Sports And Health material affects the independence of students, so this is where learning independence is needed for students. Learning independence is a learning activity carried out by students without depending on other people, both friends and teachers, in achieving learning goals, namely mastering material or knowledge well with their own goals and being able to apply their knowledge in solving problems in everyday life (Hasibuan et al., 2019).

From the results of observations and unstructured interviews with three Physical Education Sports And Health teachers conducted by the author in April 2023 at SMP N 2 Bantul and SMP N 1 Sewon there are still many obstacles in providing football material, among others: (1) the field facilities are narrow and not proportional to the number of students, (2) the environment around the school has very little vacant land where most junior high schools are located on the edge of the highway so that there are no other choices or alternatives that can be utilised by teachers and students, (3) the use of school facilities that are less maximised in Physical Education Sports And Health learning, (4) the noisy school environment by vehicles, so that the material is less clear, (6) teachers in carrying out assessments are constrained by facilities and infrastructure, (7) the absence of learning media in junior high schools. Regulatory innovation in limited places in Physical Education Sports And Health learning needs to be done from limited facilities and infrastructure, teachers must be innovative so that Physical Education Sports And Health learning can be delivered in accordance with learning objectives. In point number seven where the absence of media that supports football learning in schools, especially in SMP 2 Bantul which is constrained by narrow land and can also be in schools that have narrow land and long field distances, learning media that supports the delivery of material is needed. As a teacher, you must realise that with the existence of learning media it will be easy to explain the material to students.

Along with the practice of students at school using media or rules modified by the teacher, students will also get basic knowledge of soccer material through learning media that will be developed by the author, so that it is hoped that the objectives of the three domains can be achieved optimally. Based on what is described above, it shows that the android application system has the greatest opportunity to use learning media applications that can be modified into a learning media and inserted on a smartphone. It is still rare to find learning materials in the form of android-based applications. It is hoped that by including soccer material on smartphones, students can easily access and find information related to Physical Education Sports And Health learning material on soccer material.

METHOD

The type of research used is Research and Development (RnD) or development research. Research and Development is a process carried out to develop or improve a product and test the practicality of the product (Siahaan et al., 2021). The product development model used in this study aims to develop and test the feasibility of a product that can help students in learning. Many development models can be used, the learning development model used in this research is the ADDIE Development Design Model (Analysis-Design-DevelopImplement-Evaluate).

The subjects of this study were small-scale test subjects carried out at SMP Negeri 2 Sewon, the number of respondents was 7 students who were in accordance with the characteristics of the need, namely grade 7, large-scale subjects were carried out at SMP Negeri 2 Bantul with the number of respondents 30 students taken by random sampling. In this study, researchers used a questionnaire instrument. Questionnaires were given to material experts, media experts, and students as respondents. This

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questionnaire instrument is arranged with a Likert Scale with four kinds of answer choices. The data analysis technique was carried out using quantitative descriptive analysis techniques with percentages, namely by analysing quantitative data obtained from expert test questionnaires and field tests.

RESULTS

The results of research and development of learning media on smartphones based on android applications for soccer material for grade VII junior high school students are as follows:



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Figure 1. The results of the development of PHYSICAL EDUCATION SPORTS AND HEALTH learning media on smartphones based on Android applications

Based on the picture above, it can be seen an example of the appearance of the product development of Physical Education Sports And Health learning media for soccer material on smartphones based on android applications for VII grade junior high school students. In the process of developing android application media, the products developed need to go through a validation and trial process. The validation process in this study consists of material validation with material expert lecturers and media expert validation with media expert lecturers, followed by a trial process with VII grade junior high school students. This process is carried out so that the product developed is suitable for use in delivering material in the learning process.

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DISCUSSION

Shape of Learning Media Product

The output of this research and development is the learning media for Physical Education Sports And Health football material on smartphones based on android applications that refer to the Merdeka curriculum for class VII Junior High School. This application learning media is in the form of an application that can be downloaded via a smartphone online that has the drive link. In this android application-based learning media, there are several menu features that are tailored to the needs of students, namely learning text material, images, learning videos and interactive quizzes. The content of the android-based learning media is compiled and adapted from several books that are relevant to the learning outcomes of the independent curriculum. The learning video in the application includes a narration of each movement to make it easier for students to understand the basic movements in the game of football. The quizzes contained in the application are also adjusted to each material discussed.

In using this android application-based learning media is not difficult because in appearance it does not require special software, the most important thing is to have an android smartphone in operation is also very easy like applications in general. So that if ordinary people or senior Physical Education Sports And Health teachers who are still unfamiliar with technology have no difficulty using this learning application. The operation is quite simple because in the application there are already clear bottom buttons to use such as a picture of a house to return to the initial menu, an arrow to go to the next slide and a cross to exit the application.

Learning Media Feasibility

At the validation stage by material experts, the average percentage obtained from two material experts is 90% with the category of product feasibility is very feasible / very good to be accepted by students, while for the results of the media expert test, the percentage assessment of three media experts obtained an average product feasibility assessment with a percentage of 86.6% with a very good / very feasible category. The results of the material and media expert tests that have been carried out show that the Physical Education Sports And Health learning media application of soccer material on android-based smartphones developed is declared very feasible to be used by students as a reference material for physical education learning. There are comments and suggestions at this validation stage by both material and media experts, for example, the suitability of the image with the material should be included with the source.

After conducting validation to experts and getting input, suggestions, shortcomings and advantages of application learning media, the next step is to revise the product to make it better. The revision carried out is to fix writing errors, add image sources listed, and fix the narration in the video. The next process after making revisions according to the suggestions and input from the validator is to test the product to 7 students as a sample taken at SMP N 2 Sewon. At this stage students are asked to respond and fill out a questionnaire that has been prepared to assess the ease, attractiveness, and helpfulness of Physical Education Sports And Health learning media on soccer material on smartphones based on android applications. The results of the product trial the number of scores obtained from the response questionnaire of class VII students of SMP N 2 Sewon on the practicality of Physical Education Sports And Health learning media is 92.3% which is in the category of very good / very feasible to be used in the Physical Education Sports And Health learning process of class VII junior high school. After the small-scale trial, there were no significant obstacles so that no improvements were made to the product and the research could be continued to the next stage.

The trial was conducted with a larger sample of 30 students taken from SMP N 2 Bantul class VII by random sampling. The large-scale trial was carried out to test the practicality of asking students to fill in the items of the research instrument for the practicality of learning media based on android applications. The aspects assessed were related to media display, material content, and learning. The results of the product trial the number of scores obtained from the response questionnaire of seventh grade students on the practicality of Physical Education Sports And Health learning media on smartphones based on android applications is 90.2% in the category of very good / very feasible to use in the learning process of Physical Education Sports And Health class VII junior high school. After conducting a series of research and development of learning media for Physical Education Sports And Health football material on smartphones based on android applications can already be disseminated and used in the process of learning Physical Education Sports And Health football material in class VII junior high school.

The results of the percentage of product feasibility obtained from material experts, media experts, and responses from students. The percentage obtained from the material expert validation of 90% is included in the "very good" classification, the results of validation from media experts are obtained at 86.6% including the classification of "very good", and the response of the student assessment obtained a result of 91.3% including the classification of "very good". The highest score can be obtained from the students' response because the complete material display is in accordance with the core competencies, basic competencies, and learning objectives. Android application media is very helpful for digesting or receiving subject matter and interesting video

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displays make students not bored or bored when presenting application media. While the lowest score is obtained from media experts because the video media still has some shortcomings for the display at the end and the title is not quite right.

The data obtained from material experts, media experts, and learner responses show that the learning media on smartphones based on android applications fall into the classification of very feasible or can be used as a reference in delivering football material during the learning process.

CONCLUSIONS

This research and development has produced Physical Education Sports And Health Learning Media for soccer material on smartphones based on android applications for Class VII SMP, based on the results of research and discussion, conclusions can be drawn: (1) The product produced from this research is an android-based application that aims to facilitate learning activities at school. The application developed has passed several stages of making including making storyboards, validation of material and media experts, small-scale and large-scale trials and practicality tests. (2) The results of the validation process given by material experts to assess the content of the android-based Physical Education Sports And Health application in terms of aspects of learning strategies and aspects of material content are stated in the very good / very feasible category, while in the media expert validation process on the assessment of the appearance design aspect and the programming aspect the results are included in the very good / very feasible category. Small group and large group trials that have been conducted on seventh grade students obtained results in the very good / very feasible category. (3) The product of research and development of Physical Education Sports And Health application of soccer material on smartphones based on android applications is declared practical to use based on the results of small-scale practicality trials obtained a value of 92.3% in the very good / very feasible category. While on a large scale practicality obtained a value of 90.2% very good / very feasible category. For teachers, it is hoped that the Physical Education Sports And Health application of soccer material on smartphones based on this android application can be used as teaching material and to make it easier for teachers to convey learning material to students. For researchers to be able to always update features and materials so that they can develop better.

REFERENCES

- 1) Ahmadi, D. M. R. (2018). The use of technology in English language learning: A literature review. *International Journal of Research in English Education*, 3(2), 115–125.
- 2) Chowdhury, M. (2018). Emphasizing morals, values, ethics, and character education in science education and science teaching. *MOJES: Malaysian Online Journal of Educational Sciences*, 4(2), 1–16.
- 3) Coccia, M. (2019). A theory of classification and evolution of technologies within a Generalised Darwinism. *Technology Analysis & Strategic Management*, 31(5), 517–531.
- 4) Hasibuan, A. M., Saragih, S., & Amry, Z. (2019). Development of Learning Materials Based on Realistic Mathematics Education to Improve Problem Solving Ability and Student Learning Independence. *International Electronic Journal of Mathematics Education*, 14(1), 243–252.
- 5) Islam, M. S. (2019). Bangladeshi university students' perception about using Google classroom for teaching English. *Psycho-Educational Research Reviews*, 8(2), 57–65.
- 6) Nurrita, T. (2018). Pengembangan media pembelajaran untuk meningkatkan hasil belajar siswa. *Jurnal Misykat*, 3(1), 171–187.
- 7) Pansera, M., & Fressoli, M. (2021). Innovation without growth: Frameworks for understanding technological change in a post-growth era. *Organization*, 28(3), 380–404.
- 8) Puspitarini, Y. D., & Hanif, M. (2019). Using Learning Media to Increase Learning Motivation in Elementary School. *Anatolian Journal of Education*, 4(2), 53–60.
- 9) Siahaan, K. W. A., Manurung, H. M., & Siahaan, M. M. (2021). Android-Based Learning Media Development Strategies During Pandemic Times To Improve Student Science Literature. *International Journal of Education and Humanities*, 1(1), 34–42.
- 10) Zulfitria, Z., Ansharullah, A., & Fadhillah, R. (2020). Penggunaan teknologi dan internet sebagai media pembelajaran di masa pandemi covid-19. *Prosiding Seminar Nasional Penelitian LPPM UMJ*, 2020.



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Population Changes Under the Impact of Industrialization in Vietnam: A Case Study of Binh Duong Province



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ABSTRACT: Population change is a key component of Vietnam's economic development paradigm. However, in each locality, population shifts can be stimulating while also posing hurdles to socioeconomic development programs. This article assesses population changes in Binh Duong province and suggests plans for development and population control. The findings suggest that Binh Duong has a diversified population and is constantly receiving new population classes. Binh Duong's population increased the most rapidly between 1997 and 2023, following a centuries-long steady pace. This is also a time of dramatic demographic change, with the population becoming more multi-ethnic, multi-regional, multinational, and multicultural. Binh Duong's socioeconomic development successes reflect the contributions of all segments of the community, with immigrants playing a significant role. Binh Duong province must develop and implement policies for sustainable population management and development, including the establishment of a population database system linked to economic and social development strategies, the incorporation of population policies into economic, social, and cultural development programs and plans, and the linking of population development and management policies to sustainable population policies.

KEYWORDS: Binh Duong, Changes, Population, Industrialization, Vietnamese

1. INTRODUCTION

In recent decades, Vietnam has seen significant population mobility inside the country. While some provinces and cities with significant industrial and urban growth have become densely populated, rural populations are decreasing. Domestic population migration is seen as a key component of Vietnam's economic development strategy, contributing to economic growth. However, population changes have caused disruptions in national development policies. In the perspective of rural economic growth, migration is viewed as a "bleeding" of labor. The administration believes that rural-urban migration is damaging to development. To stem the tide of migration, the Vietnamese government has started an ambitious statewide drive to promote rural development known as the National Target Program for New countryside Construction since 2010. (Prime Minister, 2010). Population variations in industrial and urban growth zones serve as both a driving force and a significant impediment to economic and social development. When the population grows rapidly (mostly due to migrant labor), the locality provides people resources for economic development while also causing significant social and cultural pressure, particularly in issue issues concerning housing, education, healthcare, and social security, etc.

Unusual and spontaneous population changes keep local governments in a state of perplexity, particularly when it comes to incorporating population and labor issues into local development initiatives. Many indications demonstrate that population variations in Vietnam, and specifically in Binh Duong province, have not been effectively used to contribute to socioeconomic growth. This article tries to assess the current state of population change in Binh Duong province throughout time. The purpose of this article is to identify gaps and issues in population management and development policies. Based on historical population change, the article advocates a balanced population development policy that is consistent with local economic, social, and environmental goals.

2. DATA AND RESEARCH METHOD

The data used in this article are from the Vietnamese government's investigating agency, the General Statistics Office (GSO). This is an agency under the Ministry of Planning and Investment that advises and assists the Minister of Planning and Investment with state statistics management, statistical coordination, and statistical activity organization. Statistics and the distribution of socioeconomic statistics information to agencies, organizations, and individuals in accordance with applicable laws. The article

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makes use of three key data sets from this institution, including the results of national population and housing censuses conducted in Vietnam in 1999, 2009, and 2019. These are three censuses conducted every ten years to collect basic information on population and housing across the entire Vietnamese territory in order to assess the implementation of socioeconomic development strategies and monitor the country's sustainable development goals (GSO, 1999). Population and housing census data provide detailed demographic information. This is reliable information for researching, analyzing, and forecasting the population and housing development process, providing information to build a comprehensive database on population, and evaluating the results of implementing recommendations, resolutions, and plans on socioeconomic development, as well as the United Nations' sustainable development targets (GSO, 2019).

The article's second source of data comes from Binh Duong Statistics Office (BDOS) publications, which are compiled annually by the province's statistical agency. The content of statistical publications provides fundamental facts that generally reflect the dynamics and current state of the socioeconomic situation in Binh Duong province, as well as its districts, towns, and cities. The data in these publications were collected, processed, synthesized, and calculated in accordance with the scope and procedures of Vietnam Statistics (BDSO, 1999). Each chapter includes an overall socioeconomic assessment of a variety of industries and fields in 2023, as well as explanations of vocabulary, content, and calculation techniques for some statistical indicators (BDSO, 2023).

In addition to statistical publications, the article also uses data and comments in a number of publications related to the socioeconomic transformation of Binh Duong province through historical periods, on the issue population and ethnic groups in Binh Duong province in the past (Mac Duong et al., 1985; Nguyen Van Hiep, 2011; Phan Xuan Bien, 2013; Le Thu Quynh, 2020).

Regarding methodology, this article is presented based on the interdisciplinary method of historical political economy. This approach allows for the study of how political and economic actors and institutions interact over time (Jenkins & Rubin ed., 2023). The process of population change will be discussed in relation to historical progress. This method seeks to define the content and characteristics of population development stages, as well as to compare eras of change in order to determine the nature of that change and its major patterns and laws. The divergence technique is the primary tool for understanding the history of population shifts. In addition to the divergence approach, the article employs statistical methods to directly track the population's phenomena and development. This method is primarily employed in sociological research, but it may also be applied to historical research because it allows for the examination of the impact of general rules in specific historical forms that they appear (Robert 1978).

When documenting the history of population change using the multidisciplinary technique of political and economic history, it will include an in-depth study of density, structure, and characteristics, as well as a thorough exploration of politics. Treat the problems under investigation. Furthermore, studies adopting the multidisciplinary technique of political and economic history consider the historical context while discussing the causes, processes, consequences, and historical importance. The interdisciplinary approach of political and economic history lends itself to social scientific inquiry that highlights the political causes or consequences of historical problems. Jenkins and Rubin assert that the methodology allows for deepening historical sources to improve the measurement of the impact of historical context, using multiple sources to validate historical claims, analyze cause and effect relationships, explain historical events, and use historical context to better understand the past and challenges in the present (Jenkins & Rubin ed., 2023).

3. RESULTS AND DISCUSSION

3.1. From the history of progressive development of Binh Duong's population

Binh Duong is a land that the Vietnamese people explored and settled during the same period as Saigon – Gia Dinh. Many historical documents affirm that the first Vietnamese settlers from the Northern and Central regions migrated to Binh Duong for livelihood at the end of the 16th century and the beginning of the 17th century. This diverse group included impoverished farmers who could not endure the hardships and difficulties in their homeland, individuals escaping from the military, debts, or taxes, as well as those fleeing from feudal authorities abandoning fields or evading pursuit. Along with Mo Xoai, Cu Lao Pho, Ben Nghe, and the surrounding areas of Thu Dau Mot (Lai Thieu, Phu Cuong), Tan Uyen (Tan Ba, Tan Khanh...) were ideal settlement areas during the initial stages of land exploration, where communities and villages were established and expanded (Communist Party Of Song Be, 1991).

In 1698, the Southeastern region officially became a province of Vietnam, and Binh An District was established with four main administrative centers: Thu Thiem, Thu Duc, Thu Dau Mot, and Thu Bang Bot. Among them, "Thu Dau Mot" was the most significant, serving as the center of Binh An District and later becoming the administrative center of Binh An Province. The Binh An region (formerly Binh Duong) had the most fertile land, indicating that it was the most densely populated agricultural area. The areas surrounding Thu Dau Mot, such as Phu Cuong, Lai Thieu, Phu Loi, or the regions of Tan Khanh, Tan Uyen, and Cu Lao Rua, were bustling villages in Binh Duong since the early days of settlement (Phan Xuan Bien, 2013).

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From 1808 until the French invasion, the Vietnamese population in the region continued to grow. Additionally, Chinese immigrants from Cu Lao Pho (Bien Hoa) and Ben Nghe (Gia Dinh) established pottery kilns in Lai Thieu, Phu Cuong, and Tan Uyen, attracting more population and labor to form traditional Chinese settlements that persist to this day, such as in the cities of Thu Dau Mot, Lai Thieu – Thuan An, and Tan Uyen. While engaging in various traditional trades, with pottery being the predominant one, the Chinese community also thrived in trade and organized cultural festivals, contributing to the distinctive cultural vitality of the Binh Duong people throughout different periods.

When the French Colonialists imposed domination and conducted exploitative activities, the population in this region developed rapidly, leading to the formation of numerous hamlets and villages. In areas specializing in forestry, such as Thu Dau Mot, various products ranging from houses, furniture, beds, cabinets, weapons, ceremonial objects, to shipbuilding wood, were manufactured and exchanged vigorously. This region also attracted skilled architects and renowned shipbuilders nationwide. The early establishment of production, exchange, and trade activities in forestry solidified Thu Dau Mot's position as the 'capital' of the Southern region.

The heritage of houses, ancient temples, and pagodas constructed with various durable and beautiful types of wood, showcasing the pure Vietnamese architectural style, is still preserved in Binh Duong. Notable examples include the wooden ancestral shrines in Lai Thieu, the carpentry villages in Phu Tho, and Chanh Nghia, which are unique communities in Binh Duong. This is also the reason why the French established the Ba Nghe School in Thu Dau Mot, a renowned vocational training institution in the former Indochina. The development of handicrafts (pottery, carpentry, engraving, and lacquerware) has transformed the demographic composition of Thu Dau Mot.

Binh Duong has been the top rubber-growing province since the early twentieth century. As France's plantations developed, the number of rubber workers climbed. The majority of rubber growers are from the North and Central areas (primarily in the North), and the majority of them have had to leave the nation to work on "contracts." According to the 1910 Indochina Statistical Yearbook, Binh Duong had 41 Europeans, 87,000 Kinh, 1,250 Chinese, 700 Minh Huong, and 14,300 ethnic people... By 1926, there was more precise information on the city. Thu Dau Mot has a population of 105,968 Vietnamese people of Southern origin; Vietnamese people of Northern and Central region are 4,122 people, Khmer people are 2,469 people, Stieng people are 11,945 people, Cham people are 453 people, Minh Huong people are 1,097 people, Chinese people are 1,374 people" (Mac Duong et al, 1985). These statistics show that population changes are frequent and quite clear.

During the 30 years of war (1945-1975), Binh Duong's population composition and density continued to be supplemented from many places. Notably, from the migration of Vietnamese people from the Northern provinces and some from the Central region to the "district" policies of the Saigon government. In 1955, after the exodus of Catholics, Thu Dau Mot's population was 214,500 people. In 1967, after the US imperialists sent American combat troops and their allies to fight in the battlefield of South Vietnam, establishing a base in Lai Khe, Phu Loi, Binh Duong area was divided into three regions: *temporarily occupied* (area managed by the Saigon government), area 39,663 hectares, population 133,558 people; *guerrilla area* (disputed area between the Saigon Army and the Resistance Army), area 59,545 hectares, population 39,561 people; and the *resistance area* (base and liberation area managed by the revolutionary government), area of 121,344 hectares, population of 52,330 people. Although due to the war situation, in 12 years (1955 - 1967) the population in Thu Dau Mot still increased by 10,949 people (Nguyen Van Hiep, 2011)

Since the country's reunification, the population composition has changed rapidly and significantly, with some notable characteristics: people returning home after the war to their old hometowns; a group of officers and soldiers from the North came to stay and chose this place as their new hometown; new economic people, people building state-owned forestry farms in accordance with Party and State policies... Binh Duong's population has grown dramatically in the more than twenty years after liberation. Binh Duong province had 646,317 people in 1996, which was roughly comparable to Song Be province's population of 671,000 in 1980.

3.2. To the process of change in the recent quarter of a century

Since Binh Duong province was established and went into industrialization and modernization, Binh Duong's population has had notable changes in population density, population composition and many labor and social issues that are very noteworthy.

The *fastest population expansion in all historical periods* is immediately identifiable, owing primarily to policies aimed at attracting workers and jobs when Binh Duong established concentrated industrial parks. Three timelines separated by ten years: 1999, 2009, and 2019. The population increased dramatically. In 1999, there were 720,800 people; on April 1, 2009, there were 1,482,636 people, a growth of 766,208 people over 1999, making it the province with the 17th highest population among the country's 63 provinces and cities, and the third largest. In comparison to the Southeast area, only Ho Chi Minh City and Dong Nai province rank higher. The average annual population growth rate is 2.25 times higher than the general growth rate of the Southeast region and

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is the highest in the country. According to 2023 statistics, Binh Duong's population currently has 2,763,100 people (BDSO, 2023). The population chart of Thu Dau Mot, Binh Duong, looking back into the past, clearly shows that.

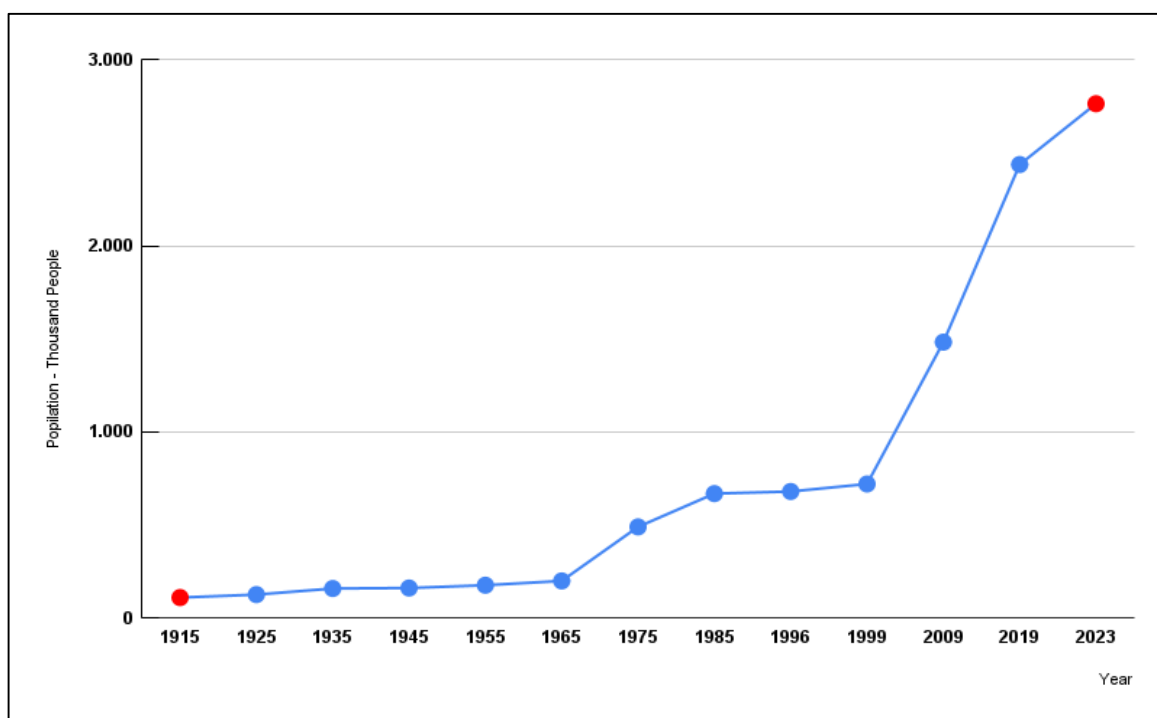


Figure 1. Binh Duong population development chart from 1915 – 2023 (Nguyen Van Hiep, 2020; BDSO, 2023)

The second change is that *the population changes more deeply towards multi-ethnic, multi-regional, multinational and multicultural*. Along with population growth (mainly mechanical growth), Binh Duong's population is clearly developing in a multi-ethnic direction. In 1999, Binh Duong had 25 ethnic groups, in 2009 there were 37 ethnic groups and by 2019 there were 49 ethnic groups. Some ethnic minorities are increasing very rapidly such as Khmer, Tay, Nung, Muong, Thai... Regarding regions, in previous centuries, people coming to Binh Duong mainly came from the North (lowland), Central, however, in recent times, regional imprints have become more diverse, in addition to the North and Central regions, there is also the South. In the North, there are not only people from the lowlands but also people from the upstream (the Muong, Tay, Thai... ethnic groups). People from the South come to Binh Duong from all over the Southeast and Southwest provinces... Foreigners coming to Binh Duong are also more diverse: Europeans, Americans and many Asian countries (China, Taiwan, Japan, Singapore, Korea...). Table 1 is detailed statistics on population changes in Binh Duong through three population censuses in 1999, 2009 and 2019.

Table 1. Population changes by ethnicity in Binh Duong through 3 population and housing censuses 1999, 2009 and 2019

No.	Ethnic group	1999	2009	2019
	Total population	716.661	1,481,550	2,426,561
1.	Kinh	695.710	1,421,233	2,306,193
2.	Hoa	14.445	18,783	17,993
3.	Khmer	1.490	15,435	65,233
4.	Tay	514	5,443	5,619
5.	Nung	453	3,050	5,178
6.	Muong	315	10,222	9,021
7.	Xtieng	60	153	355
8.	Thai	59	3,869	6,672
9.	San Chay	53	530	406
10.	Choro	27	134	120
11.	Xinhmun	26		3
12.	Dao	23	443	689
13.	Giarai	22	20	575

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14.	Sandiu	11	383	314
15.	Ngai	8		8
16.	E đê	4	99	1,937
17.	Mnong	3	59	356
18.	Tho	3	510	789
19.	Raglay	2	19	102
20.	Bru Van Kieu	2	11	100
21.	Sila	2		6
22.	Coho	1	37	141
23.	Hre	1	18	287
24.	Ma	1	18	58
25.	Chu ru	1	14	6
26.	Cham		837	2,518
27.	Mong		57	907
28.	Giay		28	14
29.	Co lao		23	72
30.	Xodang		18	100
31.	Ba na		10	250
32.	Khang		6	5
33.	La chi		5	8
34.	Mang		5	3
35.	Taoi		2	101
36.	Phula		2	4
37.	Pupeo		2	4
38.	Brau		1	1
39.	O du		1	
40.	Khomu			262
41.	Co			41
42.	Cotu			33
43.	Gietrieng			20
44.	Ha nhi			8
45.	Chut			8
46.	Romam			8
47.	Lahu			4
48.	Lolo			3
49.	Pathen			3
50.	Laha			1

The population change makes cultural and religious life in Binh Duong have many new nuances. In addition to the cultural activities and beliefs of the Vietnamese and Chinese people that have been preserved over the centuries, today Binh Duong has many more cultural activities of the Muong and Cham ethnic groups... According to data. According to 1999 statistics, Binh Duong province has 13 religions with 186,021 followers; The largest number is Catholicism (108,260 followers), followed by Buddhism (58,2020 followers), Hoa Hao Buddhism (10,619 followers), Cao Dai (5,962 followers), Protestantism (1,962), Islam (745 followers), Tu An Hieu Nghia (1010), along with many other religions such as Tinh Do Cu Si, Brahmans, Minh Ly Dao, Buu Son Ky Huong... The picture of a multi-ethnic, multi-cultural, multi-belief population Religion is also the basis for formation - also a symbol of a multi-income community adapting to the natural conditions and social context of Binh Duong during the most vibrant period of history (Nguyen Van Hiep – Tran Hanh Minh Phuong, 2020).

The third change is *the rural-urban population shift, which results in the transformation of rural agricultural society into urban industrial society*. Within 25 years of development, Binh Duong's population has shifted from rural to urban. In 1997, the province's rural-urban population ratio was 73% - 27%; in 2007, it was 71% - 29%; and in 2017, it totally broke through, with 24%

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rural and 76% urban citizens. By 2021, the ratio of rural to urban population in Binh Duong will be 16% - 84%. Binh Duong civilization essentially becomes an urban society.

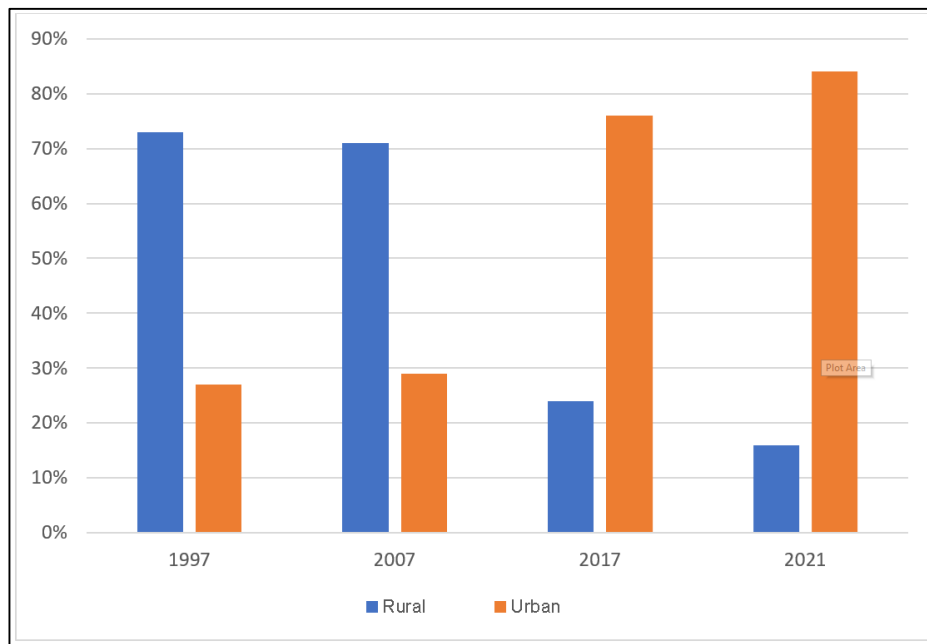


Figure 2. Diagram of rural - urban population change in Binh Duong province 1997 - 2021

The change in rural-urban population leads to a vigorous urbanization process, with the vision of a centrally managed Binh Duong metropolis in the future. Thu Dau Mot City became a provincial city in 2013. According to the 2019 housing census, Thu Dau Mot has a population of 321,607 people. With the growth planning of Binh Duong new city and the many institutions and colleges that have been and are being established, Thu Dau Mot city will continue to draw a huge number of people to come here to study and work in a variety of fields. Thuan An - Di An region, which has a high population density, is where large-scale industrial parks have been formed and developed, attracting many workers and residents from all over the region. In 2020, Thuan An and Di An have become two provincial cities with dozens of modern, typical industrial parks for the whole country. According to the 2019 Population and Housing Census, Thuan An's population is over 596,000 people, Di An's population is over 474,000 people. In reality, the number of residents in these two cities may be much larger. These are the two areas with the greatest population pressure in the province. The issue of planning and population management here is at a challenging stage. Tan Uyen and Ben Cat have formed industrial parks, industrial clusters and urban areas, attracting quite a large number of workers and residents. In 2013, Ben Cat was split into Ben Cat town and Bau Bang district, Tan Uyen was also split into Tan Uyen town and Bac Tan Uyen district. In 2019, the population of this area was 830,073 people. The population of Bau Bang and Bac Tuan Uyen districts is also increasing rapidly with the pace of industrialization and urbanization. Dau Tieng and Phu Giao districts are also entering a period of urbanization and population growth. Many towns and cities have been formed. Currently, Dau Tieng has a population of over 112,000 people; Phu Giao has over 65,000 people. It can be affirmed that the image of a centrally run Binh Duong city is clearly emerging. This is also evidence that Binh Duong's population composition has continuously changed in the last quarter of this century.

4. CONCLUSION

In recent years, Binh Duong has also prioritized economic and social development planning, including population planning. Typically, Binh Duong province's master plan for socioeconomic development to 2020 is supplemented with plans to 2025 (2014); Binh Duong province's socioeconomic development project implements a three-house cooperation model toward smart urban areas (2021), as well as many socioeconomic development plans at the city, town, and district levels. All of these programs contain aims relating to social issues and policies, such as population size, labor, employment, and social security... These are crucial foundations for the province's population policy and management.

Population data information is incomplete and not updated regularly; Some areas have high population density that exceeds the limits of technical and social infrastructure, causing many difficulties for management, especially social security and security order management.

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Binh Duong's population is huge, dense, and growing. Binh Duong has a high mechanical population growth rate, but attitudes and policies on immigration have not been properly defined in socioeconomic development plans, particularly immigration-related ones. Exploiting the benefits of immigrants to serve labor and employment policies, as well as adapting to the economic and social realities of each location when accessing fundamental social services (education, health) for immigrants.

Urban scale is rapidly developing, Binh Duong has created an appeal for people from other areas to urban areas to raise the population automatically, but planning and planning management still have many difficulties. Fragmented residential neighborhoods established on their own; forecasting population changes is insufficient to keep up with the rate of economic and social growth and people's demands.

5. RECOMMENDATION

The picture of Binh Duong's population provides us with a variety of information. It can be said that Binh Duong is what it is now because of the efforts of many generations and layers of people from all regions and nations who came together to establish their fortunes. This is also a valuable resource for the province in terms of labor, intellectual capital, market, and cultural identity. This valuable resource must be developed and marketed as a competitive advantage for the province in worldwide economic integration. As a result, planning and population development play a significant role in the province's building and growth. Some of the policy ideas below should be explored for adoption in the near future:

Developing a population database associated with economic and social development strategies: The population database is critical to socioeconomic growth because it serves as the framework for policy planning and population management. It also serves as the groundwork for the development of the digital economy and society, as well as the premise for the creation of other databases. The province must immediately study, assess, and construct a demographic database to support both immediate and long-term economic and social development initiatives, with a variety of objectives:

- Population information is complete and accurate, supplemented and updated regularly every day, interconnected with the national population database to serve different fields: people, businesses, essential public service...
- Convenient in retrieving population data by area of residence, age and gender, ethnic group, time of living and moving, occupation, and basic social security information of the individual...

Integrate population policy in the province's economic and social development strategies, programs and plans. It is vital to clearly convey that the population, particularly immigrants, is a valuable resource for socioeconomic progress. Immigrants require policies that enable access to social security as well as regimes and policies that promote long-term labor and employment, security, safety, environmental sanitation, and opportunity. Business enhances both monetary and spiritual existence. Consider caring for immigrants to be a benefit to the province rather than a "burden" on social security. In-depth research on immigrants, planning and implementing immigration policy within the context of globalization and labor market integration.

Defining the population size for each area and manage the population size scientifically. When designing and planning policies, planning, and socioeconomic development plans for each city, district, and town, the population size must be determined in order to capitalize on demographic advantages. Development and modification of local technological and social infrastructure to ensure equal access to fundamental social services (housing, education, and healthcare) for all people. The regulation of population size in each area must be stringent. There must be a strategic direction and plan in place to redistribute population and labor in accordance with the technological and social infrastructure of each locality, production, and business sector throughout each specific period.

Population policy associated with urbanization. Urbanization and rural-urban population transformation are not only unavoidable in Binh Duong, but they are also occurring at a rapid pace, exceeding prior policy plans' projections. This. As a result, in the future, the province's urbanization must be guided by demographic figures. Based on population number, density, and composition, a complete and synchronous implementation plan is designed to ensure that the population has a stable and developed life. First and foremost, data from spontaneous residential areas and points, as well as plans for each area, must be reviewed to ensure that the population scale is consistent with the technical infrastructure of the areas and housing points, assuring consistency and correctness. Develop plans and solutions to overcome technical infrastructure of the area, seriously implement planning and planning management.

Population management is associated with improving population quality. Population management must be founded on the goal of generating high-quality people resources to advance the cause of industrialization, modernization, and global integration. It is required to implement a mechanical population growth program that is linked to the development of human resource quality in order to increase the share of middle-class managers, professional and technical personnel, and skilled workers. Implement a policy that selectively attracts people based on job possibilities while also focusing on training and developing professional

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capacity and abilities to meet the needs of changing population policies and solving population challenges including magnitude, structure, distribution, and quality.

REFERENCES

- 1) BDSO (1999). Binh Duong Statistical Yearbook 1999. Vietnam: Statistics Publishing House.
- 2) BDSO (2008). Binh Duong Statistical Yearbook 2007. Vietnam: Statistics Publishing House.
- 3) BDSO (2018). Binh Duong Statistical Yearbook 2017. Vietnam: Statistics Publishing House.
- 4) BDSO (2021). Binh Duong Statistical Yearbook 2000. Vietnam: Statistics Publishing House.
- 5) BDSO (2023). Binh Duong Statistical Yearbook 2022. Vietnam: Statistics Publishing House.
- 6) Communist Party Of Song Be (1991). Song Be Province's Monography [Địa chí Song Be]. Vietnam: Song Be Province General Publishing House.
- 7) GSO (1999). Completed Results of the 1999 Viet Nam Population and Housing Census. Vietnam: Statistics Publishing House
- 8) GSO (2009). Completed Results of the 2009 Viet Nam Population and Housing Census. Vietnam: Statistics Publishing House.
- 9) GSO (2019). Completed Results of the 2019 Viet Nam Population and Housing Census. Vietnam: Statistics Publishing House
- 10) Jones, G. W. (1981). Population mobility and development Canberra, Miami: The Australian National University.
- 11) Jeffrey Jenkins & Jared Rubin (2022). Historical Political Economy: What Is It? ESI Working Papers. Chapman University.
- 12) Lê Thu Quỳnh (2020). Population changes in Thai Nguyen province under the geographic information system approach [Biến động dân số tỉnh Thái Nguyên dưới cách tiếp cận hệ thống thông tin địa lý]. Vietnam: Social Sciences Publishing House.
- 13) Mạc Đường et al. (1985). Ethnic issues in Song Be [Vấn đề dân tộc ở Song Be]. Vietnam: Song Be Province General Publishing House.
- 14) Nguyen Sum, Nguyen Thuy Vinh et al. (2008). Basic Demography Textbook [Giáo trình dân số học đại cương]. Vietnam National University Ho Chi Minh City Press.
- 15) Nguyễn Văn Hiệp (2011). Socio-economic transformation of Binh Duong province 1945 - 2007 [Sự chuyển biến kinh tế - xã hội tỉnh Bình Dương 1945 – 2007]. Vietnam: National Political Publishing House.
- 16) Nguyễn Văn Hiệp (2020). Binh Duong population during 120 years of construction and development (1900- 2020) [Dân cư Bình Dương qua 120 năm xây dựng và phát triển (1900- 2020)]. Journal Of Historical Studies. NO 5(541).
- 17) Phan Xuân Biên (2013). Binh Duong residents in the past and present [Dân cư Bình Dương trong quá khứ và hiện tại]. Thu Dau Mot University Journal of Science. N 3 (10).
- 18) Robert W. Poole (1978). The Statistical Prediction of Population Fluctuations. Annual Review of Ecology and Systematics. Vol. 9: 427-448. <https://doi.org/10.1146/annurev.es.09.110178.002235>
- 19) The Prime Minister (2010). Decision of The Prime Minister: Approving the national target program on building new rural areas for the period 2010 – 2020 [Quyết định của Thủ tướng Chính phủ: Phê duyệt Chương trình mục tiêu Quốc gia về xây dựng nông thôn mới giai đoạn 2010 – 2020]. N^o 800/QĐ-TTG. Date 4/6/2010.



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Understanding the Characteristics of Corporate Culture in Vietnam via Some Golden Periods in History



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ABSTRACT: In the Vietnamese business heritage, there were several golden times during which beneficial elements emerged and became distinct features of company culture. Using the multidisciplinary method of History of Science - Cultural Studies, this article collects and organizes historical documents to sketch a historical and comparative analysis of the value hierarchy and strengths of Vietnamese corporate culture during its golden era. The findings demonstrate that, between the 17th and 18th centuries, unique human and cultural aspects in business activities emerged in the Southern Vietnam region of Vietnam, where merchants and other factors of Corporate culture was quite frequent. In the early years of the 20th century, Vietnam witnessed a business movement aimed at economic revival and cultural development for the noble goal of national revival. Corporate culture in Vietnam has been around for a long time, reflected in the intelligence, creativity, sensitivity, and quick adaptation of Vietnamese corporates and entrepreneurs.

KEYWORDS: Corporate Culture, Development, History, Vietnam

1. INTRODUCTION

In Vietnam's economic history, business itself has not been particularly robust. Originally a country with an Eastern feudal-style agrarian economy that lasted thousands of years, Vietnam's social structure has evolved throughout time due to the weakening of industrial and commercial industry. When talking about business in ancient Vietnam, people often think of a tribute regime in the form of an Eastern-style totalitarian society, where the village was organized according to the model of public farming, self-sufficiency, and limited consumption power of industry and commerce, downsizing industry and commerce in the local market model (Tran Dinh Huou, 1996). The self-sufficient agricultural economic model has created rural and urban societies that cannot rise to become the headquarters of the market economy and the arena of professional businessmen. In the world of folk culture, the image of traders was drawn with unsympathetic lines (Nguyen Thanh Tuyen, 2019).

Although doing business is not a strong heritage among Vietnamese people, history has documented periods and places where economic achievements occurred. These were historic watershed moments. People could find the strength to produce breakthroughs in economic structure, as well as the number and quality of traders, despite the fact that feudalism and colonialism continued to be strict. From those golden milestones, one may uncover the cultural values that have developed and become the priceless inheritance of the Vietnamese people; these values also have long-term relevance if we identify a dialectical relationship between them and the nation's fundamental value system.

This article investigates the beneficial aspects of corporate culture that have thrived in various historical periods and areas of Vietnam, linking them together to identify ideals. Vietnamese people and culture's essential ideas, habits, attitudes, and qualities are reflected in commercial activities. Through this connection, the article contributes to a better understanding of social movements aimed at economic revival, cultural development for the noble goal of national resurrection, successful trading norms, desirable behavior in relationships with consumers and partners in Vietnam's cultural heritage... Learning about the positive elements of corporate culture will contribute to answering the question of whether or not there is a tradition. Vietnamese corporate culture in history and at the same time find out what factors in the past could be the driving force to activate today's corporate culture.

2. LITERATURE REVIEW AND RESEARCH METHODOLOGY

2.1. Literature review

Research on positive elements of corporate culture in history has been mentioned in many scientific works from countries around the world. Wang Shaoxiang and Liu Wenzhi (1995) investigated the clan characteristics of Chinese merchants as a key component of corporate culture. According to the author of this publication, all merchants who went out to trade originated from live families, forming unique merchant families; the big merchant clans all rely on the family's power to preserve and develop. In China, Phan Nai Viet (1994) expressed a very unique position on the possibility to apply classic Confucian ideals to social management activities and cultural commercial organizations in current times. Phan Nai Viet has made interesting discoveries about "village people" as the core of Confucius's management ideology, about Confucius's "righteousness" and the West's "public interest", about the credibility in the vitality of Confucius of an organization, about "selecting sages", "talent knowledge", "talent education" (promoting talented people, understanding talented people, training talented people) in business activities.

When discussing about the future of human and corporate activities in the new era, Rowan Gibson (editor, 2002) anticipated corporate culture as a new, revolutionary means of creating new wealth, has a revolutionary nature, overturning economic thinking. According to Rowan Gibson, nations in the process of integrating into the globalization stream are obliged to realign their commercial activities, and each business must be managed in the spirit of leadership, not managers who only understand how to operate.

Geert Hofstede (1991) is interested in cultural differences, aspects that might assist classify the organizational culture of countries, and so illuminate the business cultural identity of each country from an organizational perspective. Geert Hofstede identified variances in each country's corporate culture using the following dimensions: power distance; individualism-collectivism; masculine-feminine; control uncertainty.

A number of foreign international authors have published their findings on corporate culture, mostly to help elucidate the distinctiveness, structure, and norms of motion of this cultural phenomenon in business corporation. Some authors consider it an unconscious spiritual product of the business community, but many others emphasize the importance of being proactive in developing each company's corporate culture (Joseph Putti, 1998; Black, Richard, 2003; Thomas & Christopher (2005); Gabrielle, 2006).

Since the beginning of the twenty-first century, Vietnamese social scientists have written numerous useful works exploring Vietnamese cultural views toward business and entrepreneurs, as well as historical traces of corporate culture. Notable among them are works on culture and development (Nguyen Hong Phong, 2000), culture for development (Pham Xuan Nam, 2005), culture from a value perspective (Do Huy, 2001), traditional and modern issues, including consideration of the role of Confucianism in the past and present in Vietnam (Tran Dinh Huou, 1996), and trading villages in the Northern Delta (Nguyen Quang Ngoc, 1993). These publications also discuss company culture at both the social and business levels.

Some works directly discuss corporate culture and business philosophy of business owners. Notably, Do Minh Cuong (2001) believes that corporate culture is *the use* of cultural factors in the subject's *business activities*; and is *the culture* that business entities *create* in the business process, forming their specific and stable *business styles*. Corporate culture is essentially the corporate culture of that enterprise" (...), it "creates the identity of the enterprise and affects the emotions, reason and behavior of all its members."

2.2. Research methodology

The article uses the interdisciplinary method of cultural history, which combines historical and cultural science approaches, to investigate popular cultural aspects and cultural interpretations of historical events. It investigates the records and narrative descriptions of previous material, as well as the continuity of events (that occur consecutively and lead from the past to the present and even to the future) associated with a culture.

Using this approach, the article chronicles and evaluates events in Vietnamese history in many periods linked to corporate culture, through social, cultural, and political contexts, or related to the economic history of an area, locality, or country throughout a calendar period. Jacob Burckhardt contributed to the development of cultural history as a field of study. Cultural history investigates and explains human society's records by representing the diverse ways of life established by the individuals under examination. Cultural history is the synthesis of historical cultural activities such as rituals, class practices, and interactions with local communities (Jacob Burckhardt, 1983).

Using an interdisciplinary approach to historical science and cultural science, the essay provides a historical and comparative assessment of the value hierarchy and strengths in the characteristics of Vietnamese corporate culture in the past. From there, it can help identify, synthesize, and connect some of the hidden notions that dominate Vietnamese corporate culture.

3. RESULT AND DISCUSSION

3.1. Unique features of people and culture in business activities in Southern Vietnam region of Vietnam in the 17th and 18th centuries

In the lengthy history of Vietnam's economy, Southern Vietnam in the 17th and 18th centuries, commanded by Lord Nguyen, had the greatest impact on foreign trade. People who were willing to enter the Asian market, were good at business transactions, and had a free way of doing business have emerged in this country for more than a century, despite the fact that it was purely agricultural and inherently non-trading, according to a Chinese traveler in the 13th century (Li Tana, 1998). The great development of international trade in Southern Vietnam was owing to the pressures of the time during the conflict with King Le and Lord Trinh in Outer Circuit. To survive and become stronger, Lord Nguyen proactively changed his way of thinking and created ways of doing things to suit the operating rules of foreign trade prevailing in Southeast Asia at that time. The story between Thich Dai San, a Chinese monk invited to visit Southern Vietnam in the 18th century, and Lord Nguyen Phuc Dieu (1691-1725) was a typical sign of this rapid involvement of the Nguyen Lords. (Thich Dai San, 1963). The story went that when saying goodbye to Lord Nguyen, the monk wished his kingdom good weather and prosperous crops. However, Lord responded by introducing a new criterion to measure the prosperity of the kingdom, which was the number of merchant ships arriving in the lord's territory in a year. It was no coincidence that a Vietnamese researcher said about the Vietnamese residents in the southern region at that time that the Vietnamese created here another way of "being Vietnamese" (Li Tana, 1998). Quite quickly, Southern Vietnam transformed itself into an important link in the trade between China and Japan. To be more specific, Southern Vietnam has become the number one seller of the trade relations arena in Asia. Besides using commercial relationships, the Nguyen lords also used marital relationships to strengthen foreign trade (Nguyen Phuc Toc Governing Council, 1995).

Giving civilians a certain place in business is a distinctive aspect of Southern Vietnam's corporate approach and culture. While Nguyen Hoang and his successors were actively involved in the trading networks of the Japanese, Chinese, Westerners, and Southeast Asians, he nevertheless made room for civilians in commerce. More and more Vietnamese people travel abroad for business. Kaihentai also documented the views of some Chinese merchants who came to do business in Siam (Thailand), stating that they were "acquainted with Quang Nam people who sometimes go to Siam and we met them there" (Li Tana, 1998).

While the Southern Vietnam lord's palace had a monopoly on gold trading at the start of the 17th century, they nonetheless allowed people to exchange small amounts of items like sugar and silk at local, open markets for the establishment and growing prominence of a merchant class in Southern Vietnam society. Vu Minh Giang (2019) discussed the economic strength and style of using money (not in kind) in the exchange and consumption of merchants in Hoi An, an important port in Southern Vietnam, providing an interesting comparison. He compared offerings to two pagodas, recorded in the 17th century, one in Pho Hien – the main commercial center in Outer Circuit – and one near Hoi An. According to Vu Minh Giang's calculations, "contributions to the temple near Hoi An are on average 8 times higher than contributions to the temple in Pho Hien. Contributions to the pagoda in Pho Hien were mainly in the form of rice, while contributions to the pagoda near Hoi An are usually in money.

Southern Vietnam agriculture was geared toward commerce, with some areas exhibiting signs of specialization. Foreign researchers' observations over the last two centuries revealed that agricultural production in Southern Vietnam was increasingly oriented toward commerce rather than self-sufficiency. For example, in the 17th century, inhabitants in the Thuan Hoa region concentrated on cultivating mulberries and raising silkworms to serve the silk export industry, to the point where they had to import rice from Siam and Cambodia. Southern Vietnam rice was inferior to mulberry and sugarcane when it came to exporting silk and sugar to Japan in the 1730s. A very interesting socio-economic phenomenon was that the specialization of sugar production for export has been demonstrated to each group of households in some areas in Southern Vietnam. The sugar industry at that time developed a production system based on household groups: a group of households specializing in growing sugarcane, a group of households specializing in pressing sugarcane, and a group of households specializing in cooking sugarcane juice into white sugar. Moreover, the increase in sugar production has led to the development of local small industries that produce jars to store sugarcane juice, serving the sugar production process. (Nguyen Quang Vinh and Tran Huu Quang, 2009).

Trading via boat and ship, as well as the introduction of the "Lai" (merchant) character into Vietnamese business lexicon. In Southern Vietnam, three important port towns appeared: Hoi An (Quang Nam), Thanh Ha (Thua Thien), and Nuoc Man (Binh Dinh), with Hoi An being the most prominent. Vietnamese merchants from the 17th to 18th century included minor traders, small owners, the trading class, and shop owners. Small enterprises frequently buy from the bottom and sell from the top. Some wealthy people kept items until the "trade season" when they could sell them to foreign traders. Gold, silk, pearls, areca nuts, dried shrimp, bird's nests, sea cucumbers, acacia, sugar, mother-of-pearl handicrafts, and rare woods were among the commodities exported. In addition to trading at markets, traders foreign merchants, Vietnamese merchants also hired boats to carry goods to trade long distances by sea.

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According to Do Bang (1996), boat building was the primary mode of water transportation for people in the Thuan-Quang area (boats were 7m wide, 10m long, had three masts, weighed 100 tons, traveled at 7 nautical miles per hour, and can be transported against the wind). Many affluent merchants in Southern Vietnam purchased two or three gourd boats for coastal trade, allowing them to travel long distances to China, Singapore, and Thailand. Later, in the nineteenth century, the Southern region, with its intricate network of rivers and canals, and the valuable rice products of the Mekong Delta, elevated trade by waterways (including rivers and seas) in the South to new heights. From here, a new group of people in society called "drivers" appeared, people who "piloted" their ships and boats to do business and thereby became rich. This group of people, separated from agriculture to specialize in rice trading by water, and some of them around Saigon even – as John White observes – reached a high standard of technology. maritime people, are the people most suited to the sea (...) on par with the Chinese in this field. People often encountered Vietnamese people in Southeast Asian waters such as the Strait of Malacca, Batavia, Singapore, the Philippines... Officials of state trade delegations sometimes also encountered ordinary Vietnamese people trading in fishing boats in Southeast Asia. They carried rice to sell, some brought back... opium, so when they saw a state ship, they fled in all directions... (Nguyen Quang Vinh and Tran Huu Quang, 2009).

Unfortunately, after defeating the Tay Son, the Nguyen Dynasty returned to a policy of seclusion, prioritizing agriculture over trade. Rice, Nam Ky's main export product, was soon forbidden, and violators faced the death penalty. The court ordered individuals who had fled from the pursuit of business (commerce) to return to the fields. In any case, two centuries were insufficient to establish a more sustainable business, but they have resulted in innovation in social thought, the corporate environment, and the spread of new ideas. Merchants introduced components of corporate culture from the countryside to the port city, which were previously uncommon in Vietnamese society.

3.2. In the early twentieth century, social movements tried to revive the economy and establish industrial culture with the noble objective of national resurrection.

In the early twentieth century, amid the grip of French colonialism, a vigorous social movement emerged and spread like lightning from Central to North to South, combining political and economic reasons. Economic, cultural, and social progress toward the lofty aim of national revival. Although it lasted less than a decade, the Duy Tan movement left behind many good social concepts and principles that may be revived in modern hues given the new opportunities available to people today.

The truth was that from the late nineteenth century, a flood of inventive ideas has emerged virtually concurrently in Japan, China, and Vietnam, with varied developments based on the features of each country. Everyone recalled the renowned Japanese Iwakura delegation of approximately 20 persons, who traveled to Europe and America in 1888 to study. Since then, the Japanese have taken many good ideas from the structure of the British navy, the French army, the German railway system, and German civil law. They learned and operated those models in the Japanese style ("Western techniques, Japanese ethics"). The Chinese during this period also had many social, military and spiritual reforms, but in general they were not successful because they could not handle the relationship between tradition and modernity, or in other words, lacks a philosophy of innovation.

Famous figures in Vietnam, such as Nguyen Truong To, Nguyen Lo Trach, and Dang Huy Tru, have also advocated for innovation and reform. Everyone knew that during eight years, from 1863 to 1871, Nguyen Truong To sent 30 comments to King Tu Duc proposing a new vision and swift reforms to strengthen self-reliance. While studying in France, Nguyen met Japanese reformer Ito Hirobumi, who eventually became Japanese Prime Minister during the Meiji Restoration, and their reform views grew. Not straw fire. Nguyen Lo Trach criticized Vietnam for a lack of willingness and daring to innovate the country. He proposed that we need to learn from the West; must send their children to study abroad with full scholarships, to bring knowledge and technology back to help the country. He said our ships and guns were too weak, so we had to worry about strengthening ourselves as soon as possible. We must study and imitate the techniques of the Westerners to control their superior techniques. The case of Dang Huy Tru was a bit different: he was a royal official, so he could say important suggestions about shipbuilding, gun casting, developing trade, establishing a vocational training department etc, and had the conditions to carry out some of those innovative concerns. An example: in 1860, he shaved his head, impersonated a Qing national, went to Hong Kong to "interview the situation" (i.e., did a reconnaissance mission on the situation in the Western Ocean), then proposed many plans. Specifically, encouraging Vietnamese people to build ships in Hong Kong to study defense technology... (Nguyen Quang Vinh and Tran Huu Quang, 2009).

In that reforming tendency, Khang Huu Vi and Luong Khai Sieu's New Books and New Literature of the late nineteenth and early twentieth centuries featured capitalist class philosophies and economic theories. Rising Western assets (such as Rousseau, Montesquieu, Descartes, Darwin...) and Tan Dan's ideals have invaded Vietnam via the ports of Hai Phong, Da Nang, and Saigon, reaching the hands of patriotic and influential Confucianists throughout this era. If in the past Luong Khai Sieu went to Japan to read Western progressive books and newspapers in Japanese and thought like "a dark house can see the sun, a dry stomach can

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see wine", then Vietnamese Confucian scholars read Khang-Luong, conveying those thoughts with enthusiasm through Chinese characters that felt like "a thunderclap exploding in the blue sky" (Huynh Thuc Khang's idea).

The Duy Tan movement arose in Vietnam during the first decade of the twentieth century, in that spiritual setting. This was a really lively and clean cultural revolution of the patriotic movement, supporting innovation in social thinking, arousing patriotism, promoting practical work, encouraging commerce and industry, and generating opportunities for people to flourish and gradually restore their autonomy. The slogan of the Duy Tan movement, similar to Phan Chu Trinh's, was "stirring the people's energy, opening up the people's wisdom, and following the people's livelihood". In each region of the country, the Duy Tan movement appeared with its own, very creative lines, but in the end, it trained two new human models, that is, workers who know how to work together and are educated, have skills, patriotic passion, and the businessman aims for modernization with patriotic fervor (Nguyen Hong Phong, 1999).

During 1905 and 1906, the Duy Tan movement in the Central area was particularly active, with key figures such as Phan Chu Trinh, Huynh Thuc Khang, Tran Quy Cap, and other radical Confucian professors. People with talent and creativity included Nguyen Trong Loi, Phan Thuc Duyen, Bang Ky Lam (Nguyen Toan), Mai Di, and Phan Thanh Tai. The spirit of self-reliance was demonstrated by the trio of organizations that always worked together, complimenting one another. Commercial, agricultural, and academic associations all work together.

The Commercial association was the prominent face of Duy Tan in the Central region: it was the Lien Thanh company in Binh Thuan (still existing today after 100 years. When Nguyen Tat Thanh set out abroad to find a way to save the country, it was also recognized This company gives 7 silver coins); Dien Phong Trading Joint Stock Company in Hoi An was the headquarter for many trading transactions in Quang Nam; Phong Thu trading union (in Dien Ban district, Quang Nam)... In these "joint trading" units, intellectuals and scholars participated in large numbers, and the technical organization of trade was also very new: spacious houses, the goods were arranged in an orderly manner, there were staff to take care of the books, the liquid goods were packaged in labeled bottles, and on each product for sale there was a bamboo tag with a certain selling price. Customers were very fond of these Combined trading "supermarkets", they often called the sellers "teachers", refuse to accept change, and even demanded to buy goods at a price higher than the set price so that the sellers could get money to buy drugs for his brothers to smoke for fun (Nguyen Van Xuan, 2000).

In addition to the trade associations, the Duy Tan movement in the Central region also established agricultural associations such as farming corporations with capital from many people to explore land for growing cinnamon, tea, strawberries, sugarcane, corn..., and continue to reap profits supporting for students studying abroad (Nguyen Van Xuan, 2000).

The Duy Tan movement's educational promotion associations and schools were inextricably linked to trade associations. For example, the staff and board of directors of Phong Thu Thuong Thuong all lived together and shared dorms with academics from the two adjoining institutions. Alternatively, close to Hop Thuong Dien Phong, the movement established Dien Phong School (private), which had approximately 200 students and did not follow the state program. Older students have learned about Civil Rights theory and have read the books Khang Huu Vi and Luong Khai Sieu; classes were already familiar with using blackboards and white chalk. In 1905, the school in Phu Lam hamlet, a typical Duy Tan village, established a class particularly for female pupils. The Duy Tan movement in the North was distinguished by the establishment of a big school with a great spiritual influence on the entire country, directed by Dong Kinh Nghia Thuc (modeled after Khanh Ung Nghia Thuc in Japan). The school principal was Luong Van Can, while the school supervisor was Mr. Nguyen Quyen. Because it was the foundation of the Duy Tan movement, the school not only taught progressive and practical subjects, but it also conducted book writing, lectures, and literary reviews to promote Duy Tan and patriotism.

Cultural activities were closely associated with the opening of business organizations sponsored by the movement to revive industry and trade, such as Tan Hong Hung brand of Nguyen Quyen, Dong Thanh Xuong of Hoang Tang Bi. The movement was so stimulating that a Lang Son murderer, Nghiem Xuan Quang, also returned to Hanoi to establish a Quang Hop Ich trading company. At that time, Hanoi had good coordination with Duy Tan industry and trade in Quang Nam. An anecdote told that two intellectuals in Hanoi wore black dyed domestic fabric pants from Quang Nam, with tie collars, to support the Central region's industry and trade moving to the North, coordinating with industry and trade outside the North. collectively known as Quoc Thuong.

A unique event related to corporate culture was that Dong Kinh Nghia Thuc published and taught Luong Van Can's *Trading Study's Motto* - a book considered the first textbook on Vietnamese business management. In the book, the author mentioned 10 things that made "our people's trade route" should be more prosperous but could not be done. Luong Van Can admitted that the ancients often despised trading, but one of the reasons was the harsh moral concept of "greed for profit" and "telling little truth". But that did not make the author hesitate in highlighting the power of the market and the importance of changing thinking and respecting commerce if we want our country's trade to prosper. He wrote: "There was a proverb that says: No trade was rich, great countries could become wealthy through trade, great capitalists could become wealthy through trade, enemies of the country, then trade

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should not be strict before without paying attention to research. He continued: "In this competitive world, rich and powerful countries cannot compete in the business arena; The more advanced civilization was, the more prosperous trade becomes. Should we look down on or despise such a business that prospers and declines like that? (Tran Thai Binh, 2001). Tran Thai Binh also emphasized that, if we correctly understand today's trade, it was not as simple as many people think in the past: "There was no capital, no calculation, no books, no letters, no buying." Merchandising, display of goods, branding, marketing, commercial locations, shopping malls, communication with people, advertising, everything must have an agency. If you don't know how to study commerce, both virtue and talent, then impossible." So, 100 years ago, when training generations of modern businessmen in the early twentieth century, a Confucian scholar who quickly updated Western learning in the wind of the Duy Tan cultural revolution promptly discussed the rules of investment capital, purchasing techniques, branding, branding, marketing and public relations PR in business, etc (Tran Thai Binh, 2001).

The activities of Dong Kinh Nghia Thuc and other economic establishments in Hanoi within the framework of the Duy Tan movement have had a positive influence on the South, contributing to accelerating the Minh Tan campaign of patriots in Saigon, My Tho, Ben Tre, Long Xuyen. According to Son Nam, businessmen following this trend want to promote a Minh Tan, which can be understood as a "campaign to reform the country following the example of the Chinese and Japanese in the early 20th century." Developing industry and commerce, expanding schools, and modifying customs are interrelated issues to achieve the ultimate goal of overthrowing the French colonialists" (Son nam, 1971). The activities of this group of businessmen were quite diverse. They opened Nam Trung Hotel in Saigon, Minh Tan Hotel in My Tho and established Nam Ky Minh Tan Technology, a kind of joint stock company, to produce soap, textiles, leather, crystal and teach young people to learn those professions. All three businesses mentioned above were owned by Tran Chanh Chieu. The Minh Tan movement also opened Chieu Nam Lau headed by Nguyen An Khuong (Mr. Nguyen An Khuong was the father of Nguyen An Ninh, leader of the Duy Tan movement in Nam Ky and one of the first people to respond to the Kinh Nghia Thuc movement). He was also an assistant writer for Nong Co Min Dam newspaper). These economic establishments both promoted the economic expansion of Vietnamese people, promoted the use of domesticated goods, and serve as a gathering place for like-minded Minh Tan people.

To encourage Vietnamese people to invest, Nguyen An Khuong published some extremely smart and compassionate comments in the Luc province newspaper Tan Van Nhan Chieu Nam Lau restaurant was opened: I once again wish for my fellow countrymen to be fearless of their reputation. If you want to be renowned, invest in your home, or collaborate to build five or seven little buildings like this, pay Qing people to cook properly and entertain your compatriots, you and I can do business together. How enjoyable, how gorgeous! (Son Nam, 1971).

Following the activities of Nam Trung Hotel, we saw that in addition to normal functions, this business also opened classes to teach business bookkeeping (sign up and pay 4 dongs per month), and was a center for providing market price information, and helped agricultural product traders from the provinces to Saigon have a place to ask to sell for them, check the weight for them, and avoid being cheated. Although Mr. Tran Chanh Chieu came from the West Village, he was a businessman and a respectable patriotic soldier. His Minh Tan hotel was searched, and he himself was arrested by the French many times. He died in 1919, at the age of 52. In his eulogy for Tran Chanh Chieu, Mr. Phuong Huu, a patriotic Confucian, said: "The nationality was called Phu Lang [France], Deep in the heart was the blood of the Hung Vuong family" (Nguyen Quang Vinh and Tran Huu Quang, 2009).

Duy Tan, Minh Tan, throughout the Central, South, and North all left lasting beautiful values for the cause of patriotism and business development associated with national pride.

Vietnamese corporates in French colonial cities: had a tendency to promote Vietnamese values and seek national interests. In today's exciting days of reform and innovation, when Vietnamese goods are proudly jostling to enter an increasingly fiercely competitive market, such as Trung Nguyen coffee in Tokyo (Japan), and Basa fish to America, Saigontourist tourism products, Viet Tien shirts, Nhu Y brocades and high-end AA Corporation furniture are present in many distant meridians and latitudes..., then people suddenly remember Vietnamese products in the 30s, 40s of the 20th century had to overcome many oppressions and jealousy of the colonial environment to participate in life. That was the story of Vietnam's "king of ships" Bach Thai Buoi (owner of Giang Hai Luan boat Bach Thai company) with 30 ships running all over the rivers and seas from North to South, defeating both French and overseas Chinese opponents along with time. His ships had very Vietnamese names such as: Nguyen Trai, Bai Tu Long, Cho Bo, Yen Bai, Pho Lu, etc. He sent people to the docks and to each ship to give speeches to promote the spirit of compatriotism, calling on Vietnamese people to use Vietnamese goods, ride Vietnamese ships, to compete with foreigners. Xam singers on the Bach Thai Buoi ship also sang songs promoting investment capital contribution, joining forces to fight for "love boats". On September 17, 1920, the 600-ton Binh Chuan ship, built entirely by Bach Thai Buoi company's workshop, arrived at Saigon port, exciting the spirit of Nam Ky businessmen at that time. They cast a bronze gift to "Give the Binh Chuan ship, the first An Nam ship at Saigon port" (the original inscription is in French). The use of talent by businessman Bach was also very unique. In 1928, when he opened his business to coal mining, which was an unfamiliar field, he sought technical experts by sending people to France to

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sign contracts with students who passed valedictorian at the University of Mining. When they graduated, he took care of their plane tickets to Vietnam to work. One day in the fall of 1932, at the time of his death, Bach Thai Buoï could only think back: "You must do something to make the flag of our Vietnamese company flutter on all five continents and four seas, so that the whole world know Vietnamese people and the country of Vietnam." Truly "a man in the business world" as a contemporary magazine praised. (Le Minh Quoc, 2000).

Another businessman of the harsh years before 1945 was Nguyen Son Ha, the first Vietnamese to produce domesticated paint using modern technology, with the addition of domestic herbal materials (such as tea tree oil). At its peak, his paint could be used to paint bicycles and cars, sold to Cambodia and Laos, and won quality awards at fairs in France. The story about Mr. Ha's paint company keeping its reputation was worth thinking about. After opening a subsidiary factory in Saigon, a customer once complained that the company's Résistanco B paint took too long to dry. Upon receiving the news, he called to tell them to stop supplying the product to the market and quickly flew to Saigon. He discovered that the workers had to cook a batch of young oil, but because the delivery deadline was close, they kept delivering it to the customer. Mr. Nguyen Son Ha apologized; Anyone who buys that shipment and returns it will receive a refund with an apology. The social responsibility and civic spirit of entrepreneurs were also admirable. He bought 41 houses in Son Lam alley, Hai Phong, each 120 m² wide to gradually reward workers. He was also the one who built the Duc Anh home to raise orphans in Hai Phong and together with two friends founded the "Tam Huu Publishing Department", printing books to educate children about patriotism. During the golden week after the August Revolution, he and his wife donated 35,000 Indochina dong and 105 taels of gold to the country; Then he went to the war zone for 9 years of resistance, continuing to contribute to the production of raincoats, cooking oil, gun cleaning oil... Toward the end of his life, he still cherished the dream of painting airplanes, and "I will paint it myself." into our plane" (Le Minh Quoc, 2000).

If we look back in general, from Tran Chanh Chieu in the South, Nguyen Trong Loi, Nguyen Toan in the Central region, to Bach Thai Buoï and Nguyen Son Ha in the North, we see that they had learned and acquired a lot of knowledge, skills, technology, common business practices of the West, of the Chinese, Indians... in the process of cultural acculturation, but all had been molded again intelligently and enthusiastically to become a benefit to family businesses, co-owned businesses, and to the national economy, even in a situation of dehydration! However, despite so many efforts and creativity from the big trips to the sea in Dang Trong to Duy Tan, Minh Tan and later..., innovation trends still could not overcome the "inertia" of the traditional Vietnamese social structure and the fierce controls of the colonial political regime to achieve a "Vietnamese-style Meiji".

The preparation in terms of social and cultural structure for the transition from traditional society to modern society needs to go through an era of transition, in order to promptly transform the established economic, social and humanistic germinating into dynamic foundations for genuine reform.

4. CONCLUSION

Vietnamese history records a number of periods that, in a special socio-economic context, became a period of rise for the entire Vietnamese society in the process of economic revival and development of diverse fields. This movement was expressed both in the field of economic structure, social structure and on elements of the superstructure such as legal, ethical views, and the general spiritual world of the people. The unique human and cultural features of business activities in Southern Vietnam of Vietnam in the 17th and 18th centuries, the passionate wishes and calculations of the Minh Tan, Duy Tan movements and of the Patriotism in the early 20th century has become a feature of Vietnam's business cultural tradition.

Overcoming many old prejudices, Vietnamese society has also had a golden age of seeing *business activities* as a form of *labor* and bringing *benefits* to society. Business has found its *legitimate, legal and ethical place* in social life. Society's positive concepts and values towards business have become the core of corporate culture at the social level. Understanding the positive factors in corporate culture shows that there is a clear connection between the *business and consumption behaviors* of people and businessmen and *national pride*.

It can be affirmed that Vietnamese corporate culture appeared very early. Through historical periods, overcoming the harsh economic and social conditions, Vietnam's corporate culture has always shown itself in the intelligence, creativity, acumen, and quick adaptation of Vietnamese businessman. This reform now needs to learn from history, enhance the role and position of businesses and entrepreneurs in society and is an important condition for Vietnam's corporate culture to gradually be developed with full nuance.

REFERENCES

- 1) Black, Richard J. (2003). *Organisational Culture: Creating the Influence Needed for Strategic Success*. London UK, ISBN 1-58112-211-X.

Understanding the Characteristics of Corporate Culture in Vietnam via Some Golden Periods in History

- 2) Cummings, Thomas G. & Worley, Christopher G. (2005). *Organization Development and Change*. 8th Ed., Thomson South-Western. USA, ISBN 0324260601.
- 3) Jacob Burckhardt (1983). *The Age of Constantine the Great*. University of California Press
- 4) Do Bang (1996). *Port town in Thuan Quang region in the 17th-18th centuries [Phố cảng vùng Thuận Quảng thế kỷ XVII-XVIII]*. Thuan Hoa Publishing House.
- 5) Do Huy (2001). *Developing a cultural environment in our country from a value perspective [Xây dựng môi trường văn hóa ở nước ta từ góc nhìn giá trị học]*. Culture Of Vietnamese Ethnic Groups Publishing House One Member Company Limited.
- 6) Do Minh Cuong (2001). *Culture and business philosophy [Văn hóa và triết lý kinh doanh]*. Vietnam: National Political Publishing House.
- 7) Geert Hofstede (1994). *Cultures and Organisations [Văn hóa và tổ chức]*. Harper Collins Business, London.
- 8) Ho Chau (2021). *Foreign trade in Southern Vietnam during the Nguyen lord's time [Ngoại thương Đàng Trong thời chúa Nguyễn]*. Doctoral thesis in history. Hue University.
- 9) Nguyen Phuc Toc Board of Governors (1995). *Nguyen Phuc's genealogical family*. Thuan Hoa Publishing House.
- 10) Le Minh Quoc (2000). *Vietnamese pioneers [Những người Việt Nam đi tiên phong]*. Tre Publishing House.
- 11) Li Tana (1998). *Nguyen Cochinchina: Southern Vietnam in the 17th and 18th Centuries*. Cornell University Ithaca New York
- 12) Nguyen Hong Phong (1999). *Vietnamese political culture, traditional and modern*. [Văn hóa chính trị Việt Nam, truyền thống và hiện đại]. Information an Communications Publishing House.
- 13) Nguyen Quang Vinh, Tran Huu Quang (2009). *Entrepreneurs and Corporate culture [Doanh nhân và văn hóa kinh doanh]*. Vietnam: Hochiminh City Publishing House.
- 14) Nguyen Quang Ngoc (1993). *About some trading villages in the Northern Delta in the 18th and 19th centuries*. [Về một số làng buôn ở đồng bằng Bắc bộ thế kỷ XVIII-XIX]. Vietnam Association of Historical Sciences.
- 15) Nguyen Thanh Tuyen (2019). *Ancient Vietnamese traders – Issues, characters, anecdotes*. [Thương nhân Việt Nam thời xưa – Vấn đề, nhân vật, giai thoại]. Vietnam: Saigon Cultural Publishing House.
- 16) Nguyen Van Xuan (2000). *Duy Tan movement [Phong trào Duy Tân]*. Da Nang Publishing House.
- 17) O'Donovan, Gabrielle (2006). *The Corporate Culture Handbook: How to Plan, Implement and Measure a Successful Culture Change Programme*. The Liffey Press, ISBN 1-904148-97-2
- 18) Phạm Xuân Nam (chủ biên, 2005). *Culture and development [Văn hóa và phát triển]*. Vietnam: Social Sciences Publishing House.
- 19) Phan Nai Viet (1994). *Confucius with modern management and business ideas [Khổng tử với tư tưởng quản lý và kinh doanh hiện đại]*. Tre Publishing House.
- 20) Rowan Gibson (1999). *Rethinking the Future [Tư duy lại tương lai]*. Tre Publishing House.
- 21) Sơn Nam (1971). *Heaven and earth association and the Minh Tan [Thiên địa hội và cuộc Minh Tân]*. Phu Sa Publishing House.
- 22) Thich Dai San (1963). *Overseas Memoirs [Hải Ngoại Ký sự]*. Vol. 3. Hue University.
- 23) Tran Dinh Huou (1996). *Coming to modernity from tradition [Đến hiện đại từ truyền thống]*. Vietnam: Culture Of Vietnamese Ethnic Groups Publishing House One Member Company Limited.
- 24) Tran Thai Binh (2001). *Understanding Vietnamese history [Tìm hiểu lịch sử Việt Nam]*. Culture Of Vietnamese Ethnic Groups Publishing House One Member Company Limited.
- 25) Vuong Thieu Tuong – Luu Van Tri (1999). *Chinese Merchants – Who were they? [Thương nhân Trung Hoa – Họ là ai?]*. Tre Publishing House.
- 26) Vu Minh Giang (2019). *Brief history of Southern Vietnam [Lược sử vùng đất Nam Bộ Việt Nam]*. Vietnam National University - Ho Chi Minh City Press.



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Exploring the Impact of Proactive Personality on Organizational Innovative Performance in Higher Education: The Mediating Role of Innovative Work Behavior



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ABSTRACT: One of the challenges in improving the innovative performance of higher education institutions is the proactive attitude and innovative work behavior of lecturer. This research aims to analyze the influence of proactive personality and innovative work behavior on increasing organizational innovative performance. The data analysis process uses AMOS version 22 with the SEM (Structural Equation Model) application. There are 216 lecturers as the unit of analysis from 17 private universities accredited as superior and A in Jakarta, Indonesia. Research findings show that proactive personality (PP) and innovative work behavior (IWB) have a positive and significant effect on the innovative performance of higher education. In addition, IWB plays a positive and significant role as a mediator in increasing the influence of PP on organizational innovative performance. Therefore, universities need to create a work atmosphere that supports the proactive attitude of lecturers and allows the emergence of innovative work behavior.

KEYWORDS: proactive personality, innovative work behavior, organizational innovative performance, higher education

I. INTRODUCTION

In the digital era 4.0, the global market demands companies to innovate swiftly and flexibly, aligning with evolving market needs and embracing best practices in research and development (Saad and Alnuami, 2022). Companies that fall short in innovation may face setbacks and risk being left behind. Consequently, innovation stands out as the key to gaining a competitive advantage in a highly dynamic business environment and emerges as the primary driver for a country's economic growth (Neely and Hii, 1998). Farrukh *et al.* (2021) emphasize the vital role of innovation in enhancing organizational performance, enabling quick adaptation to market changes, and facilitating the introduction of new products and services. This, in turn, ensures organizational sustainability, growth, and effective leadership with high performance (Dwivedi *et al.*, 2021).

An organization's ability to innovate hinges on both personality factors and innovative work behavior. A proactive personality plays a crucial role in enhancing an organization's innovative performance. Individuals with a proactive personality actively shape their environment, constantly seeking new and more efficient ways to improve performance (Alikaj *et al.*, 2020). Those possessing a proactive personality demonstrate the capacity to generate innovation at work and influence a culture of innovation in the workplace (Li *et al.*, 2022). Notably, individuals with a proactive attitude exhibit superior performance compared to their passive counterparts, driven by their commitment to advancing the organization (Fuller *et al.*, 2010). Encouraging proactive behavior among employees becomes pivotal in elevating an organization's innovative performance, prompting managers to actively foster such behavior to enhance product development and streamline organizational processes (SegarraCiprés *et al.*, 2019).

A proactive personality, as highlighted by Li *et al.* (2020), plays a significant role in enhancing innovative work behavior (IWB). IWB is characterized by individual actions aimed at deliberately introducing new and beneficial ideas, processes, products, or procedures within a work role, group, or organization (de Jong and Hartog, 2008). It emphasizes employee behavior focused on creating, applying, and implementing novel ideas, products, processes, and methods within their job position, department, or organization (Kheng *et al.*, 2013).

Employee IWB is a pivotal factor for improving business performance, contributing to increased profits, sales growth, and employment expansion (Jankelova *et al.*, 2021). It has become crucial across various industries such as manufacturing, finance, and services, enhancing company performance and competitive advantage in terms of technological progress, product quality,

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and market share (Adekanmbi and Ukpere, 2022; Fatoki, 2021). Notably, a proactive personality not only strengthens employees' IWB but also significantly impacts the overall business performance of a company (Li *et al.*, 2022; Jankelova *et al.*, 2021).

Indonesia faces challenges in elevating the innovative performance of higher education institutions. Scimago Innovation Rank (SIR) data from 2018 to 2024 indicates that Indonesian Higher Education still ranks above 4000 globally and 1000 regionally in Asia (SIR, 2018-2024). This is reflected in the limited innovation results from Higher Education in Industry during 2016-2018, producing only nine innovations (Sjachrial, 2019).

This phenomenon highlights a notable challenge: the quality of research and development (R&D) in higher education, born out of innovation, falls short in addressing the developmental needs of Indonesia's population. The country is characterized by a remarkably small R&D expenditure, marked at -0.4/year (Pradana *et al.*, 2021). The government responded to this challenge in 2005 with the introduction of Government Regulation (PP) Number 20 of 2005, focusing on the Transfer of Intellectual Property Technology and Results of Research and Development Activities by Universities and Research and Development Institutions. Despite this initiative, and subsequent efforts in 2018 through the Higher Education Innovation Management (HEIM) policy, the anticipated outcomes in innovation performance have not materialized as expected.

Sumule's (2018) analysis reveals a decade of less-than-optimal results from the implementation of PP No. 20 of 2005. The contribution of Science and Technology (IPTEK) to the industrial sector remains notably low. Furthermore, the outcomes of Science and Technology (S&T) research have not been efficiently utilized, and the intermediation between providers and users of science and technology is not yet optimal. Additionally, there is a lack of financial institutions promoting the use of Intellectual Property Rights (IPR) (Directorate of Innovation Systems, Ministry of Research, Technology and Higher Education, 2018).

This condition raises serious concerns, especially for a country boasting one of the highest numbers of tertiary institutions—4,475 in total, with 2,694 (60.2%) being universities (Kemdikbud-PDDikti, 2023). Achieving a higher ranking than the current state of affairs becomes imperative for Indonesia.

This research aims to dissect the factors contributing to the underperformance of Indonesian higher education institutions. It does so by scrutinizing the role of lecturers' innovative work behavior (IWB) as a mediator, facilitating an understanding of how personal factors, specifically proactive personality traits, influence the innovative performance of these institutions. Innovation is not a sudden occurrence; rather, it stems from human ideas. Innovators within companies or organizations play a pivotal role in producing new products, services, and experiences for consumers and society. Liu *et al.* (2017) assert that at the organizational level, innovation is intricately tied to the innovative work behavior of individual employees. Dedahanov *et al.* (2017) emphasize that innovation in organizations is invariably linked to individuals who introduce, modify, and implement ideas. Consequently, organizations depend on the creativity and innovation of employees to enhance their overall innovation performance.

The novelty of this research lies in several aspects: firstly, it positions innovative work behavior (IWB) as a mediator between personal factors (proactive personality) and the innovative performance of higher education institutions. While existing studies generally treat IWB as the dependent variable influenced by leadership, proactive attitude, and organizational innovative climate, research on IWB as a mediator remains scarce. Secondly, the research departs from the conventional focus on IWB within the context of companies or the business world. Instead, it explores IWB in the realm of higher education, an area rarely investigated by both national and global researchers. This contextual shift is deemed crucial, as emphasized by Farrukh *et al.* (2021). Lastly, the study addresses a significant gap in academic research by delving into IWB within Indonesian higher education. Despite academics showing considerable interest in IWB, evidenced by numerous publications in the business context, this research is among the few that center on the role of IWB in enhancing the innovative performance of higher education institutions. A review of Garuda Reference Digital (Garuda) reveals a dearth of publications on IWB in Indonesian Higher Education, with only 191 articles from 2017 to January 2023, overwhelmingly concentrated (98%) on company contexts. By shedding light on the unique intersection of IWB, higher education, and the Indonesian context, this research aspires to contribute significantly to the advancement of IWB for lecturers in Indonesian universities.

THEORETICAL FRAMEWORK

Proactive Personality (PP)

The theory of proactive personality (PP), initially proposed by Bateman and Crant in 1993, posits that individuals possess the capability to shape their environment or, conversely, resist its influence. This theory introduces a dynamic interaction process where the individual, environment, and behavior mutually influence each other (Bateman and Crant, 1993). Proactive behavior, as outlined by Bateman and Crant (1993), involves direct actions that bring about changes in the environment and can be sustained over time. A proactive person, according to the same source, is characterized by three key attributes: (1) a relative lack of constraint by situational forces, actively influencing environmental changes instead of passively reacting to them; (2) a continuous

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search for opportunities, demonstrating initiative, taking decisive action, and persisting until goals are achieved through transformative change; and (3) active engagement in professional activities that expand interpersonal networks and career potential, along with involvement in volunteer work, charities, and other initiatives aimed at improving society and the lives of others (Bateman and Crant, 1993).

Proactive individuals transcend mere initiative-taking; their behavior originates from a heightened awareness of personal choices aligned with their values. Consequently, these individuals refrain from attributing their circumstances to external factors, as noted by Covey in 2016. The proactive personality, as described by Alikaj *et al.* (2020), signifies individuals actively shaping their surroundings to better meet their needs, perpetually seeking novel and more efficient approaches to enhance performance. Furthermore, individuals with a proactive personality not only possess the capacity to generate innovation in their work but also exert influence on innovative behavior within the workplace, as highlighted by Li *et al.* (2022). This continuum of proactive personality, from its theoretical roots to its real-world applications in shaping environments and fostering innovation, underscores the dynamic and influential role of individuals in their surroundings.

Innovative Work Behavior (IWB)

Referencing Farr and Ford's seminal work in 1990, de Jong and Hartog (2008) define Innovative Work Behavior (IWB) as an individual's intentional initiation and introduction of a new idea, process, product, or procedure within a work role, group, or organization, with the aim of being useful. Building on this foundation, Kheng *et al.* (2013), drawing from West and Farr (1989), characterize IWB as employee actions directed at creating, implementing, and introducing new ideas, products, processes, and methods, not only for individual job positions but also for entire departments, units, or organizations. Al-Omari *et al.* (2019) offer a perspective that views IWB as the result of identifying a problem and generating an idea to create a product, process, or service that serves a practical purpose. Similarly, Jankelová *et al.* (2021) describe IWB as the intentional creation, introduction, and implementation of new ideas to enhance the performance of a work role, group, or organization. Gkontelos *et al.* (2022) contribute to this understanding by framing IWB as an iterative multi-stage process where employees intentionally create new concepts. This process involves exploring various possibilities, implementing plans, and executing actions while ensuring the sustainability of the ideas, all aimed at benefiting the organization in the long term.

Expanding on the works of de Jong and Hartog (2008) and Khang *et al.* (2013), Gkontelos *et al.* (2022) propose four dimensions of IWB: (a) Opportunity Exploration: This involves individuals discovering innovative processes by chance through identifying opportunities, problems, or puzzles that need solving. The trigger for exploration may be an opportunity for improvement or a threat that demands immediate attention; (b) Idea Generation: Individuals, recognizing a need or opportunity, serve as the source of new ideas, developing novel approaches to address these needs; (c) Championing: Innovative individuals must advocate for their ideas, gaining support from their work team or other relevant parties; (d) Application: This dimension refers to improving existing products or procedures or developing entirely new products. Innovative employees invest significant effort and a results-oriented attitude to transform their ideas into reality. By presenting these dimensions, Gkontelos *et al.* (2022) provide a comprehensive framework that captures the intricacies of Innovative Work Behavior and its transformative impact within organizational settings.

ORGANIZATIONAL INNOVATIVE PERFORMANCE

According to YuSheng and Ibrahim (2020), organizational innovative performance in a company or organization is characterized by the introduction of new products, services, technologies, or administrative practices. These innovations are strategically employed to enhance business delivery services or processes, showcasing the organization's capabilities in adapting to technological changes, evolving markets, and competitive models. The dimensions of a company's innovative capability, as outlined by YuSheng and Ibrahim (2020), encompass organizational innovation, product innovation, process innovation, and market innovation. Waheed *et al.* (2019) further elucidate that an organization's innovative performance is intricately tied to key activities, including new product development, the evolution of new processes, the formulation of creative strategies, and economic organization. Berber and Lekovic (2018) define innovative performance as the cumulative outcome of innovation activities within an industry or product category. They emphasize that it can be directly measured through the percentage of turnover derived from the introduction of new or improved products. Organizational innovative performance indicators generally consist of input from research and development (R&D), the number of patents, patent citations, and the introduction of new products. This is evaluated across two dimensions: administrative performance, which gauges the organization's response to environmental changes and its level of innovation in terms of planning procedures, integrated processes, and control mechanisms;

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and technical performance, which measures a company's development of new technology, incorporation of technology into new products, and facilitation of new processes to enhance quality and reduce costs (Berber and Lekovic, 2018).

In the context of Higher Education in Indonesia, the innovative performance is reflected in the five pillars of Higher Education Innovation Management. These include policies related to entrepreneurship education, incentives for lecturers, innovation development, innovation master plans, non-academic curriculum, and part-time workers; resources such as lecturers, teaching staff, students, laboratories, funds, and supporting facilities; institutions associated with incubation, start-up, and spinoff programs, innovation institutions, Intellectual Property Rights (IPR) centers, and entrepreneurship-based business units; networking with industry, government, society, and the international community; and innovation results in the form of patents, licenses, innovation impact and income, Return on Investment (ROI), R&D projects, and innovation awards (Ristekdikti, 2019). However, for the specific focus of this research on the commercialization aspect of innovation, two pillars stand out: resources (pillar 2) and innovation results (pillar 5). This aligns with the vision of the President of the Republic of Indonesia, Ir. Joko Widodo, who emphasizes that higher education innovation should not halt at the prototype stage but must progress towards commercialization (Sekretariat Presiden, 2020).

HYPOTHESIS DEVELOPMENT

Proactive personality and innovative work behavior

Drawing on research findings, Proactive Personality (PP) emerges as a potential predictor for Innovative Work Behavior (IWB). Mustofa *et al.*'s (2020) study conducted on Micro, Small, and Medium-sized Enterprises (MSME) employees in Kebumen Regency, Central Java, establishes a positive correlation between PP and increased IWB among employees. The research suggests that IWB flourishes when employees operate in positive and enjoyable mental and emotional conditions, fostering the creation of novelty and the generation of useful ideas (Mustofa *et al.*, 2020). Mubarak *et al.* (2021) further affirm the significant role played by PP in the IWB of MSME employees, underscoring its positive outcomes for companies. In a related analysis, Zuberi and Khattak (2021) examine PP and Leader-Member Exchange (LMX) as predictors for IWB, concluding that these factors exhibit a robust positive relationship with employee IWB. Park and Jo (2018) contribute to this understanding by highlighting that employees with a proactive attitude tend to initiate actions to alter their environment, actively seek better ways to enhance or modify the status quo, and ardently pursue the implementation of their ideas. Proactive individuals, as described by Le *et al.* (2020), consistently gather information, identify and seize opportunities, and reshape current situations or transition to ideal conditions, effecting substantial changes in the workplace. Individuals with a proactive personality are more likely to exhibit innovative work behavior, aligning with the findings of previous studies and reinforcing the notion that proactive traits contribute positively to the generation of novel and useful ideas in the workplace. Building upon these insights, the following hypothesis is proposed: H1. Proactive personality has a positive and significant effect on innovative work behavior.

Proactive personality and organizational innovative performance

Highlighting the significance of proactive behavior in organizational performance, proactive individuals possess the ability to actively seek and map opportunities, demonstrate initiative, take persistent action, and drive transformative change within the organization (Bateman and Crant, 1993). This viewpoint underscores the crucial role of proactive behavior in enhancing organizational performance. While several researchers have explored the impact of Proactive Personality (PP) on Innovative Work Behavior (IWB), creativity, and job performance, there has been limited examination of its relationship to organizational performance. This research aims to fill this gap and serves as a reference for investigating the role of PP in organizational performance. Tai and Mai (2016) discovered that employee PP significantly contributes to enhancing organizational innovative capability in various national and multinational companies in Thailand. Zahoor (2020) similarly concluded that PP among employees positively and significantly influences company service performance. Irani *et al.* (2023) affirmed this by establishing that managers' proactive handling of guest and employee problems at Cyrus Hotels directly impacts organizational performance. This aligns with Zhang *et al.* (2022), who identified a direct relationship between team proactivity and team performance, generating attitudes and behaviors among employees that foster organizational performance. In analyzing the service performance of 5-star hotels in China, Yang *et al.* (2020) found that proactive employees actively contribute beyond their specified tasks, demonstrating higher motivation for contextual performance. Proactive individuals, leveraging their inherent strengths, respond better to organizational encouragement, thereby enhancing managerial efficiency and aiding resource utilization to achieve organizational goals (Upadhyay and Mishra, 2021). Hsiao and Wang (2020) stated that individuals with a proactive personality are more willing to make sacrifices to improve organizational performance when contributing to the organization. These findings are consistent with Fuller *et al.* (2010), who observed that individuals with a high proactive attitude outperformed

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passive counterparts, driven by a sense of commitment to their work and the organization's progress. Therefore, individuals with a proactive personality positively influence organizational innovative performance, contributing to the organization's overall success and progress.

Based on the aforementioned insights, the following hypothesis is proposed:

H2. Proactive personality has a positive and significant effect on organizational innovative performance.

Innovative work behavior and organizational innovative performance

The impact of employee innovative work behavior on organizational performance is a well-established phenomenon, with various studies providing valuable insights. Guan *et al.* (2019) conducted a study on the IWB of the new generation of entrepreneurs in China, examining aspects of innovation in company production and operations, as well as management system innovation. The results indicated a positive influence of IWB on organizational performance. Similarly, Jankelova *et al.* (2021) analyzed the IWB of managers in various companies operating in Slovakia and identified employee IWB as a key factor for enhancing business performance, encompassing increased profits, sales growth, and employment expansion. Adekanmbi and Ukpere (2022) asserted that employee IWB is a crucial factor in improving company performance across manufacturing, financial, and service industries in Nigeria. Additionally, Fatoki (2021) found that IWB among Micro, Small, and Medium-sized Enterprises (MSME) employees in South Africa contributes to competitive advantage (CA), making companies more profitable than their competitors in terms of technological progress, product quality, market share, and attractiveness in the value and income creation process. Specifically focusing on MSMEs, Ausat *et al.* (2022) discovered a positive and significant influence of IWB on business performance, manifesting as increased customer trust, enhanced productivity, heightened employee commitment, profit and sales growth, and additional employment.

Alarifi and Adam (2023) further established a positive and significant correlation between IWB and Small and Medium-sized Enterprises (SME) resilience, emphasizing the positive impact of innovative employee behavior on short-term business performance and the long-term ability to survive and confront challenges posed by crises. In the context of university lecturers, Khiong and Utomo (2023) found that the IWB of lecturers in Banten Province improved organizational performance, contributing to the development of competent and highly competitive human resources at both national and global levels. This was coupled with the application of science and technology to society. It can be concluded that innovative work behavior of employees positively contributes to the overall innovative performance of the organization, aligning with the collective findings from various studies across different industries and contexts. Based on these research findings, the proposed hypothesis is as follows:

H3. Innovative work behavior has a positive and significant effect on organizational innovative performance.

Proactive personality, organizational innovational performance, and innovative work behavior as mediators

A proactive person is a person who is relatively not limited by situational forces but instead influences environmental changes, can see opportunities, shows initiative, and takes action (Bateman and Crant, 1993). Covey (2013) states that a proactive person has the ability or some kind of responsibility to choose a response to events around him (response-ability) and therefore even though he is still influenced by external stimuli, whether physical, social, or psychological, he gives a response based on values both consciously and unconsciously. A proactive person is driven by values, unlike a reactive person who only acts (responds) based on certain feelings (Covey, 2013). A proactive personality will increase creativity and innovative work behavior at work which will have an impact on improving organizational performance. Roppak *et al.* (2019) found that a leader's proactive attitude strengthens the creativity and innovation behavior of his subordinates, and therefore results in creative performance in the workplace (Choi *et al.*, 2021). The influence of a proactive personality strengthens employees' innovative work behavior, as found by Li *et al.* (2022) on IT sector workers in China. Jankelova *et al.* (2021) found a direct and significant influence of the IWB of company employees in Slovakia on company business performance. Akekanmbi and Ukpere (2022) observed a strong impact of employee IWB on the performance of service-based organizations in Nigeria. The results of the research above found a positive and significant influence of PP on IWB and IWB on organizational performance, so it can be assumed that IWB can mediate the influence of PP on organizational performance.

Apart from that, the study of the role of IWB as a mediator between PP and organizational performance is also based on research references on personality aspects that influence performance through innovative work behavior. Jankelová and Joniaková (2021) in their research on innovative performance in Slovak companies operating in the agrarian sector found that organizational performance increased due to the role of managers who behaved entrepreneurially and were supported by innovative work behavior at work. A person who has an entrepreneurial spirit is one of the characteristics of a proactive person. Farukh and Ansari (2021) examined the role of IWB in moderating psychological capital (psyche) on customer value creation (CCV) as an output of the performance of the hotel industry in Pakistan. According to Pusparini and Aryasa (2021), employees who have freedom,

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independence, and flexibility in working (work autonomy) and a broad mindset such as sensibility, awareness, vision, and willingness to take risks (individual global mindset) tend to have innovative work behavior that helps employees to improve personal and organizational performance. Lu *et al.* (2022) examine employee mental health, namely a state of well-being in which individuals are aware of their abilities, can cope with the normal stresses of life, can work productively and fruitfully, and can contribute to their community and its influence on employees' sense of engagement in the company with IWB as mediator. The findings of this research are that the state of positive influence inherent in mental health that appears in innovative work behavior and work engagement is very important for meeting work demands which in turn, these two behaviors are positively related to job performance (Lu *et al.*, 2022). Based on the review of the research results above, the following hypothesis is proposed: H4. Innovative work behavior mediates the positive and significant influence of a proactive personality on organizational innovative performance.

METHODOLOGY, SAMPLE, AND MEASUREMENT

Research models

The conceptual framework in this research is in Figure 1 which shows that PP influences IWB, PP influences OIC, IWB influences OIC and IWB can mediate the influence of PP on OIC.

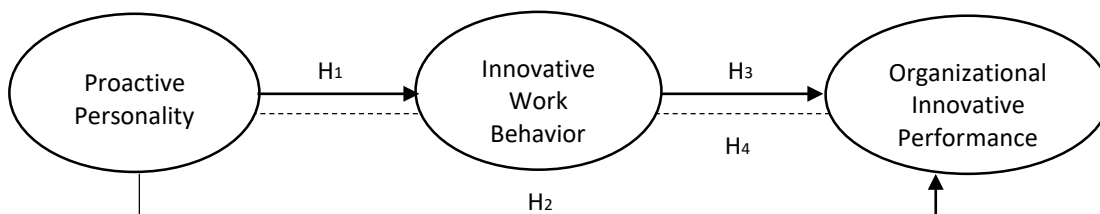


Figure 1. Conceptual framework

This research analyzes the correlation of influence between these variables using descriptive statistics the *Structural Equation Modeling - Analysis of Moment Structures* (SEM-AMOS) method and the AMOS application ver. 22.0. SEM is a statistical model that attempts to explain the relationship between several variables by analyzing the structure of the relationship expressed in a series of equations. This equation describes all relationships between the constructs (dependent and independent variables) and the variables involved in the analysis (Hair, *et al.*, 2019). This research uses primary data collected from respondents with a questionnaire in the form of a *Google form*. The type of research is *one-shot* or *cross-sectional*, that is, data collection is carried out only once within a certain period.

Sampling and data collection

The unit of analysis is 216 permanent lecturers at 17 private universities registered at LLDIKTI Region III, Jakarta which are included in the Superior Institution Accreditation rankings, A and B (BAN-PT, 2023). This research uses a stratified random sampling technique, which is a sampling technique based on certain strata by first dividing the population into homogeneous strata or subsamples (grouping individuals or entities based on the characteristics they have), and then simple random sampling or random sampling. Systematic sampling was used to select cases within each stratum (Friedman and Taub, 2006).

Table 1 shows that the majority of respondents were 123 (57%) men, and 93 (43%) women; 110 (51%) were Gen X, 67 (31%) were millennials; There are 121 (56%) lecturers who are currently or have completed doctoral education, and 95 (44%) are Masters; 107 (49.5%) people have been teaching for more than 10 years. The majority of lecturers only produce 1 publication a year for both national (Sinta 125 (58%)) and international journals (Scopus [125 (57.90%)]); During the last 5 years (2019-2023), there were 177 lecturers (81.94%) who did not have a patent. There are 136 (63%) lecturers who do not yet have IPR only 39 (18%) lecturers who have recognized innovations, and 177 lecturers (82%) who do not have recognized innovations. Descriptive data on lecturers' professional performance shows that lecturers' research results do not have the expected quality so outcomes in the form of publications, patents, innovations, and IPRs are not achieved.

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Table 1. Demographic characteristics of effective samples

Variables	Categories	Frequency	Percentage
Gender	Male	93	43%
	Female	123	57%
Cohort generation	<i>Gen Z</i>	0	0%
	<i>Millennials</i>	67	31%
	<i>Gen X</i>	110	51%
	<i>Baby boomers</i>	39	18%
Level of education	Masters	95	44%
	Doctor	78	36%
	Doctoral student	43	20%
Teaching experience	5 years and below	51	24%
	5-9 years	58	27%
	10 years and above	107	49.50%
Number of publications (2019-2023) in national accredited journal (Sinta) as first author	5 articles and below	125	58%
	5-10 articles	43	20%
	11-15 articles	15	7%
	16-20 articles	4	2%
	21 articles and above	5	2%
	None	24	11%
Number of publications (2019-2023) in international accredited journal (Scopus) as first author	5 articles and below	125	57.90%
	5-10 articles	12	5.60%
	11-15 articles	0	0.00%
	16-20 articles	1	0.50%
	21 articles and above	1	0.50%
	None	77	35.60%
Number of Patents (2019-2023) 1 patent	22	10.19%	
	2 patents	8	3.70%
	3 patents and above	9	4.17%
	None	177	81.94%
Number of Intellectual Property Rights (IPR) (2019-2023)	1 IPR	32	15%
	2 IPRs	12	6%
	3 IPR and above	36	17%
	None	136	63%
Number of recognized innovations (2019-2023)	1 innovation	28	13%
	2 innovations	3	1%
	3 innovations and above	8	4%
	None	177	82%

Variables and measurements

Proactive personality variable was adapted from Bateman and Crant (1993) with 17 statements; The measurement of the innovative work behavior variable adapted from de Jong and Hartog (2008) has 4 dimensions (opportunity exploration, idea generation, championing, and implementation) with 10 indicators; the measurement of the organizational innovative performance variable adapted from the Higher Education Innovative Management indicator (Ristekdikti, 2019) has 2 dimensions (resource dimension and innovation result dimension) with 19 statements. Measurement for each variable uses a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

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RESULTS

Descriptive analysis and Confirmatory Factors Analysis (CFA)

Descriptive statistics (table 2) show that respondents gave a relatively high assessment of the research indicators (mean variable proactive personality between 3,542 – 4,444; mean innovative work behavior ranging between 3,831 – 3,889; and mean organizational innovative performance between 3,046 – 3,559).

Table 2. Descriptive Statistics and Respecification of the Confirmatory Factor Analysis Model

Variable	Indicator	Mean	Standard Deviation	Loading Factor	Cronbach's Alpha	Construct Reliability	Variance Extracted
Proactive Personality	PP1	4,444	0.568	0.676	0.919	0.928	0.5
	PP2	4,134	0.732	0.775			
	PP4	3,838	0.707	0.757			
	PP5	3,866	0.725	0.715			
	PP6	4,370	0.580	0.643			
	PP8	4,120	0.692	0.671			
	PP10	3,699	0.770	0.761			
	PP11	4,176	0.576	0.678			
	PP12	3,722	0.805	0.702			
	PP13	3,542	0.867	0.635			
	PP15	3,690	0.729	0.807			
	PP16	3,676	0.751	0.734			
	PP17	4,023	0.650	0.609			
Innovative Work Behavior	EXP	3,831	0.645	0.789	0.919	0.923	0.75
	IDEA	3,889	0.598	0.907			
	CHAM	3,831	0.644	0.880			
	IMPL	3,878	0.596	0.883			
Organizational innovative performance	POWER	3,559	0.691	0.698	0.703	0.705	0.543
	INOV	3,048	0.724	0.776			

Respecification of the CFA model shows that the factor loading value is above 0.60, meaning that the indicators included in the model validly reflect the measurements (Chin, 1998). *Proactive Personality* loading factor with Cronnach's Alpha between 0.643 - 0.807 and Composite Reliability > 0.70. The *Innovative Work Behavior* variable has a loading factor between 0.789 – 0.907 with an acceptable level of reliability above 0.70. The *Organizational innovative performance* variable has a loading factor between 0.691 and 0.724 with a reliability level of 0.705 > 0.70. Overall the CFA model is acceptable and has convergent validity as indicated by Variance Extracted (VE) > 0.50. In this way, the variation of indicators contained in the research variables is fulfilled.

Discriminant validity

Discriminant validity (table 3) explains that theoretically the variable is different from other variables and has been tested statistically. The HTMT (Heterotrait Monotrait ratio) method recommended by Henseler, Ringle, and Sarstedt (2015) shows that this method is stronger in detecting discriminant validity than the Fornell Lacker and Cross Loading methods. The estimation results show that the HTMT value for the pair between variables is <0.90. These results confirm that discriminant validity is met.

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Table 3. Discriminant Validity

Variables	Proactive Personality	Innovative Behavior	Work	Organizational innovative performance
Proactive Personality				
Innovative Behavior	0.806			
Organizational innovative performance	0.414	0.772		

HYPOTHESIS TESTING

Following are the results of hypothesis testing at table.4.

Hypothesis	Hypothesis Statement	Estimates (Unstandardized)	Estimates (Standardized)	S.E	CR	Pvalue	Information
H1	Proactive Personality --> Innovative Work Behavior	1,089	0.797	0.120	9,079	0,000	Accepted
H2	Proactive Personality --> Organizational innovative performance	0.393	0.250	0.193	2,038	0.042	Accepted
H3	Innovative Work Behavior --> Organizational Innovative performance	0.639	0.555	0.149	4,277	0,000	Accepted
H4	Proactive Personality --> Innovative Work Behavior --> Organizational innovative performance	0.695	0.443	0.193	3,601	0.008	Accepted

Based on Table 4, it can be concluded that hypothesis 1 (H1) is accepted: proactive personality has a significant effect on innovative work behavior ($P < 0.05$). This means that every change in proactive personality will increase innovative work behavior. Hypothesis 2 (H2) is accepted: proactive personality also has a significant effect on increasing organizational innovative performance ($P < 0.05$). The influence of proactive personality is higher on innovative work behavior ($r = 0.797$) than the influence on organizational innovative performance ($r = 0.250$). Hypothesis 3 (H3) is accepted: innovative work behavior has a significant effect on organizational innovative performance with a path coefficient of 0.555.

Mediation testing uses a bootstrapping process with the *bias-corrected and accelerated (BCa) bootstrap method* which can scale data when the data is not normally distributed. The test results show a significant mediation coefficient of 0.695 and a p-value of $0.008 < 0.05$ (hypothesis 4 is accepted). These results confirm that innovative work behavior plays a significant role as a mediating variable. The mediation effect size is calculated according to the recommendations of Lachowicz *et al* (2018) by squaring the mediation coefficient and calculating (effect size = 0.483) in high mediation quality.

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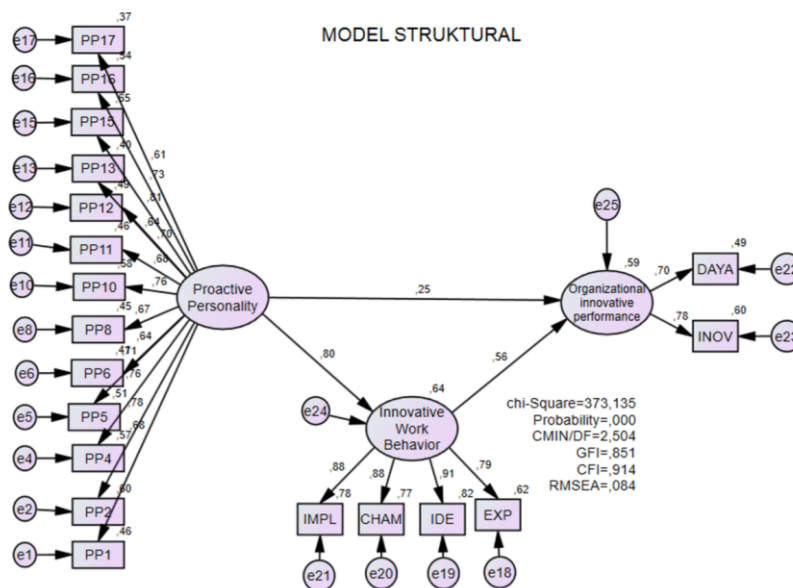


Figure 2. Structural Model Diagram

GOODNESS OF FIT MODEL

The goodness of fit analysis (table 5) shows that the model is accepted (good fit) with the statistical size CMIN/DF being $2.504 < 5$, RMR $0.026 < 0.05$, CFI $0.914 > 0.90$ and TLI $0.902 > 0.90$ and RMSEA $0.084 < 0.10$ (acceptable fit).

Table 5. The goodness of fit model

Goodness of Fit Size	Standard	Estimate	Conclusion
P value Chi-Square Test	> 0.05	0,000	Poor Fit
CMIN/DF	< 5	2,504	Good Fit
GFI	> 0.90	0.851	Poor Fit
RMR	< 0.05	0.026	Good Fit
RMSEA	< 0.10	0.084	Acceptable Fit
CFI	> 0.90	0.914	Good Fit
TAG	> 0.90	0.902	Good Fit

DISCUSSION

This study delves into the nuanced relationship between proactive personality (PP), innovative work behavior (IWB), and organizational innovative performance (OIP) among university lecturers. The analysis reveals a positive and significant effect of PP on lecturers' IWB, aligning with Bandura's (1989) concept that personality and behavior dynamically interact, fostering a reciprocal relationship. Proactive individuals, characterized by the initiative and action to effect change, showcase a heightened propensity for innovative work behavior (Park and Jo, 2018). This positive and significant relationship underscores the intricate interplay of thoughts, emotions, and actions propelling innovative work behavior among lecturers. Despite the positive perception of lecturers towards a proactive attitude within the workplace, there exists a degree of hesitancy in extending this attitude to external initiatives, such as instigating changes in the work environment or promoting innovative ideas. Consequently, there is a call for universities to proactively cultivate an environment that supports and accelerates the proactive personalities of lecturers. This entails not only recognizing but also encouraging a proactive approach, fostering an atmosphere conducive to innovative work behavior.

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Moving beyond the individual level, the study extends its focus to the broader organizational context. The findings showcase that a proactive personality plays a pivotal role in enhancing organizational innovation performance within higher education. The proactive attitude of lecturers becomes a driving force for innovation, as evidenced by their continuous search for novel ways to effect change, make a meaningful impact on campus, and convert ideas into reality. This emphasizes the importance of nurturing proactive individual lecturers, involving them as key contributors to the innovative initiatives driving higher education.

In the context of innovative work behavior (IWB), its positive influence on organizational innovative performance resonates with previous studies (Guan *et al.*, 2019; Jankelova *et al.*, 2021).

The study's findings indicate that lecturers' IWB significantly enhances the innovative performance of higher education. This is exemplified by lecturers' proactive exploration of opportunities, generation of novel ideas, championing initiatives, and effective implementation, as indicated by a mean score of > 3.8 for the IWB variable. The robust correlation between IWB and organizational innovative performance further validates organizational behavior (OB) theory, asserting that individual behavior is a catalyst for organizational development (Champoux, 2011). The study employs the bias-corrected and accelerated (BCa) bootstrap method to reveal IWB as a significant mediating variable. This underscores the pivotal role of IWB in bridging the gap between a proactive personality and organizational innovative performance. Proactive individuals, inclined towards proactive attitudes, are more likely to exhibit IWB (Lie *et al.*, 2022). The results affirm that IWB acts as a conduit, strengthening the influence of a proactive personality on the innovative performance of higher education. Lecturers acknowledge the positive measurement items for PP, IWB, and OIP, emphasizing the integral role of a proactive attitude in enhancing innovative work behavior, which, in turn, contributes to the university's innovative performance.

LIMITATIONS

This study is subject to certain limitations that warrant consideration for future research endeavors. Firstly, the investigation focused exclusively on two factors influencing innovative performance in higher education—proactive personality factors and innovative work behavior (IWB). To enrich the understanding, future studies should incorporate additional dimensions such as creativity, diverse personality types, and various aspects impacting individual and organizational performance, such as motivation, job satisfaction, attitude, and values. Secondly, the research is confined to private universities within the LLDikti Region III, excluding high schools, institutes, academies, and state universities in the region. Consequently, the findings may not be readily generalizable to encompass all Private Higher Education Institutions (PTS) and Public Higher Education Institutions (PTN) in Indonesia. To address this limitation, future research should strive to include a broader spectrum of educational institutions, providing a more comprehensive and representative analysis. Thirdly, for a more thorough and conclusive understanding of the influence of proactive personality and innovative work behavior on organizational innovative performance in private universities within LLDikti Region III Jakarta, it is recommended to increase the number of respondents. A larger sample size would enhance the statistical robustness of the findings, ensuring greater reliability in drawing comprehensive conclusions.

CONCLUSION

In the journey towards fostering innovation within higher education institutions, this research unveils crucial insights. Lecturer personality factors (PP) emerge as powerful catalysts, exhibiting a positive and significant influence on innovative work behavior. Elevating proactive attitudes among lecturers becomes pivotal, demanding concerted attention from universities. Strengthening these personality dimensions not only propels innovative work behavior but also propels the entire organizational innovative performance of higher education institutions to new heights. The impact of lecturer innovative work behavior on the innovative performance of higher education is undeniable. As universities cultivate environments conducive to idea exploration and champion the implementation of innovative ideas, the ripple effect is evident.

The findings emphasize the imperative for institutions to create conditions fostering creativity, allowing lecturers the freedom to explore, promote, and execute innovative ideas. Crucially, this research establishes the mediating role of innovative work behavior in amplifying the influence of proactive personality on organizational innovative performance. A dynamic interplay unfolds—where proactive attitudes seed innovative work behavior, and in turn, this behavior enhances the innovative performance of higher education institutions. It is a symbiotic relationship that, when nurtured, results in a flourishing landscape of resources and innovation outcomes. In essence, the conclusion drawn is clear: the journey to innovation in higher education necessitates a dual focus. By fortifying proactive personality traits and cultivating environments that nurture innovative work behavior, universities can embark on a transformative path. This path not only promises heightened organizational innovative performance but also positions higher education institutions at the forefront of creativity, adaptability, and progress.

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REFERENCES

- 1) Adekanmbi, F.P. & Ukpere, W.I. (2022). The relational effects of perceived leadership 4.0, workplace ostracism, and innovative work behavior on organizational performance in the fourth industrial revolution (4IR). *EUREKA: Social and Humanities*, No.2.
- 2) Alarifi, G. & Adam, N.A. (2023). The role of participatory leadership and employee innovative behavior on SMEs' endurance. *Sustainability*, 15, 2740. <https://doi.org/10.3390/su15032740>.
- 3) Alikaj, A., Ning, W. and Wu, B. (2020), *Proactive personality and creative behavior: examining the role of thriving at work and high-involvement hr practices*, *Journal of Business and Psychology*.
- 4) Al-Omari, M.A., Choo, L.S. & Ali, M.A.M. (2019). Innovative work behavior: a review of literature. *International Journal of Psychosocial Rehabilitation*, Vol. 23, Issue 02.
- 5) Ausat, A.M.A., Widayani, A., Rachmawati, I., Latifah, N. & Suherlan, S. (2022). The effect of intellectual capital and innovative work behavior on business performance. *Journal of Economics, Business, & Accountancy Ventur*, Vol. 24, No. 3, pages 363 – 378.
- 6) Bateman, T.S & Crant, J.M. (1993). The proactive component of organizational behavior: a measure and correlates. *Journal of Organizational Behavior*, Vol. 14, 103-118.
- 7) Champoux, J.E. (2011). *Organizational Behavior: Integrating Individuals, Groups, and Organizations (4Th Ed)*, Routledge, New York.
- 8) Choi, W.S., Kang, S.W. & Choi, S.B. (2021). Innovative behavior in the workplace: an empirical study of moderated mediation model of self-efficacy, perceived organizational support, and leader–member exchange. *Behav. Sci.* 11, 182. <https://doi.org/10.3390/bs11120182>.
- 9) Covey, S.R. (2013). *The 7th Habits for Highly Effective People (25th Anniversary Edition)*. Publisher: Simon and Schuster.
- 10) de Jong, J.P.J., & Hartog, D.N.D. (2008). *Innovative work behavior: measurement and validation (working paper)*. SCALES-initiative: EIM Research Reports.
- 11) Dedahanov, A.T., Rhee, C., & Yoon, J. (2017). Organizational structure and innovation performance: Is employee innovative behavior a missing link? *Career Development International*, Vol. 22 No. 4, pp. 334-350. Doi 10.1108/CDI-122016-0234.
- 12) Directorate of Innovation Systems, Ministry of Research, Technology and Higher Education, 2018. General Guide to Implementing Innovation Management in Higher Education, 2018 edition 1, Directorate General of Strengthening Innovation, Jakarta.
- 13) Dwivedi, P., Chaturvedi, V. & Vashist, J.K. (2021) Innovation for organizational sustainability: the role of HR practices and theories. *International Journal of Organizational Analysis*, DOI 10.1108/IJOA-07-2021-2859.
- 14) Farrukh, M. & Ansari, N.Y. (2021). Effect of psychological capital on customer value cocreation behavior: the mediating role of employees' innovative behavior. *Benchmarking: An International Journal*, Vol. 28 No. 8, pp. 2561-2579. DOI 10.1108/BIJ-08-2020-0398.
- 15) Fatoki, O. (2021). Innovative behavior and firm competitive advantage: the moderating effect of environmental dynamism. *Foundations of Management*, Vol. 13. Doi: 10.2478/fman-2021-0012.
- 16) Fuller, J.B., Hester, K. & Cox, S.S. (2010). Proactive personality and job performance: Exploring job autonomy as a moderator. *Journal of Managerial Issues*, Vol. XXII, No.1: 33-51.
- 17) Gkontelos, A., Vaiopoulou, J. & Stamovlasis, D. (2022). Teachers' innovativework behavior scale: psychometric properties of the greek version and measurement invariance across genders. *Social Sciences*, 11: 306. <https://doi.org/10.3390/socsci11070306>.
- 18) Guan, H., Zhang, Z. Zhao, A., Jia, J. & Guan, S. (2019). Research on innovation behavior and performance of new generation entrepreneur based on grounded theory. *Sustainability*, 11, 2883. Doi:10.3390/su11102883.
- 19) Hair, J.F., Black, W.C., Babin, B.J. & Anderson, R.E. (2019). *Multivariate data analysis*, (Eighth Edition), Publisher Annabel Ainscow.
- 20) Hsiao, C.H. & Wang F.J. (2020). Proactive personality and job performance of athletic coaches: organizational citizenship behavior as mediator. *Palgrave Communications*, 6:33. <https://doi.org/10.1057/s41599-020-0410-y>.
- 21) Irani, F., Rahimzhan, S. and Eluwole, K. K. (2021). Proactive personality and organisational performance of hotels in Cyprus and Taiwo Temitope Lasisi, *European Journal of Tourism*, 34, 3405.
- 22) Jankelová, N. & Joniaková, Z. (2021). The role of innovative work behaviour and knowledge-based dynamic capabilities in increasing the innovative performance of agricultural enterprises. *Agricultural Economics – Czech*, 67, (9): 363–372.

Exploring the Impact of Proactive Personality on Organizational Innovative Performance in Higher Education: The Mediating Role of Innovative Work Behavior

- 23) Jankelová, N., Joniaková, Z, & Mišún, J. (2021). Innovative work behavior—a key factor in business performance? the role of team cognitive diversity and teamwork climate in this relationship. *Journal of Risk and Financial Management*, 14: 185. <https://doi.org/10.3390/jrfm14040185>.
- 24) Kemendikbud. (2023), PDDikti. Diakses dari: <https://pddikti.kemdikbud.go.id/>.
- 25) Kheng, Y.K., Mahmood. R. & Beris, S.J.H. (2013). A conceptual review of innovative work behavior in knowledge intensive business services among knowledge workers in malaysia. *International Journal of Business, Humanities and Technology*, Vol. 3 No. 2.
- 26) Khiong, K. & Utomo, B. (2023). The effect of organizational trust, perceived organizational support (POS) and innovative work behavior (IWB) on university performance during digital era. *International Journal of Social and Management Studies (IJOSMAS)*, Vol. 4 No. 2.
- 27) Li, W., Gill, S.A., Wang, Y., Safdar, M.A. and Sheikh, M. R. (2022). Proactive personality and innovative work behavior: through the juxtapose of Schumpeter's theory of innovation and broaden-and-build theory. *Front. Psychol*, 13:927458. Doi: 10.3389/fpsyg.2022.927458.
- 28) Li, W., Gill, S.A., Wang, Y., Safdar, M.A. and Sheikh, M.R. (2022). Proactive personality and innovative work behavior: through the juxtaposition of Schumpeter's theory of innovation and broaden-and-build theory. *Front. Psychol*, 13:927458. Doi: 10.3389/fpsyg.2022.927458.
- 29) Lu, X., Yu, H. & Shan, B. (2022). Relationship between employee mental health and job performance: mediation role of innovative behavior and work engagement. *Int. J. Environ. Res. Public Health*, 19, 6599. <https://doi.org/10.3390/ijerph19116599>.
- 30) Mubarak, N., Khan, J., Yasmin, R. & Osmadi, A. (2021). The impact of a proactive personality on innovative work behavior: the role of work engagement and transformational leadership, leadership & organization. *Development Journal*, Vol. 42 No. 7, pp. 989-1003. DOI 10.1108/LODJ-11-2020-0518.
- 31) Mustofa, A., Purnomo, R., Darmawati, D. and Helmy, I. (2020), The effect of proactive personality on innovative work behavior with creative self efficacy as a mediator (study on smes woven pandanus kebumen), *International Sustainable Competitiveness Advantage*.
- 32) Neely, A. & Hii, J. (1998) Innovation and business performance: A literature review. *The Judge Institute of Management Studies*, University of Cambridge.
- 33) Park, S. & Jo, S.J. (2018). The impact of proactivity, leader-member exchange, and climate for innovation on innovative behavior in the Korean government sector. *Leadership & Organization Development Journal*, Vol. 39 No. 1, pp. 130-149. Doi 10.1108/LODJ-09-2016-0216.
- 34) Pradana, A.W., dkk. (2021) *Cetak biru ekosistem pengetahuan dan inovasi*. Ristek-BRIN.
- 35) Pusparini, E.S. & Aryasa, K.B. (2021). Entering the global market: the role of work autonomy and individual global mindset as antecedents of innovative work behavior in defining employee task performance. *The South East Asian Journal of Management*, Vol. 15 No. 1, pp. 97-111.
- 36) Ristekdikti (2019). *Pengukuran kinerja inovasi Perguruan Tinggi*, Direktorat Sistem Inovasi, Ditjen Penguatan Inovasi.
- 37) Roppak, K., Mirsha, S.K. & Sikarwar, E. (2019). Linking leader–follower proactive personality congruence to creativity. *Personnel Review*, Vol. 48 No. 2, pp. 454-470. DOI 10.1108/PR-11-2017-0332.
- 38) Saad, S. & Alnuaimi, S. (2022) Innovation Framework for Digital Era, *Advances in Manufacturing Technology*, XXXV. DOI:10.3233/ATDE220565.
- 39) Segarra-Ciprés, M., Escrig-Tena, A. and García-Juan, B. (2019). Employees' proactive behavior and innovation performance: Examining the moderating role of informal and formal controls, *European Journal of Innovation Management*, Vol. 22 No. 5, pp. 866-888, DOI 10.1108/EJIM-02-2019-0041.
- 40) Presidential Secretariat (2020, November 10). President Jokowi's speech at the Opening of the 2020 Indonesia Innovation Expo [video]. <https://www.youtube.com/watch?v=QHh5euhk9cc>.
- 41) Tai, H.T. & Mai, N.Q. (2016). Proactive personality, organizational context, employee creativity and innovative capability. *International Journal of Organizational Analysis*, Vol. 24, Iss 3, pp. 370 – 389.
- 42) Upadhyay, R.K. & Mishra, A.K. (2021). Proactive personality and managerial efficiency: a mediating role of organization commitment. *Ilkogretim Online - Elementary Education Online*, Vol 20 (Issue 4): pp. 4155-4172. Doi: 10.17051/ilkonline.2021.04.452.

Exploring the Impact of Proactive Personality on Organizational Innovative Performance in Higher Education: The Mediating Role of Innovative Work Behavior

- 43) Waheed, A., Miao, X., Waheed, S., Ahmad, N. & Majeed, A. (2019). How new HRM practices, organizational innovation, and innovative climate affect the innovation performance in the it industry: a moderated-mediation analysis. *Sustainability*, 11, 621. Doi:10.3390/su11030621.
- 44) Yang, C., Chen, Y., Zhao, X. and Hua, N. (2020). Transformational leadership, proactive personality and service performance: The mediating role of organizational embeddedness. *International Journal of Contemporary Hospitality Management*, Vol. 32 No. 1, pp. 267-287. Doi 10.1108/IJCHM-03-2019-0244.
- 45) YuSheng, K. & Ibrahim, M. (2020). Innovation capabilities, innovation types, and firm performance: evidence from the banking sector of Ghana. *SAGE Open*, 1– 12. DOI: 10.1177/2158244020920892.
- 46) Zahoor, A. (2020). Employee proactivity, work engagement, job resources and service recovery performance: a study of structural linkages. *Journal of Contemporary Marketing Science*, Vol. 3 No. 2, pp. 153-168. DOI 10.1108/JCMARS-022019-0016.
- 47) Zhang, G., Zhang, X. & Wang, Y. (2022). Perceived insider status and employees' innovative behavior: the role of knowledge sharing and organizational innovation climate. *European Journal of Innovation Management*. Doi 10.1108/EJIM-03-2022-0123.
- 48) Zhang, L., Fan, W. and Li, M. (2022), Proactive personality and entrepreneurial intention: Social class' moderating effect among college students, *Career Dev Q*;70:271–283.
- 49) Zuberi, M.A. & Khattak, A (2021). Impact of proactive personality and leader member exchange on innovative work behavior: A job design perspective. *International Journal of Innovation Science*. Vol. 13 No. 5, pp. 664-683, DOI 10.1108/IJIS-11-20-0251.



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Tourist Perception of the Existing Conditions of Kurenai Beach Tourism



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ABSTRACT: Kurenai Beach is a tourist destination on the coast of Tomini Bay, Bone Bolango Regency, Gorontalo Province. This beach has fine white sand and stretches quite wide, allowing various beach tourism activities to be carried out. It is essential to measure tourist perceptions of a tourist destination because tourist perception is a form of assessment of the existence of tourism that aims at the development of future destinations and helps guide beach managers to make decisions in pursuit of sustainable beach tourism. Some factors that influence tourists' perception of choosing a beach include attractions, accessibility, and amenities. This research aims to provide scientific information on tourists' perceptions of the Kurenai Beach tourist area as a first step towards sustainable tourism management. Tourist perceptions were obtained through incidental interviews with 120 tourists. Tourist perception is measured on five components: the physical condition of facilities and infrastructure, accessibility, tourist attraction, tourist infrastructure, and the quality of tourist areas. Data analysis in this study used the Likert scale to determine tourists' perception of the existing conditions of Kurenai Beach tourism. The results showed that, in general, tourists' perceptions of the current conditions of Kurenai Beach tourism were on good criteria, with a total percentage value of 67.4%. The tourist attraction component has the highest perception value, and the physical condition component of facilities and infrastructure has the lowest perception value. The low achievement of the value of tourist perception of the existing condition of Kurenai Beach needs special attention in the context of the sustainability of this tourism in the future.

KEYWORDS: visitor perception, tourism sustainability, Likert scale, Kurenai Beach, Tomini Bay

I. INTRODUCTION

Tourism is one of the driving sectors of the Indonesian economy. The government revenue from the tourism sector was recorded at 229.5 trillion in 2018, which increased to 280 trillion in 2019 (Kemenparekraf, 2020). However, the sector experienced a significant impact, mainly due to the COVID-19 pandemic, which was indicated by a decrease in revenue from the tourism sector to 7.5 trillion in 2021 (Widi, 2022). The government has made various efforts to save tourism in Indonesia, namely through emergency response, recovery, and normalization efforts. Since 2020, efforts to save tourism have been at the recovery stage, namely the gradual opening of tourist attractions in Indonesia. Preparations began with implementing the CHSE (Cleanliness, Health, Safety, and Environmental Sustainability) protocol at tourist attractions and support for optimization of MICE (Meeting, Incentive, Conference, Exhibition) activities. The beach is one of the most visited tourist destinations (Hasan et al., 2022). BPS (2019) states that beach tourism is included in the second order regarding tourist visits. Indonesia's coastal potential is quite significant, which supports the tourism industry, considering that Indonesia is an archipelagic country with a coastline of 99,093 km (Arifin et al., 2020).

Gorontalo Province, with a coastline of 903.7 km, is divided into the Tomini Bay area along 572.5 km of the south coast and the Sulawesi Sea area along 331.2 km of the north coast (DKP Gorontalo Province, 2021). The length of the coastline and the presence of small islands have considerable potential for coastal tourism development. Some well-known beach tourism destinations in Gorontalo Province are Minanga Beach, Botutonuo Beach, Tilalohe Beach, Dulanga Beach, Pohon Cinta Beach, and Kurenai Beach. Kurenai Beach is a coastal area on the shores of Tomini Bay, Bone Bolango Regency, Gorontalo Province. This beach has wide white sand, allowing various beach tourism activities. In addition, the location of Kurenai Beach is very strategic as it is easily accessible and not far from Botubarani Whale Shark Tourism (\pm 4.1 kilometers) and the center of Gorontalo City (\pm 15 kilometers). Preliminary observations indicate that the Kurenai Beach area is now beginning to be visited by many tourists.

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The management of recreational ecosystem services depends on public perceptions, so the perceptions should be considered to improve their management (Daily, 2000). Tourists' perceptions of the coastal environment can provide helpful information to guide beach managers in pursuing sustainable beach tourism (Chen and Teng 2016). The individual choice of a particular beach depends on the site's characteristics and the visitor's perceptions. The key factors influencing the visitor's perception in choosing a specific beach include the state of beach development, i.e., functional, comfortable, user-friendly, and safe beaches (Breton et al., 1996; Alves et al., 2014). According to Chen and Teng (2016), beach cleanliness, safety, information provision, sediment and habitat management, and population density are tourist indicators when choosing a tourist destination. According to Keliwar and Nurcahyo (2015), tourist perception is an impression that manifests itself in the form of interpretations and attitudes towards tourist attractions, tourism facilities, public facilities, tourism information, and services provided to tourists while at the tourist attraction. Every tourist who travels has a different perception of the objects visited, which depends on the travel experience, education level, environmental conditions, socio-cultural conditions of the tourist's home country, and psychological influences. Thus, this study provided scientific information on visitors' perceptions of the Kurenai Beach tourist area as a first step for sustainable tourism management in Kurenai Beach.

II. RESEARCH METHODS

Time and Place

The research was carried out from March to October 2023 in Tomini Bay, Kurenai Beach, and Bone Bolango Regency, as shown in Figure 1. This research uses survey and interview methods.

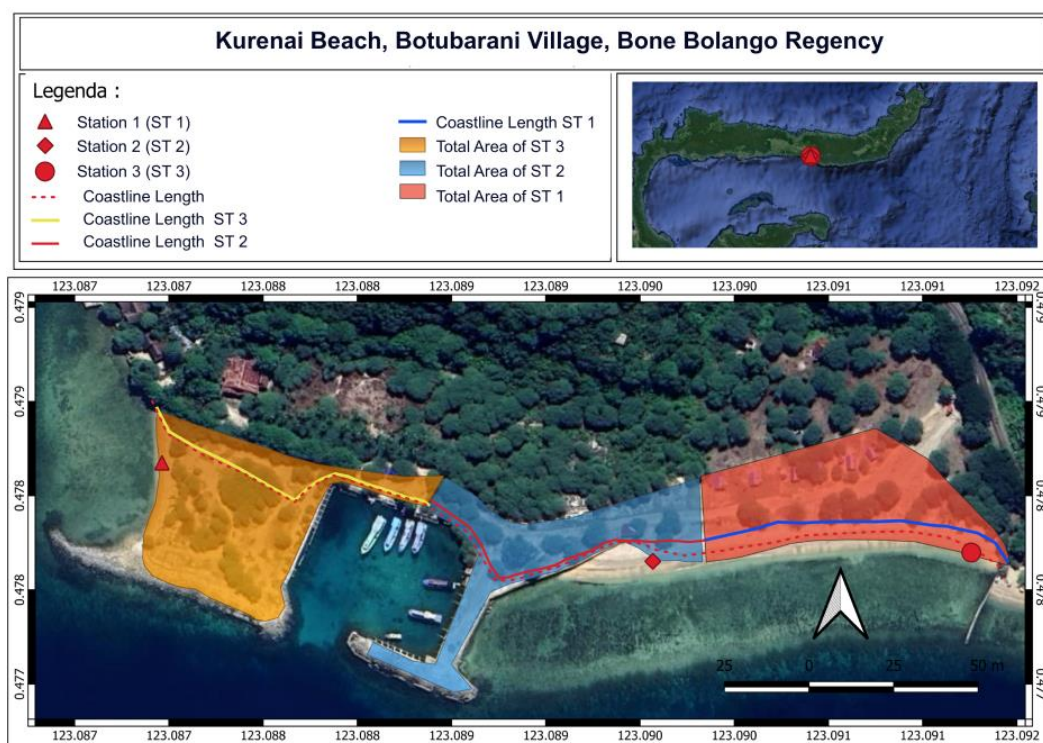


Figure 1. Map of Research Location

Data Retrieval Methods

Data collection on tourist perceptions in this research used the incidental interview method with 120 respondents. This method is considered for visitor or tourist respondents as it is easy to collect data from respondents who happen to be in the tourist area of Kurenai Beach. The data collection is carried out every week, considering the characteristics of the respondents, namely those aged 17 years and above (Ahmad et al., 2022).

Data Analysis

Tourists' perceptions of the existing conditions of Kurenai Beach were analyzed using a Likert Scale. Each answer in the questionnaire is given a value or weight (Hamzah et al., 2023) as follows:

- Very good/Very participatory given weight (5)
- Good/Participate weighted (4)
- Good enough/Enough weighted (3)

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- d. Less good/Less weighted (2)
- e. Do not know/Do not participate are weighted (1)

The percentage of answers that have been obtained then calculated using the formula (Sugiyono, 2017) as follows:

$$P = \frac{F}{N} \times 100\%$$

Information:

- P : Percentage of answers (%)
- F : The frequency of each answer that respondents have chosen
- N : Number of respondents

Furthermore, to determine the interpretation/score value of tourist perception of the existing condition of Kurenai Beach, it is divided into five classes referring to Amirin (2011) with the following criteria:

- 0% – 19,99% = Very not good
- 20% – 39,99% = Less good
- 40% – 59,99% = Good enough
- 60% – 79,99% = Good
- 80% – 100% = Excellent

III. RESULTS AND DISCUSSION

Characteristics of Tourist Respondents

Tourists who were respondents in this study were those who came to the Kurenai Beach area and engaged in tourist activities. The number of tourist respondents in this study was 120. Interviews with tourists were conducted to determine the tourists' perceptions of the existing condition of tourism at Kurenai Beach. Information on the characteristics of tourists who visited Kurenai Beach can be seen in Table 1.

Table 1. Percentage of characteristics of traveller respondents at the study site

Characteristic	Classification	Percentage (%)
Regional Origin	Gorontalo Province	96,7
	Outside Gorontalo Province	3,3
Gender	Male	48,8
	Female	51,2
Age (years)	≤ 17	0,8
	18–27	39,7
	28–37	28,1
	38–47	21,5
	48–57	9,1
	≥ 58	0,8
Work	Housewives	11,6
	SOEs/BUMDs	4,1
	Student	7,4
	Honorary Employees	4,1
	Private Employees	26,4
	Professional (Doctor, Judge, Lecturer, Teacher, Accountant)	3,3
	Civil servants	19,0
	Entrepreneurial	10,7
	Fisherman	0,8
	Other	12,4

Table 1 shows that tourists visiting Kurenai Beach are dominated by local (Gorontalo Province) tourists, 96.7%, and only 3.3% come from outside Gorontalo Province. The high percentage of local tourists from Gorontalo Province shows that this destination is well known to the people of Gorontalo Province. However, there are also tourists from outside Gorontalo Province. The

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interview results showed that tourists from outside Gorontalo Regency who visited Kurenai Beach came from North Sulawesi and Central Sulawesi. Although still small in number, this is undoubtedly a positive factor that needs to be considered by the tourism managers of Kurenai Beach so that the tourists who come continue to grow from regional and national tourists to international tourists. The more tourists from different backgrounds that visit, the more successful the promotion of these destinations can be. The results of the study, as presented in Table 1, show that based on gender, tourists visiting Kurenai Beach are more female, with a percentage of 51.2%, and male tourists, with a percentage of 48.8%. Andani (2017) stated that the role of women in tourism activities is necessary to reduce gender inequality.

Prasetio (2011) states that age affects a person's physical ability to make tourist visits. The results showed that the majority of tourists who visited Kurenai Beach were in the age group of 18-27 years (39.7%). These results indicate that tourism at Kurenai Beach is in demand by young people who like to travel. Based on the type of work, tourists visiting Kurenai Beach are dominated by those who work differently. Hamzah (2020) states that work can influence interest in travel, where work provides an individual with income and the ability to travel. The interview results showed that private employees dominated the visiting respondents by 26.4%. The results of this study are similar to the findings of Hakim et al. (2019), where private employees dominated the respondents travelling to Padang-Padang Beach, Badung. The results of this study indicate that remote employees in Gorontalo Province mostly use their holidays for tourism.

Tourists' Perception

Tourists' perception of a tourist attraction is one of the things considered in the progress of a tourist attraction. Tourist perception is related to tourists' opinions of the attractions visited, so in more significant cases, it can affect the number of tourist visits (Marcelina et al., 2018). Tourist perception shows assessments of services, facilities and infrastructure, accessibility, tourist attractiveness, tourist infrastructure, and quality of tourist areas.

1. Tourists' Perception of Kurenai Beach Tourism Facilities and Infrastructure

Facilities and infrastructure are essential aspects that must be present in a tourist attraction to support the tourism activities carried out in the tourism industry. Kurenai Beach has several facilities and infrastructure that support tourism activities, but the availability of these facilities and infrastructure may differ from the needs and desires of tourists. Based on this, tourists' perceptions of Kurenai Beach are shown in Table 2.

Table 2. Tourists' perception of Kurenai Beach tourism facilities and infrastructure

Tourists' Perception of Facilities and Infrastructure	ΣTS	Percentage (%)
Parking lot	433	71,6
Stalls	436	72,1
Restaurant	436	72,1
Lodging	299	49,4
Camping Tent	370	61,2
Security Post	400	66,1
Toilet	381	63,0
Trash Can	313	51,7
Path	370	61,2
Gazebo	329	54,4
Resource Center	350	57,9
A Place to Relax	451	74,5
Ticket Counter	420	69,4
Snorkelling/ Diving/ Water Sport/ Fishing Rod	396	65,5
Average Amount	384,571	63,57
Criterion	Good	

Table 2 shows that tourists' perceptions of tourist facilities and infrastructure at Kurenai Beach are on good criteria, with a percentage value of 63.57%. The facilities and infrastructure that received the highest score were places to relax, with a score of 74.5%. The facilities and infrastructure with the lowest score are trash can facilities, with a score of 51.7%. In general, the facilities and infrastructure at Kurenai Beach need to be completed and have been arranged accordingly.

Some of the tourism facilities and infrastructure at Kurenai Beach, such as parking lots, restaurants, stalls, and toilets, are newly built. While other tourism facilities and infrastructure at Kurenai Beach have been in place for a long time, some tourists suggest

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that more attention should be paid to the existing facilities and infrastructure so that tourism activities can run well. According to Fajriah and Massadun (2014), the availability of facilities and infrastructure in a tourist attraction is very important in attracting and increasing the number of visitors, which can affect the development and progress of the tourist attraction.

2. Tourists' Perceptions of Accessibility

Accessibility is the ease of achieving goals related to comfort, safety, and travel time from one place to another (Nabila & Widiyastuti, 2018). The comfort and ease of accessibility experienced or perceived by tourists is influenced by road conditions, road width, availability of transport, and road signs to tourist sites. The results of the interviews on tourists' perceptions of the accessibility conditions of Kurenai Beach can be seen in Table 3.

Table 3. Tourists' Perceptions of Accessibility

Tourists' perceptions of accessibility	ΣTS	Percentage (%)
Road conditions	428	70,7
Road width	408	67,4
Transportation availability	367	60,7
Road signs	362	59,8
Average Amount	391,250	64,67
Criterion	Good	

Table 3 shows that tourists have a good perception of the accessibility of the Kurenai Beach tourist site, with a percentage value of 64.67%. The road conditions to Kurenai Beach have the highest perception value, while the availability of road signs has the lowest perception value.

The journey to Kurenai Beach only takes one route if the journey starts from the direction of Gorontalo City. The means of transport used to reach tourist destinations can be public transport and private vehicles. The interview results showed that 117 respondents used private cars to visit tourist attractions, and three others used public transport. Tourists who come to Kurenai Beach are dominated by tourists from Gorontalo City, who choose to visit Kurenai Beach because of its proximity to Gorontalo City, with a travel time of ±15-30 minutes. In addition, this tour is much cheaper than other beach tours in Gorontalo Province. Tourists consider these factors, making Kurenai Beach the leading tourist destination that can be visited. The interview results showed that as many as 70.2% of the respondents stated that Kurenai Beach was the top tourist destination. Furthermore, 89.3% of the tourists surveyed had visited Kurenai Beach 2-5 times. The number of visits and the enthusiasm of tourists to visit Kurenai Beach is high, so special attention should be paid to the beach's accessibility for tourists.

Although the results of the analysis of tourists' perceptions of the accessibility of Kurenai Beach are generally in the good category, tourists still hope that efforts will be made to improve accessibility. This aspect of accessibility needs to be a concern for both the government and tourism managers so that tourists' journeys to tourist sites are more comfortable. Tourists perceive the condition of roads to tourist sites to be inadequate; many have potholes and need to be more comprehensive, even though the access roads are used to visit tourist attractions. According to Handayani et al. (2019), accessibility conditions significantly impact the comfort of tourism activities and should be considered as an effort to support appropriate tourism activities.

3. Tourists' Perception of Tourism Attraction

Tourist attraction is the availability and use of the environment in tourist attractions as an element that attracts tourists to visit these tourist attractions. Law No. 10 of 2009 on Tourism states that tourist attraction is everything that has uniqueness, convenience, and value from the environment managed by humans so that it becomes a place of means for tourist visits.

The tourist attractions available at Kurenai Beach are natural scenery/relaxation/recreation/white sand, snorkelling/diving/water sports, fishing, swimming, and camping. Tourists' perceptions of tourist attractions at Kurenai Beach are shown in Table 4.

Table 4. Tourists' Perception of Kurenai Beach's Tourist Attraction

Tourists' Perception of Tourism Attraction	ΣTS	Percentage (%)
Natural scenery/Relaxation/ Recreation/ White sand	461	80,2
Snorkeling/Diving/Water Sport	234	74,3
Fishing	169	61,5
Swimming	240	73,8
Camping	224	75,9
Average Amount	265,60	73,1
Criterion	Good	

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Based on Table 4, it is known that tourists' perception of the attractiveness of Kurenai Beach meets good criteria, with a percentage value of 73.1%. The indicator of tourist perception of the tourist attraction of Kurenai Beach received the highest percentage value compared to other indicators of tourist perception of the existing tourism of Kurenai Beach. The acquisition of this value proves that the tourist attraction of Kurenai Beach dominates other indicators in its existence as a tourist destination.

Wiradiputra and Brahmanto (2016) stated that the attractiveness of a good tourist area can influence tourist interest in the number of tourist visits. However, the attention of tour managers is needed to maintain the existence of tourist attractions so as not to decrease. According to Hardiyanti and Subari (2020), tourist attractiveness in a tourist area is closely related to the use of natural resources that need to be maintained to maintain these tourist attractions from time to time.

4. Tourists' Perception of Tourism Infrastructure

Tourism infrastructure is an artificial resource in a tourist destination to meet the needs of tourists, such as bridges, power grids, communication networks, and clean water facilities (Dalimunthe et al., 2020). The availability of infrastructure in a tourist destination is one of the things that tourists consider when visiting a tourist area. Tourism managers or owners need to pay attention to the availability of infrastructure so that tourism activities can run well and the number of tourists can be maintained. The tourism infrastructure available at Kurenai Beach includes communication networks, electricity networks, and clean water facilities. Tourists' perceptions of the tourism infrastructure at Kurenai Beach are shown in Table 5.

Table 5. Tourists' Perception of Kurenai Beach Tourism Infrastructure

Tourists' Perception of Tourism Infrastructure	ΣTS	Percentage (%)
Communication Network	445	73,6
Power grid	373	61,7
Clean Water Installation	411	67,9
Average Amount	409,67	67,71
Criterion	Good	

Table 5 shows that tourists' perception of tourism infrastructure is good, with a percentage value of 67.71%. The communication network has the highest percentage value of 73.6%. The high perception of tourists shows that communication and internet network access are available in the tourist area of Kurenai Beach. Electricity and clean water networks still need the managers' attention, although they are in a good category. The field observations show that lighting is unavailable at this location, so tourist activities are recommended to be carried out only from morning to evening. The availability of clean water at this site is minimal, as there are only two sources of water for washing and bathing, which are a considerable distance away. According to Moerwanto and Juniasmono (2017), infrastructure is required as a form of readiness and one of the essential aspects of carrying out a tourist activity.

5. Tourists' Perception of the Quality of Tourist Areas

The quality of tourist areas is part of several other indicators that determine the success of a tourism activity. Tourist areas can be judged by the satisfaction with the use of facilities, the cleanliness, the comfort of traveling, and the satisfaction of tourists during tourist activities. Some of these components can increase tourists' interest in visiting a tourist area. Therefore, paying attention to and improving the quality of tourist areas is necessary to maintain and increase tourist interest in these attractions. Tourists' perceptions of the quality of the Kurenai Beach tourism are shown in Table 6.

Table 6. Tourists' Perception of the Quality of Tourist Areas

Tourists' Perception of the Quality of Tourist Areas	ΣTS	Percentage (%)
Tourism Hygiene	392,07	64,8
Satisfaction of the Use of Facilities and Infrastructure	376,50	62,2
Travel Convenience	268,20	71,6
Tourism Satisfaction	268,20	71,6
Average Amount	326,24	67,5
Criterion	Good	

Table 6 shows that tourists' perception of the quality of tourist destinations is good, with a percentage value of 67.5%. The indicator with the lowest percentage is tourists' perception of cleanliness and satisfaction with using facilities and infrastructure. Based on the results of the interviews, some tourists stated that the cleanliness of tourism and the availability of facilities and

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infrastructure at the Kurenai Beach tourist site still need to be improved. The availability of trash cans that are still lacking and the availability of infrastructure facilities, which need to be completed and updated, also affect tourists' perceptions. According to Budiyo and Soelistyari (2016), the quality of tourist sites is closely related to their beauty, accompanied by the cleanliness of tourists, the satisfaction of traveling, and the comfort of tourist activities. Hence, these aspects must be considered to maintain the quality of tourist sites.

6. Recapitulation of Tourists' Perceptions of The Existence of Kurenai Beach Tourism

A recapitulation of tourist perceptions of the existence of Kurenai Beach tourism, both tourist perceptions of the facilities and infrastructure, tourist perceptions of accessibility, tourist perceptions of attractiveness, tourist perceptions of infrastructure, and tourist perceptions of the quality of Kurenai Beach tourist areas can be seen in Table 7.

Table 7. Recapitulation of Tourists' Perceptions of the Existence of Kurenai Beach

Recapitulation of Tourists' Perceptions of Existing Kurenai Beach Tourism	ΣTS	Percentage (%)
Tourists' perception of the facilities and infrastructure	384,57	63,57
Tourists' perception of Accessibility	391,25	64,67
Tourists' perception of tourist attraction	265,60	73,1
Tourists' perception of tourist infrastructure	409,67	67,71
Tourists' perception of the quality of tourist areas	409,67	67,71
Average Amount	372,15	67,4
Criterion	Good	

Table 7 shows that the tourists' perception of the existing conditions of Kurenai Beach tourism is generally on good criteria, with a percentage value of 67.4%. Although it meets good criteria, the percentage value achieved is relatively low, so it is necessary to improve all aspects that support tourism activities at the Kurenai Beach tourism site. Widari (2021) stated that the assessment of tourists' perceptions of the existing conditions of a tourist area can help managers improve and evaluate the existence of tourism to maintain the existence of a tourist attraction.

IV. CONCLUSION

Tourists' perception of the condition of the existence of Kurenai Beach tourism is assessed from five perception components, namely the physical condition of facilities and infrastructure, accessibility, attractiveness, infrastructure tourist perception, and the quality of the area is in a good category with a value of 67.4%. Although it meets good criteria, the percentage value achieved is relatively low, so it is necessary to improve all aspects that support tourism activities at the Kurenai Beach tourist site.

REFERENCES

- 1) Alves, B., Benavente, J., and Ferreira, O. 2014 Beach users' profile, perceptions and willingness to pay in Cadiz (SW Spain). *Journal of Coastal Research: Special Issue 70 - Proceedings of the 13th International Coastal Symposium*, 521-526.
- 2) Ahmad, N.F., Hamzah, S.N., & Nursinar, S. (2022). Community Perceptions of Minanga Beach Tourism Management, Kotajin Utara Village, Atinggola District, Gorontalo Utara Regency. *Journal of Indopacific Aquatic Resources*, 6(2), 121-130.
- 3) Amirin, T. (2011). Population and study sample 4: Slovin formula sample size. Erlangga.
- 4) Andani, F. (2017). The role of women in tourism activities in the Okura High Cliff Tourism Village, Pekanbaru City. *Student Online Journal (JOM) of Social and Political Sciences*, 4(2), 1-11.
- 5) Arifin, A., Awaluddin, M., & Amarrohman, F. J. (2020). Analysis of the effect of coastline changes on the boundaries of marine area management in DKI Jakarta Province. *Undip Geodesy Journal*, 9(1), 156-165.
- 6) BPS [Central Bureau of Statistics]. (2019). *Statistics of Tourism Attraction Objects* (Directorate of Financial Statistics, Information Technology and Tourism (ed.)). BPS RI.
- 7) Breton, F., Clapés, J., Marquès, A. & Priestley, G.K. (1996). The recreational use of beaches and consequences for the development of new trends in management: the case of the beaches of the Metropolitan Region of Barcelona (Catalonia, Spain). *Ocean & Coastal Management*, 32(3), 153-80.
- 8) Budiyo, D., & Soelistyari, H. T. (2016). Evaluation of the visual quality of Balekambang Beach tourism landscape in Srigonco Village, Malang Regency. *Indonesian Journal of Landscapes*, 8(2), 81-90.
- 9) Chen, C.H.L., & Teng, N. (2016). Management priorities and carrying capacity at a high-use beach from tourists perspectives: a way towards sustainable beach tourism. *Mar. Pol.*, 74, 213-219
- 10) Daily, G.C. (2000). Managing objectives for protection of ecosystems services, *Environ Sci Policy*, 3, 333-339.

"Tourists' perception of the existing condition of Kurenai Beach tourism"

- 11) Dalimunthe, D. Y., Valeriani, D., & Wardhani, S. (2020). Readiness of Supporting Infrastructure in Tourist Destinations in Realizing Sustainable Tourism Development. *Society*, 8(1), 227-244.
- 12) DKP [Marine and Fisheries Service] Gorontalo Province. (2021). Marine Protected Area Zoning Plan of Gorontalo Bay Coastal Park, Gorontalo Province.
- 13) Fajriah, S. D., & Mussadun, M. (2014). Development of facilities and infrastructure to support sustainable coastal tourism (case study: Wonokerto coastal area, Pekalongan regency). *Journal of Urban and Regional Development*, 10(2), 218-233. <https://doi.org/10.14710/pwk.v10i2.7653>
- 14) Hakim, M. F., Suardana, I. W., & Suwena, I. K. (2019). Motivation of tourists to share their travel experiences through Instagram (case study on Padang-padang Beach, Badung). *IPTA Journal*, 7(2), 189-201.
- 15) Hamzah, S. N. (2020). Sustainable Marine Tourism in Olele Water Area, Bone Bolango Regency, Gorontalo Province [Dissertation]. Sam Ratulangi University, Manado.
- 16) Hamzah, S.N., Siki, L.N., & Panigoro, C. (2023). Community Perception and Participation in Management of Binuanga Mangrove Tracking Tourism, Bolaang Mongondow Utara Regency. *Journal of Fisheries and Marine*, 28(1), 60-64. <http://dx.doi.org/10.31258/jpk.28.1.60-64>
- 17) Hardiyanti, N., & Subari, S. (2020). Economic Valuation of Natural Attractions of Dalegan Gresik White Sand Beach. *AGRISCIENCE*, 1(1), 124-137.
- 18) Hasan, D., Hamzah, S. N., & Nursinar, S. (2022). The Impact of Minanga Beach Tourism on the Economy of NORTH Gorontalo Regency. *Journal of Indonesian Tropical Fisheries*, 5(2), 287–299.
- 19) Keliwar, S., & Nurcahyo, A. (2015). Motivation and Perception of Visitors to the Tourism Objects of Pampang Cultural Village in Samarinda. *Journal of Resort and Leisure Management*, 12, 2.
- 20) Kemenparekraf [Ministry of Tourism and Creative Economy]. (2020). Ministry of Tourism Performance Report 2019. Ministry of Tourism and Creative Economy.
- 21) Marcelina, D., Febryano, I. G., Setiawan, A., & Yuwono, S. B. (2018). Tourists' perception of tourist facilities at the elephant training center of Way Kambas National Park. *Journal of the Wilderness*, 1(2), 45-53.
- 22) Moerwanto, A. S., & Junoasmono, T. (2017). Integrated tourism infrastructure development strategy. *Journal of HPJI (Indonesian Road Development Association)*, 3(2). <https://doi.org/10.26593/jh.v3i2.2735.%25p>
- 23) Nabila, A. D., & Widiyastuti, D. (2018). Study of Attractions, Amenities and Accessibility for the Development of Umbul Ponggok Tourism in Klaten Regency. *Bumi Indonesia Journal*, 7(3).
- 24) Prasetio, B. (2011). Analysis of the Economic Impact of Marine Tourism on the Community on Pramuka Island, Thousand Islands National Park [Thesis]. Bogor Agricultural University, Bogor.
- 25) Sugiyono. (2017). Quantitative, Qualitative, and RdnD Research Methods. Alfabeta.
- 26) Widari, D. A. D. S. (2021). Perceptions of Domestic and Foreign Tourists on the Management of Jatiluwih Tourism Attraction, Tabanan Regency, Bali Province. *Journal of Applied Tourism Vol*, 5(1).
- 27) Widi, S. (2022). Indonesia, Foreign Exchange Income from Tourism Sector (2013-2023). *DataIndonesia.Id*. <https://dataindonesia.id/sektor-riil/detail/pendapatan-devisa-pariwisata-indonesia-melejit-pada-2022>.
- 28) Wiradiputra, F. A., & Brahmanto, E. (2016). Analysis of tourist perceptions regarding the decline in the quality of tourist attraction on visiting interest. *Journal of Tourism*, 3(2), 129-137. <https://doi.org/10.31294/par.v3i2.1561>



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The Connectivity of Anti-Corruption Education with Local Wisdom in Developing Honesty Character in Elementary Schools



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ABSTRACT: Honesty as one of the values in anti-corruption education is a demand in today's society. The spectacle of misappropriation of funds and arrest of individuals in the media has become a negative dish and inspiration for the younger generation. This phenomenon becomes the focus of teachers in building honesty character oriented to the connectivity of anti-corruption education with local wisdom. This article examines anti-corruption education as character building that emphasizes the habit of saying and behaving in accordance with the actual situation, not cheating, and having the courage to admit mistakes. The results obtained are that anti-corruption education for elementary school students requires character building through local cultural values to retain the value of honesty.

KEYWORDS: Anti-corruption education, local wisdom, honesty character.

INTRODUCTION

One of the problems that occur in Indonesia today is the practice of corruption. This can be proven by the number of corruption cases in Indonesia. According to the Indonesian Corruption Watch (ICW), Indonesia's Corruption Perception Index (CPI) has decreased from a score of 38 to a score of 34, placing Indonesia at 110 out of 180 countries. Meanwhile, according to TI Indonesia's records, Indonesia currently ranks or is in position 1 of the 3 most corrupt countries in the world and in Southeast Asia lags far behind Singapore, Malaysia, Timor Leste, Vietnam and Thailand.

These results show that the assessment of the level of corruption in Indonesia is relatively low, with a minimal score indicating that there is less public trust in the country. The problem of corruption that continues to occur is certainly worrying. Corruption seems to be a paradigm that affects the mentality of Indonesians and in fact is very difficult to eliminate. Corruption causes various problems including poverty, injustice, poor public services, inequality and the impact of other problems, if it is allowed to continue, it will also have an impact on the decline in the moral quality and character of individuals and society as a whole which will jeopardize the quality of human resources in the future.

Anti-corruption education has become part of national education, as stipulated in the Regulation of the Minister of National Education (Permendiknas) No. 22 and 23 of 2006 on Content Standards and Graduate Competency Standards for Primary and Secondary Education Units. The Minister of National Education Regulation stipulates that the development of anti-corruption attitudes and behaviors is part of the subject curriculum. The strategy used to implement anti-corruption education is done through integrating anti-corruption education values into the learning process, namely through (a) relevant topics, (b) local content, (c) and self-development. (Ramadani and Sari, 2023).

The purpose of anti-corruption education is to provide an understanding of and hostility to deviant behavior. Elementary school students go through the stage of starting to learn about many things, including values in education and anti-corruption. Corruption prevention measures carried out with the integration of anti-corruption education values starting from elementary school (SD) is a very appropriate action because sociologically, students at elementary school age between 7 and 12 years old are in the phase of self-formation (Anwar and Choirul, 2021). So that teachers as educators need to instill Anti-Corruption Education in their students. Instilling anti-corruption values must be given early and included in the learning process starting from the basic education level. This is an effort to shape the behavior of students who are anti-corruption. The essence of cultivating anti-corruption is to instill anti-corruption values, one of which is the value of honest character.

Local wisdom was originally formed from two words, namely wisdom and local. Zunanik (2019: 30) explains that local wisdom refers to local ideas that are smart, meaningful, and of good value, which are handled and followed by community members. The formation of local wisdom is influenced by cultural advantages and geographical conditions in the local area at

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large. As a cultural product of the past, local wisdom needs to be preserved and inherited as a sustainable guide to good life. Romadi and Kurniawan (2017: 84) explain that local wisdom is a characteristic of the Indonesian nation that can undergo cross-cultural changes, resulting in national cultural values. Local wisdom in Indonesia is reflected in the philosophy and outlook on life reflected in various aspects of life, such as social and economic values, architecture, health, the environment, and so on. Some examples of local wisdom are: Jimpitan in night patrol activities, class fees by mutual agreement, and correcting other students' work after evaluation.

Character education is needed in the current era because the growth of science raises intelligent people but more importantly intelligent character. According to Lickona (Azzarima, et al, 2023) explains through his book work with the title: education for character: how our schools can teach respect and responsibility, that one of the reasons why character education is needed for a nation, this is due to the fact that the most striking deficiency in students is in terms of moral values. Hariyanto (Azzarima, et al, 2023) explains that character education is a process of providing guidance to students to become fully human with character in the dimensions of heart, mind, body, and taste.

Nugraha, et al, (2019) explained that forming and developing an honest attitude requires habituation in learning activities at school, one of which is through school culture. This statement confirms that schools should have designed and established programs and activities in creating a school culture that focuses on honest character in developing students' honest character.

RESEARCH METHODS

This article describes the theoretical description from several perspectives related to anti-corruption education in shaping the character of students in elementary schools (SD). The approach used is a qualitative approach with a literature study method. Creswell (2016) explains that literature studies rely on various literatures in obtaining research data and use a qualitative approach because the data produced is in the form of words or descriptions. The results obtained are based on comparisons of various references to books, articles and other media.

The literature study in this article is intended to provide information to readers. The information comes from the results of research sourced from: articles, books, and mass media that have relevance to the research conducted by researchers and also relate to this article. The literature study aims to describe the connectivity of anti-corruption education with local wisdom in developing honesty character in elementary schools.

RESULTS AND DISCUSSION

Anti-corruption education needs to be instilled in students from an early age, one of which is instilled through education in elementary schools. Anti-corruption education in elementary schools is important as a way to shape students' childhood experiences that greatly affect the development of their personalities. The Corruption Eradication Commission (KPK) as an institution that has the vision "Together with the Elements of the Nation, Realizing an Indonesia Clean from Corruption" and in carrying out one of its duties in the field of prevention in accordance with the mandate of Law No. 30 of 2002 article 13 letter c, namely the implementation of anti-corruption education programs at every level of education, of course, in increasing the effectiveness and results of corruption eradication efforts, the participation of all stakeholders of this nation is needed.

Anti-corruption education is an action to control and reduce corruption in the form of an overall effort to encourage future generations to develop an attitude of firm rejection of every form of corruption. The main target of anti-corruption education is to introduce and provide basic knowledge about the phenomenon of events that include criteria, consequences, and causes, and always increase awareness of corruption crimes. In order to apply an anti-corruption attitude, this is considered very effective through education, because education is a process in character building and changes in attitudes, behavior, and mentality that occur in students. Through education, corruption behavior can also be measured properly and easily (Ramadani and Sari, 2023).

Elementary school students are introduced to many things, including anti-corruption education or values (Ramadani and Sari, 2021). The introduction of anti-corruption through education is a conscious effort to direct and mold individual behavior in a good direction. It is hoped that the younger generation of future national leaders will be able to build anti-corruption values that are inherent in their character (Ariani and Kajen, 2014). Humaira, et al, (2021) also stated that elementary school education is a foundation that will support further education. Creating an anti-corruption generation is certainly not an easy thing, this generation does not appear directly but through a process (Ramadani and Sari, 2021). Therefore, programmatic, holistic efforts or strategies are needed, and have clear benchmarks in their implementation. Clear benchmarks to eradicate corruption will allow the program to be passed on to the next generation (Slamet Widodo. (2019).

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Values of Anti-Corruption Education

Anti-corruption values are the basis for individuals not to commit criminal acts of corruption. Saeful, A., (2021) explains that corrupt behavior needs to be eradicated because it makes this nation miserable. Hariandi, A. P., (2020) explains that the value of anti-corruption education is the values integrated in learning, namely through (a) appropriate subjects, (b) local content, (c) and self-development. Meanwhile, Pratiwi, N. D., (2021) explains that anti-corruption education in school habituation is a process of acculturation, institutionalization and strengthening of anti-corruption values in accordance with the school climate. This is reinforced by Arliman, L., (2017) explaining that habituation is the process of creating various situations and conditions (continuous situations and conditions). Teachers in schools must instill the values taught in Anti-Corruption Education such as teaching children the values of honesty, caring, discipline, responsibility, hard work, simplicity, courage and caring.

The Value of Honesty

Honesty is always saying and behaving in accordance with the actual situation, not cheating, not recognizing people's property as his own, and daring to admit mistakes (Sari, N. K., 2021). Honesty can also mean telling the truth according to what is seen, heard. Honest anti-corruption values are always speaking and acting according to the facts (consistent), not committing fraudulent acts, not lying, not recognizing other people's property as their own (Sakinah & Bakhtiar, 2019). Honest character value is a trait possessed by humans that comes from the heart and is influenced by thoughts and behavior. While the meaning of the word "honest" is having a straight heart and not cheating which can affect the level of trust of others in us. If students have an honest nature, they will always try to do good, and can even prevent others from being dishonest. Therefore, as a teacher, you should have an exemplary nature in being honest so that students can also imitate the same thing.

Efforts to Instill the Value of Honesty

Strategies for teaching anti-corruption values in primary schools can be implemented through exemplary student behavior. Exemplary behavior is exemplary through good deeds so that teachers, education personnel, and students can become role models for other students and achieve the expected goals. Efforts to convey the value of honesty in this area can be carried out in the learning process through topics related to corruption by using examples that are easily understood by students, apart from examples of common corruption cases. Conscious efforts to convey anti-corruption values are reflected in the preparation of materials and the insertion of materials in the learning process. By providing clear and simple examples in the context of friendship, interactions between friends, and within the family, you can tell a story throughout the learning process. Suggestions or Examples: This anti-corruption values activity/activities can be applied to social studies, science, and math subjects and other subjects to teach anti-corruption values as a whole.

In addition, you can also teach them the value of honesty by integrating the value of anti-corruption education on the value of honesty carried out during the learning process both in the classroom and outside the classroom. Examples of teachers' efforts to increase the value of honesty in the classroom are: (1) Motivating students to be encouraged and courageous to learn, especially in improving students' honest attitudes; (2) Using methods to make it easier for students to understand learning; (3) Reducing student grades if caught cheating on their friends' test results; (4) Giving sanctions if students are dishonest in talking to the teacher; (3) Providing directions given by the teacher to students to always instill an honest attitude in themselves.

Habituation to say and behave in accordance with the actual situation.

Habituation is the oldest method in learning. Saying and behaving in accordance with the actual situation can be formed through describing activities and written in the honesty report card. Hapsari (2020) explains that the honesty report card is a method that aims to produce a religious generation and students have honest behavior that is sholeh and sholehah. Kemal, et al., (2016) explained that the honesty report card is adjusted to the grade level so that the content of the report is different for each grade level, so that the honesty report is expected to have a good effect on students' honest behavior.

Salistina, D., (2015) explains that habituation can be said to be successful characterized by indicators, namely: gradual or the need for a process. This means that habituation is not incidental, but full of planning and evaluation; repeating continuously so that it cannot be separated. This means that habituation activities require continuous stimulus so that they can generate a response which of course needs to be given further stimulus; continuous guidance. This emphasizes that students need to be invited to share or discuss honesty material according to their capacity and at the end of the discussion they can draw conclusions and come up with new ideas to develop existing ones; the existence of an example that always appears to be imitated, this is intended to realize a wise sentence, namely giving one example is better than a thousand advice.

Do not cheat

Cheating in primary school learning can be seen in the habit of students cheating during evaluation. Bloodgood, et al., (Meutia Karunia Dewi, 2019) explains that cheating behavior is inappropriate and unethical behavior because it has a serious

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impact, namely: making the assessment of learning outcomes or assignment activities biased; impact on other honest students; create situations and conditions that are mutually suspicious and build distrust between cheaters, peers, supervisors, and teachers; can transmit an unhealthy virus to other students, to do the same.

Hamdani (Azzarima, et al., 2023) mentions several factors that cause students to have cheating behavior, namely: not understanding the ins and outs with the subjects delivered by the teacher; having or the emergence of laziness to learn and try to understand more deeply; students in their learning are value-oriented not in the process of building knowledge; the influence of other students and the playing environment that is not conducive, thus building a mindset of not achieving. Such as: gambling places, places to buy and sell drugs, places to drink alcohol.

Dare to admit mistakes

Daring to admit mistakes is a character of humility that needs to be developed in students. Djajendra (Azzarima, et al., 2023) explains that recognizing personal weaknesses means the emergence of awareness of personal imperfections in life. Recognizing personal imperfections can mean that there is awareness every day in being humble, and the next result is to bring up the courage to improve oneself, being able to serve life with a better quality of self.

Indicators of having humility are explained by Azzarima, et al (2023), namely: willing to admit their limits or mistakes, not selfish, prioritizing others over themselves, choosing not to highlight themselves in the crowd do not think they are better than others, but tend to be simple, and do not boast or attract undue attention to themselves.

CONCLUSION

Anti-corruption education on the value of honesty can be connected to local wisdom in schools, namely: getting used to saying and behaving according to the real situation, not cheating, and daring to admit mistakes. These three things need to be implemented in stages, namely: process, continuous repetition, continuous guidance, and role model.

REFERENCES

- 1) Aditya, Hidayatul, Trismelinda, Silvia, & Widya. (2020). Menanamkan Karakter Anti Korupsi di Sekolah Dasar Sebagai Proses Awal Munumbuhkan Jiwa Anti Korupsi. *Jurnal: Education and Learning of Elementary School*, 1(1), 25 - 30
- 2) Anwar, Choirul. (2021). Strategi Pendidikan Anti Korupsi pada Jenjang Sekolah Dasar. *Journal of Social Science and Education*, 2(2), 195–202.
- 3) Ariani & Kajen. (2014). Menumbuhkan Pendidikan Karakter Anti Korupsi Melalui Model Pembelajaran Carilem. Makalah Seminar Nasional Pendidikan, Sains dan Teknologi Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Muhammadiyah Semarang, 170–176.
- 4) Arliman, L. (2017). Konsep Dan Gagasan Pengenalan Pendidikan Antikorupsi Bagi Anak Dalam Rangka Mewujudkan Generasi Yang Bebas Korupsi. *Nurani: Jurnal Kajian Syari'ah Dan Masyarakat*, 17(1), 49–64.
- 5) Azzarima, Pratama, Settiya. (2023). Implementasi Pendidikan Karakter Kejujuran pada Peserta Didik di Lingkungan Sekolah Dasar. Makalah: *Confrence of Elementary Studies (C.E.S) 2023*, 412-418.
- 6) Creswell, John W. (2016). *Research Design: Pendekatan Metode Kualitatif, Kuantitatif dan Campuran*. Edisi Keempat (Cetakan Kesatu). Yogyakarta: Pustaka pelajar
- 7) Hapsari. (2020). Pengaruh Metode Pembiasaan Terhadap Perilaku Siswa. *Jurnal Pendidikan Guru Sekolah Dasar*, 9(3), 250-258.
- 8) Hariandi, A. P. (2020). Implementasi Nilai Kejujuran Akademik Peserta Didik di Lingkungan Sekolah Dasar. *Jurnal Pendidikan Dan Sosial Keagamaan*, 7(1), 52–66.
- 9) Humaira, Jihan, Dewi, Furnamasari. (2021). Implementasi Pendidikan Anti Korupsi pada Pembelajaran Pendidikan Kewarganegaraan Siswa di Sekolah Dasar. *Jurnal Pendidikan Tambusai*, 5(3), 8612–8620.
- 10) Kemal, Isthifa dan Marlina. (2016). Penggunaan Model Pembiasaan Modeling untuk Meningkatkan Perilaku Disiplin Anak Kelompok B di TK Kartika XIV-12 Banda Aceh. *Jurnal Buah Hati*, 3(1), 37-48.
- 11) Meutia Karunia Dewi. (2019). Moralitas dan Perilaku Curang. Makalah: *Sustainable Competitive Advantage-9 (Sca-9) Feb Unsoed*.
- 12) Nugraha, Sapriya, & Rahmat. (2019). Kajian Tentang Penumbuhan Karakter Jujur Peserta Didik Sebagai Upaya Pengembangan Dimensi Budaya Kewarganegaraan (Civic Culture) di Sma Alfa Centauri Bandung. *Modeling: Jurnal Program Studi PGMI*, 6(2), 220-232.
- 13) Pratiwi, N. D. (2021). Peran Guru Dan Orang Tua Dalam Membentuk Karakter Jujur Pada Anak. *Tunas nusantara jurnal ilmiah pendidikan dasar*, 3(1), 45-56.
- 14) Ramadani, Sari. (2023). Nilai-Nilai Pendidikan Anti Korupsi Di Sekolah Dasar Swasta Melati Kota Medan. *Adabiyah Islamic Journal: Jurnal Fakultas Agama Islam*, 1(1), 29–36

The Connectivity of Anti-Corruption Education with Local Wisdom in Developing Honesty Character in Elementary Schools

- 15) Romadi & Kurniawan. (2017). Pembelajaran Sejarah Lokal Berbasis Folklore untuk Menanamkan Nilai Kearifan Lokal. *Jurnal Sejarah Dan Budaya Tahun Kesebelas No. 1*, 79–94
- 16) Sakinah, & Bakhtiar. (2019). Model Pendidikan Anti Korupsi Di Sekolah Dasar Dalam Mewujudkan Generasi Yang Bersih Dan Berintegritas Sejak Dini. *El-Ibtidaiy: Journal of Primary Education*, 2(1), 39–49.
- 17) Saeful, A. (2021). Implementasi Nilai Kejujuran Dalam Pendidikan. *Tarbawi: Jurnal pemikiran dan Pendidikan Islam*, 4(2), 124-142.
- 18) Salistina, D. (2015). Pendidikan Anti Korupsi Melalui Hidden. *Jurnal Ta'allum*, 3(46), 163–184.
- 19) Slamet Widodo. (2019). Membangun Pendidikan Antikorupsi di Sekolah Dasar. *JPD: Jurnal Pendidikan Dasar*, 10(1), 35-44.
- 20) Sari, N. K. (2019). Implementasi Pendidikan Karakter di Sekolah Dasar. *Jurnal Dikdas Bantara*, 2(1), 35-46.
- 21) Zunanik. (2019). Identifikasi Dan Analisis Kearifan Lokal Sebagai Sumber Pembelajaran IPS di Tingkat SMP (Studi Di SMP N 2 Demak). *Skripsi Prodi Pendidikan Ilmu Pengetahuan Sosial Fakultas Ilmu Sosial Universitas Negeri Semarang*.



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The Effect of Small Sided Games and Dynamic Passing Training on Improving Cognitive Intelligence and Vo2max Ability of Football Players



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ABSTRACT: The game of soccer is a team game played by two teams where each team has 11 players, with the aim of scoring as many goals as possible. This study used small sided games and dynamic passing training methods, aiming to determine the effect of small sided games and Dynamic Passing training on improving cognitive intelligence and VO2Max ability of soccer players. This research is a quasi-experimental research, with a research design of two groups pretest and posttest design. The sample in this study amounted to 19 children. The data analysis technique uses a t-test with a significance value of <0.05 assisted by the SPSS application version 25. Based on the results of digit span test data analysis, the treatment group received a sig value. 0.361 and a control group of SIG. 0.375, due to differences in respondent characteristics, background cognitive abilities and the small number of respondents. Meanwhile, from the results of VO2Max data analysis, the treatment group obtained sig values. 0.005 and a control group of SIG. 0.045, because in the preparation of its exercise program it has applied important factors in increasing endurance. Then the results of the independent sample t-test t-test digit span test get a sig. 0.157 and VO2Max test results get sig. 0.333. The conclusion in this study is (1). There was no significant effect of small sided games and dynamic passing on cognitive intelligence. (2). There is a significant effect of small sided games and dynamic passing exercises on Vo2Max Ability. (3). There was no significant difference in the effect of small sided games and dynamic passing on cognitive intelligence and Vo2Max ability.

KEYWORDS: Cognitive, VO2Max, Small Sided Games, Passing

I. INTRODUCTION

Sports are all systematic activities and aim to foster, encourage, and increase physical, mental, and social potential (Abdulaziz et al. 2016). Football has transformed into one of the Most popular sports in the world today. Football can also be loved by all ages and all walks of life. (Prawira & Tribinuka 2016). Football requires two teams of 11 players to play it, one of the players is the goalkeeper, and each team tries to defend its goal so as not to concede the ball and score against the opponent (Luxbacher 2011). Nugraha (2013) explained that in soccer, players must be proficient in many aspects, both physical, technical, tactical, and mental. Among these various aspects, fitness plays an important role in entering the professional level, because fitness is a fundamental factor for soccer players to play optimally.

According to Jamaris (2014) intelligence is the ability of an individual to remember something, interpret a concrete or abstract concept, understand the relationship of an object or event that exists and the ability to solve problems faced by individuals from experiences experienced in the surrounding environment. Football also requires intelligence (short term memory) in this case speed in decision making as once stated by Kusuma & Kelli (2015) that short-term memory plays an important role in all cognitive processes and affects not only football, but also intelligence and academic performance of children. Galton in Yuliani (2013) suggests that a person's cognitive superiority is expressed in the superiority of physical strength. Based on the results of a preliminary study with UKM football coach Fikes Sports Club revealed that the average player is only able to play optimally in the first 45 minutes, while excellent physical condition and strong endurance are needed in football, because soccer players last for 2x45 minutes under normal circumstances, As stated by Arsil in Syahda (2016) that "endurance in football is the body's ability to perform activities during the game".

According to Hasanani (2018) explained that general cardiovascular endurance is a person's ability to use the heart, lungs and circulatory systems effectively and efficiently to carry out continuous work that involves contracting a number of muscles with

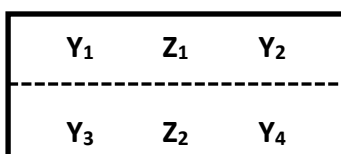
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high intensity for a long time. Sukadiyanto (2011) suggests that "VO2Max is the ability of the human respiratory system to breathe as much oxygen as possible during exercise (physical activity)". According to Sugiharto (2014) in (Putra et al. 2016) The level of individual fitness associated with increased VO2Max depends on the method, intensity of exercise, and test instruments applied to determine VO2Max. According to Budiwanto in (Putra et al., 2016) that Cara measures her own stamina by measuring the player's VO2Max. There are several exercises that coaches can apply to train VO2Max, especially soccer players, including fartlek training, interval training, continuous training, and small sided games. Small sided games are games in which there are two types to increase aerobic capacity, including intermittent and continuous (Koklu et al. 2012). According to Setiyadi (2016) Small sided games are a training model that includes technical, physical and tactical aspects. Maliki et al, (2017) revealed that "Physical strength used in soccer games is endurance, explosive strength, agility and speed". Small sided games are a modified soccer training model with several restrictions, including restrictions on field size, duration, and reduction in the number of players. Game models with ball possession and a small number of players are great for developing an understanding of tactics and honing players' technical skills (Scheunemann in Putra et al. 2016).

Because of the importance of cognitive intelligence and endurance in supporting a sports achievement, therefore researchers have an interest in carrying out research: "The effect of small sided games and dynamic passing training on increasing cognitive intelligence and VO2Max football players".

II. METHOD

The design applied to this study is "Quasi Experimental Design using a two-group pretest and posttest design model". In this research design, ordinal pairing is used to divide the sample into two groups that will be carried out preliminary tests to find out whether there is a difference between the experimental group and the control group in the initial state. According to Sugiyono (2016), pretest data is good if the differences between the two groups are not so significant



Informasi:

Y_1 (Treatment group before treatment)

Y_2 (Treatment group after treatment)

Y_3 (Control group before treatment)

Y_4 (Control group with unequal treatment)

Z_1 (A form of treatment of small sided games)

Z_2 (a form of dynamic passing treatment)

Population is the entire area that includes objects and subjects with characteristics that have been determined by researchers and also drawn conclusions (Sugiyono 2016). The population used in this study is UKM Fikes Sports Club football players with a population of 30 players. While the sample is part of pupolation. The sample will be taken using a sampling technique using purposive sampling. The analysis used in this study is the normality test and homogeneity as a prerequisite test before the hypothesis test. The data is said to be normally distributed if the value of sig. > 0.05 and homogeneous if the value of sig. > 0.05. The hypothesis test used is the t-test, assisted by SPSS app version 26.

III. RESULT AND DISCUSSION

Table 1. Pretest and Posttest results of cognitive intelligence control group

No	Category	Value	Frequency
1	Excellent	15-19	0
2	Good	11-14	3
3	Average	9-10	2
4	Bad	5 – 8	4
5	Very Bad	0 – 4	0
Sum			9

No	Category	Value	Frequency
1	Excellent	15-19	0
2	Good	11-14	5
3	Average	9-10	2
4	Bad	5 – 8	2
5	Very Bad	0 – 4	0
Sum			9

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Comparative data of pretest and posttest cognitive intelligence of the control group can be seen in the table above.

Table 2. Pretest Results of Cognitive Intelligence Treatment Group

No	Category	Value	Frequency
1	Excellent	15-19	0
2	Good	11-14	3
3	Average	9-10	2
4	Bad	5 – 8	4
5	Very Bad	0 – 4	1
Sum			10

No	Category	Value	Frequency
1	Excellent	15-19	0
2	Good	11-14	2
3	Average	9-10	3
4	Bad	5 – 8	4
5	Very Bad	0 – 4	1
Sum			10

Comparison data of pretest and posttest cognitive intelligence treatment groups can be seen in the table above.

Table 3. Control Group Vo2Max Pretest Results

No	Category	Value	Frequency
1	Extraordinary	52,4)	0
2	Excellent	(46,5 – 52,4)	1
3	Good	(42,5 – 46,4)	0
4	Keep	(36,5 - 42,4)	5
5	Less	(33,0 - 36,4)	2
6	Very Lacking	(≤ 33,0)	1
Sum			9

No	Category	Value	Frequency
1	Extraordinary	52,4)	0
2	Excellent	(46,5 – 52,4)	2
3	Good	(42,5 – 46,4)	1
4	Keep	(36,5 - 42,4)	3
5	Less	(33,0 - 36,4)	1
6	Very Lacking	(≤ 33,0)	2
Sum			9

The comparison data of the control group's Vo2Max pretest and posttest can be seen in the table above.

Table 4. Pretest Results Vo2Max treatment group

No	Category	Value	Frequency
1	Extraordinary	52,4)	0
2	Excellent	(46,5–52,4)	1
3	Good	(42,5–46,4)	1
4	Keep	(36,5-42,4)	4
5	Less	(33,0-36,4)	2
6	Very Lacking	(≤ 33,0)	2
Sum			10

No	Category	Value	Frequency
1	Extraordinary	52,4)	0
2	Excellent	(46,5 – 52,4)	1
3	Good	(42,5 – 46,4)	5
4	Keep	(36,5 - 42,4)	3
5	Less	(33,0 - 36,4)	1
6	Very Lacking	(≤ 33,0)	0
Sum			10

Comparison data of pretest and posttest Vo2Max treatment groups can be seen in the table above

Table 5. Normality test results

Tests of Normality					
	Group	Shapiro-Wilk			
		Statistic	df	Sig.	Ket.
Pre_test_VO ₂ Max	KK	.979	9	.961	Normal
	KT	.959	9	.790	Normal
Post_test_VO ₂ Max	KK	.894	9	.221	Normal
	KT	.894	9	.217	Normal
Pre_test_DS	KK	.929	9	.469	Normal
	KT	.907	9	.296	Normal
Post_test_DS	KK	.884	9	.173	Normal
	KT	.962	9	.819	Normal

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Based on statistical analysis of normality tests that have been carried out using the Shapiro-Wilk test, in all pretest and posttest data passing ability is obtained from the results of the normality test data significance value $p > 0.05$, which means the data is normally distributed.

Table 6. Homogeneity test results

Test of Homogeneity of Variances				
	Levene Statistic	df1	df2	Sig.
Pre_test_VO ₂ Max	.079	1	17	.781
Post_test_VO ₂ Max	1.086	1	17	.312
Pre_test_digit span	.313	1	17	.583
Post_test_digit span	1.406	1	17	.252

From the results of the homogeneity test, the control group and the treatment group obtained a significance result above 0.05 which shows that the results of the sample variant are homogeneous.

Table 7. Paired sample t-test and independent sample t-test results

Paired Samples Test				
		T	df	Sig. (2-tailed)
VO ₂ Max	Pre dan Posttest KK	-2.379	8	.045
VO ₂ Max	Pre dan Posttest KT	-3.655	9	.005
Digit span	Pre dan Posttest KK	-.939	8	.375
Digit span	Pre dan Posttest KT	.497	9	.631

Independent Samples Test						
			Sig.	T	df	Sig. (2-tailed)
Post_test VO ₂ Max	KT	1.086	0.312	-0.997	17	0.333
	KK			-0.982	14.932	0.342
Post_test Digit span	KT	1.406	0.252	1.481	17	0.157
	KK			1.514	15.613	0.150

Based on the paired sample t test results, it did not show any significant from either group. Significant values on the VO₂Max test of the treatment group were 0.045 and the control group was 0.005. The data showed that there was a significant influence between the provision of exercise with increased intensity and limited touch. While the significance value of the digit span test, the control group had a value of 0.375 and treatment of 0.631. The data showed that the provision of dynamic passing exercises had no significant effect on test results.

Based on an independent sample t-test against two Posttest data, namely VO₂Max capability and digit span. Significance results were obtained on the VO₂Max ability test for the treatment group with a value of 0.333 and the control group with a value of 0.342. As for the digit span test results, the significance results of the treatment group with a value of 0.157 and the control group with a value of 0.150. From the results of the two Posttest data, a significance result of > 0.05 was obtained and it can be concluded that there is no significant difference in the effect between the provision of increased intensity training in small sided games and the provision of free touch training in dynamic passing.

DISCUSSION

This study had a sample of 19 out of 30 children who were active in the Fikes Sports club football UKM and were male. This is because 8 respondents did not fill out the letter of willingness, 3 respondents did not meet the research criteria. Based on table 7. shows paired sample test results

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T-test digit span with the control group obtained a significance value of 0.375, while the treatment group with a significance value of 0.631 which means there was no significant effect on the provision of small sided games and dynamic passing exercises. Table 4.15 also shows the results of paired sample t-test VO2Max with the control group obtaining a significance result of 0.045 and the treatment group with a significance value of 0.005 which means that there is a significant influence on the provision of small sided games and dynamic passing exercises.

Table 7. is the independent test results on digit span, namely the treatment group showed a result of 0.157 and the control group showed a result of 0.150 and which means that there is no significant difference between the two groups. As for the VO2max ability, the treatment group showed results of 0.333 and the control group 0.342. The results showed that there was no significant difference between the control and treatment groups because the significance value > 0.05 .

This research has been carried out with an exercise program in accordance with the exercise dosage guidelines according to Delta youth soccer in Komarudin (2016). Treatment was carried out for 14 meetings and the results of the study stated that there was no effect of small sided games and dynamic passing training on improving cognitive intelligence, due to differences in respondent characteristics, cognitive ability background, small number of respondents and pretest results that were classified as good so that the results of this study were less than optimal in cognitive variables. Meanwhile, the results of the study above stated that there is a significant influence of small sided games and dynamic passing training on increasing VO2Max ability, because in the exercise program has applied important factors in endurance (VO2Max), as stated by Sukadiyanto (2011) that "factors that play an important role in endurance are frequency, duration of exercise, intensity, age, sex, and genetics".

IV. CONCLUSION

Based on the results of research that has been carried out on the effect of small sided games and dynamic passing training on improving cognitive intelligence and VO2Max ability of soccer players, researchers came to the following conclusions: (1). There is no significant effect of small sided games and dynamic passing exercises on cognitive intelligence. (2). There is a significant effect of small sided games and dynamic passing training on VO2Max ability. (3). There was no significant difference in the effect between the control group and the treatment group on cognitive intelligence and VO2Max.

REFERENCES

- 1) Abdulaziz, M.F., Dharmawan, D.B., & Putri, D.T. 2016, 'Motivasi Mahasiswa terhadap Aktivitas Olahraga pada Sore Hari di Sekitar Area Taman Sutura Universitas Negeri Semarang' *Journal of Physical Education Health and Sport*, 3(2), 113–120. <https://doi.org/10.15294/jpehs.v3i2.7594>
- 2) Hasanani, Faridatul 2018, 'Hubungan Kadar Hemoglobin Dengan Daya Tahan Kardiovaskuler Pada Atlet Atletik Fik Universitas Negeri Makassar'. Diploma Thesis, Universitas Negeri Makassar.
- 3) Jamaris, M. 2014, 'Pengembangan instrumen baku kecerdasan jamak anak usia dini', *Parameter: Jurnal Pendidikan Universitas Negeri Jakarta*, Vol. 25, no. 2, pp. 123–137. <https://doi.org/10.21009/parameter.252.08>
- 4) Khurrohman M.F. 2020, 'Pengaruh latihan multilateral berbasis *small sided games* terhadap peningkatan kecerdasan kognitif dan psikomotor peserta ekstrakurikuler futsal sman 1 sokaraja', *Skripsi, FIKES UNSOED*, Purwokerto.
- 5) Koklu, Y. 2012, 'A Comparison Of Physiological Responses To Various Intermittent And Continuous Small Sided Games In Young Soccer Players', (Online), 31: (89-96), (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3588661/>), diunduh 8 Februari 2022.
- 6) Komarudin. 2016, 'Small-sided games sebagai sarana untuk mengembangkan kemampuan pengambilan keputusan dalam permainan sepak bola', *Jurnal Pendidikan Jasmani*, vol. 9, no. 1, pp. 58-63.
- 7) Kusuma, M N H. & Kelli, J. 2015, 'Affecting factor of swimming exercises based on multi-lateral method to increasing cognitive intelligence of children', *Journal Proceeding-International Conference of APEC*, pp. 180-185.
- 8) Luxbacher, J. A. 2011, *Sepak Bola*. Bandung: RajaGrafindo Persada.
- 9) Maliki, Osa, Husnul Hadi, & Ibnu Fatkhul Royana. 2017, 'Analisis Kondisi Fisik Pemain Sepak Bola Klub Persepu Upgris Tahun 2016', *Jendela Olahraga* Vol. 2, no. 2, Pp 2.
- 10) Nurhasan, H., & Cholil, D. 2007, Tes dan pengukuran keolahragaan. *Bandung: Universitas Pendidikan Indonesia*
- 11) Nurhasan, H., & Cholil, D. 2007, Tes dan pengukuran keolahragaan. *Bandung: Universitas Pendidikan Indonesia*.
- 11) Prakoso, A. F., Trisnawati, N., Soesatyo, Y., Tjipto Subroto, W., & Canda Sakti, N. 2019, Keefektifan Pemantapan Kemampuan Guru SMK dalam Menulis Proposal Penelitian Eksperimen. *Jurnal Pemberdayaan Masyarakat Madani (JPMM)*, Vol. 3, no. 1, Pp 59–82. <https://doi.org/10.21009/jpmm.003.1.05>

The Effect of Small Sided Games and Dynamic Passing Training on Improving Cognitive Intelligence and Vo2max Ability of Football Players

- 12) Prawira, R. R. Z., & Tribinuka, T. 2016, Pembinaan Pemain Muda Melalui. *Jurnal Sains Dan Seni Its*, Vol. 5, no. 2, Pp 13–17.
- 13) Putra, A. U. K., Sudjana, I. N., & Amiq, F. 2016, Pengaruh latihan *small sided games* terhadap peningkatan kemampuan vo2max pemain sepak bola u-17 di persatuan sepak bola SMUBA junior Kota Batu. *Jurnal Pendidikan Jasmani*, Vol. 25, no. 1, Pp 20–30.
- 14) Scheunemann, T, 2012, '*Kurikulum dan Pedoman Dasar Sepak bola Indonesia*'. Jakarta: Persatuan Sepak bola Seluruh Indonesia.
- 15) Sugiyono. 2016, *Metode Penelitian Kuantitatif Kualitatif dan R & D*, Penerbit CV, Alfabeta, Bandung.
- 16) Sujiono, Yuliani Nurani, *et al.* 2013, "Hakikat Pengembangan Kognitif." *Metode Pengembangan Kognitif* : pp. 1-35.
- 17) Sukadiyanto, 2011. Pengantar Teori Dan Metodologi Melatih Fisik. CV Lubuk Agung. Bandung.
- 18) Syahda, I. A., Damayanti, I., & Imanudin, I. 2016, 'Hubungan Kapasitas Vital Paru-Paru Dengan Daya Tahan Cardiorespiratory Pada Cabang Olahraga Sepak Bola'. *JTIKOR (Jurnal Terapan Ilmu Keolahragaan)*, Vol. 1, no. 1, pp. 24-28.



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A Review of Legal Justice: Parole in The Indonesian Prison System



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ABSTRACT: This research aims to examine analyze and review the parole arrangements in the correctional system in Indonesia. In addition, to study and analyze the implementation of parole in order to ensure legal justice. This research uses normative legal research that focuses on the review or study of positive law. The research approach is a method or way to conduct a study so that researchers get information from various aspects to find the issues they are looking for answers to. In accordance with the type of research, namely normative juridical, the research approach used in this research is the Normative/Statute Approach, Conceptual Approach, conceptual approach and Case Approach. The results of this study indicate that there are regulations regarding parole in the correctional system in Indonesia, but these rules are not in line with their implementation so that solutions need to be given in these problems in order to ensure legal justice in parole in the correctional system in Indonesia.

KEYWORDS: Community Institutions; Parole; Correctional System.

I. INTRODUCTION

The prison system was already known before Indonesia was colonized. The prison system before Indonesia was very different from the current prison system which is better known as permasyarakatan, because there are certain ruling factors related to policies in the prison system.¹ As an institution, prison in this context can be understood that the writing of the history of prison cannot escape from the concentration of value systems that are intertwined and have a relationship with the punishment of loss of freedom. Particularly the implementation that took place during a certain period of time and is historical evidence in the development of Peno-Correctional philosophy from time to time. In addition to the connection with the previous implementation of the punishment of loss of freedom which is oriented towards a certain Peno-Correctional philosophy, imprisonment is also a reality in which something exists and as something that exists it has its causes to exist. By something that exists, it is a system, namely the system of treatment of those who have been convicted of something prohibited by law, involved in criminal proceedings and in particular those who have been found guilty and sentenced to loss of liberty.

Correctional as a system, involves correctional in context both in essence and in substance, and also involves correctional in action. In essence, the correctional system is based on a philosophy that is very consistent with the view of the Indonesian nation in treating human lawbreakers, including how to handle them. This philosophy is a manifestation of Pancasila which is the philosophy of life of the Indonesian nation. Society in its substance will not be separated from society in its essence. Although the substance shows perspectives that point to the influence of enculturation (the process of learning cultural values and norms). Socialization in action is also inseparable from socialization in its essence and socialization in its substance which manifests as a system of gotong royong.

At the stage in the Correctional System relating to problems in law enforcement today, it becomes a separate assessment by every citizen. Although then each society with its own characteristics, may provide its own style of problems in the framework of law enforcement. However, every society has the same goal to achieve peace in society as a result of formal law enforcement.²

The development of life and development in society brings social changes, including changes in values, attitudes and patterns of behavior. This has caused a shift in the view of the actions of community members. The shift in norms in society can

¹ S. Rahayu, S., 2017, *Konflik Rasial Antara Etnis Tionghoa Dan Pribumi Di Surakarta*, Jakarta: Buana, p.46.

² Iqraq Sulhin, "Filsafat (Sistem) Pemasyarakatan", *Jurnal Kriminologi Indonesia*, Vol. 7 No.1, 2010, p.140.

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trigger various conflicts in society, both between individuals and individuals, individuals and groups, as well as conflicts that occur between community groups. This, directly or indirectly, will result in the destruction of the community order in various fields, especially in terms of the security of citizens living in conflict areas.

It is generally understood that prisons are institutions designed to imprison or change and reintegrate prisoners. Prisons are intended to shape the character or behavior of prisoners for a better life after imprisonment. Therefore, prisons should ideally be institutions capable of providing care and training to prisoners, with the hope of reducing the risk of recidivism. Reintegration in the form of treatment and training is the key to reducing recidivism, as expressed by Ksenija Butorac in a journal on crime recidivism as follows: The behaviour of re-offenders can often be linked to substance abuse, mental illness, lack of job skills, learning disabilities and lack of education. Prison sentences for less serious crimes often result in shorter sentences. Thus, even if prisons offer treatment and support for offenders while indetention, less time in prison can limit access to these services. In order to stop the cycle of recidivism what is crucial is reintegration programmes which offer treatment and support to these prisoners after their release.³

Seeing the over crowded conditions that occur in prisons and detention centers throughout Indonesia, it certainly has a major influence on the success of Guidance and Guidance from the Correctional System, so it is concluded that there is no significant difference between Guidance for all Prisoners. Some of the factors that affect the coaching and mentoring include the lack of budget, human resource capacity, limited facilities and infrastructure in the implementation and supervision of the implementation of activities so that it can affect the pattern of coaching and mentoring.

Thus, in an effort to maintain order in social life, the law must be enforced, which means that every crime and violation of the law must be sanctioned according to the level of the crime and violation itself. Sanctions consist of various forms that aim to provide justice, not only to victims but also as a value system that binds the order of social life.

The rise of law violations that occur in society, both in the form of minor offenses such as theft, as well as other offenses such as persecution and murder, to the category of serious crimes such as terrorism, narcotics and other transnational crimes. So many of these incidents, making the number of prisoners in the Correctional Institution (Lapas) and State Detention Center (Rutan), need special attention.

As a result of the emergence of various levels, forms, types, and behaviors of crime, both transnational crime, organizer crime, white collar crime, and economic crime, the implementation of correctional duties faces quite severe conditions, namely the high occupancy rate of correctional institutions (Lapas). Based on data available at the Directorate General of Corrections, the occupancy rate of correctional institutions continues to experience a fairly high increase. This condition is often referred to as overcapacity.

Conditional rights are of great concern to prisoners. Many prisoners hope for these conditional rights, so they try to behave well in prison. However, for prisoners who have difficulty receiving remission, they appear apathetic. They argue that there is no need to improve themselves in prison if they do not get their rights. Of course, the attitudes and statements of some prisoners give a tendency to have a selfish attitude or lack of awareness from them to improve themselves, and this can be said to be the attitude of humans in general and also for life imprisonment prisoners who will remain imprisoned for the rest of their lives, as long as they are still alive. If the prisoner has passed away or the president has granted a pardon or amnesty, the sentence will be completed. Prisoners serving life terms will not be eligible for parole, family visits, or rehabilitation programs. This is stated in Ministerial Regulation No. 21/2013 on the Necessary Conditions and Procedures for Parole, Free and Conditional Leave, as well as Remission, Assimilation, Family Visits, and Re-entry.⁴

It can be seen that if more and more convicts are serving a criminal period in the penitentiary, then the penitentiary will be increasingly full with new convicts. Moreover, if the inmate is sentenced to life imprisonment, then the correctional institutions in Indonesia will be increasingly full. Therefore, it is necessary to find a solution so that the purpose of the implementation of imprisonment can be achieved properly. Efforts to solve the problem of overcapacity are the implementation of the rights of prisoners, including through the acceleration of the granting of Parole (PB), Conditional Leave (CB) and Leave Ahead of Freedom (CMB). In general, parole entitles a prisoner to serve a sentence outside the prison walls. The conditions are: the sentence imposed is more than nine months, has served 2/3 of the sentence, and has behaved well during the coaching period'. Article 1 point (7) of Government Regulation No. 32 of 1999 concerning Conditions and Procedures for the Implementation of the Rights of Prisoners concludes: parole is a process of fostering prisoners outside prison after serving

³ Ksenija Butorac, *et.all*, "The Challenges in Reducing Criminal Recidivism", Public Security and Public Order, Vol. 18, No. 5, 2017, p. 155-131.

⁴Kamea, H.C., "Pidana Penjara Seumur Hidup dalam Sistem Hukum Pidana Di Indonesia", Lex Crimen, Vol. 2, No.2, 2013, p.43-55.

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at least 2/3 of the criminal period of at least 9 months. In essence, those who are entitled to parole rights are not prisoners sentenced to imprisonment.⁵

Conditional rights are also a concern for prisons because by obtaining the right to remission or PB, it will reduce the number of residents in prisons which has an impact on providing solutions to overcapacity in almost all prisons in Indonesia today.

For Prisoners to obtain these 2 (two) rights, the Ministry of Law and Human Rights has tightened the requirements by amending Government Regulation Number 32 of 1999 with Government Regulation Number 28 of 2006 and then refined with Government Regulation Number 99 of 2012 and currently replaced by Minister of Law and Human Rights Regulation No. 7 of 2022. The latest Government Regulation adds several special remission and PB requirements for special category prisoners such as drugs, terrorists, corruption and other transnational crimes.

The implementation of PB does not mean that the Ministry of Law and Human Rights will necessarily shorten the prisoner's sentence. Article 15 of the Criminal Code stipulates that a prisoner can be granted parole if he has served 2/3 of his sentence. As the name implies, prisoners who get PB rights can be released with various requirements which are currently regulated in Government Regulation Number 99 of 2012. The legal basis for parole is regulated in Article 15 of the Criminal Code which explains the conditional release for prisoners, namely first, if the prisoner has served two-thirds of the actual sentence or at least nine months.

Parole, remission, assimilation, and leave before release in the law are rights for all prisoners including life convicts. However, in Indonesia there is no regulation regarding life-long prisoners who can get their remission rights such as parole.⁶

Criminal acts allegedly committed by the suspect will be faced with the function of criminal law which determines the imposition of law on the perpetrator for sanctions for criminal acts that have been committed by a person. In the Criminal Code, it has been stipulated that there are main punishments, namely closure punishment, fine, confinement, imprisonment and death penalty. The type of punishment or criminal will be discussed by the author in this article which is based on normative legal research is life imprisonment. Talking about criminal law has an understanding that is one of the branches of law that has the main function and its use is played when the branch of law, the duration of problem solving, which later criminal law is the last resort (*ultimum remedium*). The main criminal sanction of imprisonment with a class of life sentence regulated in Article 12 paragraph (1) of the Criminal Code is not uncommon to be the choice of consideration for judges compared to imposing the death penalty.

The coaching program can actually run in accordance with the stages regulated in Government Regulation No. 31 of 1999 concerning the Guidance and Guidance of Prisoners, but in fact the recovery efforts have not been able to be carried out optimally due to several obstacles, including inadequate facilities and infrastructure that have resulted in the impact of over crowded in most prisons and detention centers, the ability and capacity of human resources employees in carrying out the functions of coaching and guidance, as well as the lack of budget which results in the effectiveness of program implementation.

The increase in the number of prisoners, which has a significant impact on over crowded prisons and detention centers, has the opportunity for the emergence of recidivists, when compared to the number of employees tasked with providing guidance to prisoners, as well as mentoring Correctional Clients. This condition becomes a phenomenon in itself, thus inviting the author's interest to be able to find an ideal formula in the regulation, implementation and function of Corrections with well-coordinated legal political efforts in the formation of norms in the correctional system in Indonesia. From the background mentioned above, the author is interested in compiling a discussion on parole in the correctional system in terms of legal justice.

II. RESEARCH METHOD

The type of research used is normative legal research which focuses on the review or study of positive law. Normative juridical research is legal research that places the law as a building system of norms. The system of norms in question is about principles, norms, rules from laws and regulations, court decisions, as well as doctrines or teachings.⁷ In accordance with the scientific character of normative law, the review of positive law includes a review of legal dogmatics, a review of legal theory,

⁵ Rico Vincent, 2010, *Pemberian Hak Pembebasan Bersyarat Bagi Narapidana (Studi Kasus Pada Lembaga Pemasyarakatan Kelas Iia Wirogunan Yogyakarta)*, Yogyakarta: Fakultas Hukum Universitas Atmajaya, p.8-9.

⁶ Soedjono Dirjosisworo, 1984, *Fungsi Perundang-Undangan Pidana dalam Penanggulangan Korupsi di Indoensia*, Bandung:PT. Sinar Baru, p. 17.

⁷ Retno Saraswati, "Desain Sistem Pemerintahan Presidensial yang Efektif", *Jurnal MMH*, Vol. 41 No. 1, 2012, p. 137.

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and a review of legal philosophy.⁸ At the level of legal dogmatics, the focus is on the identification of several laws and regulations related to the correctional system in Indonesia, while at the level of legal theory a review of theories that can be used to analyze the value of justice, the legal system, the operation of law and progressive law on parole arrangements in the correctional system. In terms of legal philosophy, the study focuses on parole arrangements for convicts based on the value of justice in the correctional system in Indonesia.

The research approach is a method or way to conduct a study so that researchers get information from various aspects to find the issues they are looking for answers to.⁹ In accordance with the type of research, namely normative juridical, the research approach used in this research is the Normative / Statute Approach, Conceptual Approach, conceptual approach and Case Approach. The types of legal materials that will be used in this research are primary legal materials, secondary legal materials, and tertiary legal materials. In this research, the method of collecting legal materials is carried out through a literature study of legal materials using a card system or document study (card system) and an electronic system (electronic system). The results of the analysis are poured in the form of descriptive qualitative descriptions, namely a description that describes the problems and solutions clearly and completely based on the legal materials obtained.

III. RESULT AND DISCUSSION

a. Arrangement of Requirements and Mechanisms for Parole in Correctional Institutions

The State of Indonesia is a State of Law regulated in the 1945 Constitution Article 1 paragraph (3) which states that Indonesia is a state of law, where the actions of the Government and other institutions including citizens must be based on law. The number of crimes that occur in Indonesia is increasing from time to time. The parole is part of the function of the Correctional Institution, which is one of the parts of the Indonesian criminal justice system, namely the Police, the Prosecutor's Office, and the District Court.¹⁰ The legal basis for parole is Article 86 of the Regulation of the Minister of Law and Human Rights Number 07 of 2022 which states that people who are convicted or imprisoned can be released by agreement.

The Criminal Code does not include a definition of parole, but based on the provisions of Article 15 of the Criminal Code, it can be concluded that parole is a legal institution that provides an opportunity for prisoners who have served two-thirds of their sentence. Two-thirds of the criminal period is at least nine months, to be outside the correctional facility by fulfilling certain conditions and remaining under supervision. In addition, parole can only be granted to prisoners sentenced to imprisonment. However, not all convicts sentenced to imprisonment who fulfill the provisions in Article 15 of the Criminal Code can be granted parole. This is related to life imprisonment inmates.

Therefore, conditional release is not possible with respect to life imprisonment, because 2/3 of the life imprisonment cannot be taken into account. If life imprisonment is to be imposed on a person sentenced to life imprisonment, then the life imprisonment must first be made a temporary imprisonment by clemency. Only then can a conditional release be granted.¹¹

When through two-thirds (2/3) of the actual sentence or at least nine (9) months of it. In essence, the granting of parole to prisoners is a gift of remission from the state for prisoners to be free in advance of their actual sentence. Parole for prisoners is one of the rights that must absolutely be obtained by prisoners provided that the prisoner has fulfilled certain conditions determined by Ministerial Regulation Number 07 of 2022, among others:

1. Has served at least 2/3 (two-thirds) of the criminal period, provided that 2/3 (two-thirds) of the criminal period is at least 9 (nine) months;
2. Good behavior during the criminal period of at least 9 (nine) months calculated before the date of 2/3 (two-thirds) of the criminal period;
3. Has participated in the coaching program well, diligently, and enthusiastically; and
4. The community can accept the prisoner's coaching activity program.

From the legal basis above, one of which is regarding parole for prisoners is an absolute right for prisoners as long as they fulfill the applicable terms and conditions that already exist in correctional institutions. The public perception when hearing the term convict is a person who, as a result of his actions, is punished in prison and the punishment is appropriate because of the consequences of his actions that violate the law. In this effort, the law as a fair legal medium is a law that binds humans in their consciousness because the law is an order. The state has the responsibility for prisoners through correctional

⁸ Hafrida, 2016, *Metode Penelitian Hukum*, Jambi: Fakultas Hukum Universitas , p.15.

⁹ Nico Ngani, 2012, *Metodologi Penelitian dan Penulisan Hukum*, Yogyakarta: Pustaka Yustisia, p. 178.

¹⁰ Suyanto, "Efektivitas Pelepasan Bersyarat dalam Pembinaan Narapidana", *Jurnal Pro-Hukum*, Vol 1, No 2., 2016, p. 40.

¹¹ Saleh Roeslan, 1983, *Stelsel Pidana Indonesia*, Jakarta: Aksara Baru, p. 37.

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institutions (lapas) to provide appropriate guidance to prisoners so that the prisoners are aware and do not repeat acts that violate the norms of the law so that they can be accepted back into the surrounding community. The issue of imposing punishment or punishment for prisoners is very important in criminal law and criminal justice, not a matter of abstract theory.

Moreover, as stated by Sudarto that, our Criminal Code does not contain general guidelines for the administration of punishment (strafosmetingselidraad), which is a guideline made by the legislator that contains certain principles that need to be considered by the judge in imposing criminal law, there are only rules for the administration of punishment (strafosmetingregels), for example the provisions regarding the reduction of punishment Article 33 of the Criminal Code also contains rules for the administration of punishment, namely the provision of deductions from the punishment with the period during which the defendant is temporarily detained. A person needs to be reviewed as to what the essence and purpose of punishment actually is. This raises several theories and brings us to the issues of why a crime is subject to a punishment. Below will be briefly described the purpose of the punishment that must be taken into account by the judge in imposing punishment. Broadly speaking, there are three theories on the purpose of punishment, namely:¹²

- a) Absolute Theory or Retaliation Theory. This theory assumes that every crime must be followed by punishment, without bargaining. A person gets punishment because he has committed a crime. It does not see any consequences that arise with the determination of punishment. It does not matter whether society might be harmed. Only looks to the past, not the future.
- b) Relative Theory or Goal Theory. This theory assumes that a crime does not absolutely have to be followed by a punishment. For this reason, it is not enough for there to be a crime, but the benefits of the crime for society or for the criminal himself must also be questioned. It is not only seen in the past, but also in the future. Therefore, there needs to be a further goal than just keeping the punishment away. This goal must be solely directed towards prevention (prevention) or so that the crime is not repeated. Prevention efforts are not only aimed at the criminal, but also at other people.
- c) Combined Theory. The theory combines the Absolute Theory and Relative Theory.

Correctional institutions are part of the correctional system. It is a place for inmates to undergo a criminal period and obtain training. Correctional institutions through the correctional system provide more humane treatment to prisoners through coaching patterns, this is different from the previous system, namely imprisonment, in Article 2 of Law No. 22 of 2022 concerning Corrections states that the correctional system is organized in the context of prisoners realizing mistakes, improving themselves and not repeating criminal acts, this is to prepare prisoners to integrate healthily with society.

The correctional system in Indonesia contains great ideals. Community development given to prisoners and correctional students must make prisoners who support the limitations and goodness in their respective communities, so that they become a complete society that has characteristics.¹³

- 1) To be a good, useful, and active and productive member of society; and
- 2) To be happy in this world and the hereafter.

In the process of implementation in correctional institutions, there are three things that must be first understood that the correctional process is organized and managed with great care and guidance rather than retaliation. That the correctional process includes the development of prisoners inside and outside. The correctional process requires participation, integration of correctional officers on inmates and correctional students and members of the general public. Parole is the release of convicts after passing at least two-thirds of the sentence with the provision that two-thirds is not less than 9 (nine) months. Every citizen, especially Indonesians, should have their rights protected. Parole is carried out in accordance with the principles in the implementation of the general duties of government and development as well as guidance education, respect for human dignity, loss of independence is the only suffering and the right to contact with family and certain people is guaranteed.

Parole must be beneficial for the person and family of the convict and juvenile offender and not contrary to the public interest and sense of justice of the community. Parole is held with the intention of holding a transitional period between imprisonment and full freedom in the community. The rights of prisoners are entitled to integration services, one of which is the granting of parole as stated in Law Number 22 Year 22 concerning Corrections. Parole is a process of fostering prisoners by integrating or mixing prisoners and correctional students who are in accordance with existing and predetermined requirements so that prisoners can interact directly, adjust to the new environment and restore the human values that exist in prisoners so that society can accept them again after serving their sentence. Therefore, parole is detained who is discharged from the correctional organization before completing his detention period with a commitment to meet the specified conditions and is charged to the detainee. Parole (voorwaardelijkeinviheidstelling) delivers prisoners who have fulfilled for the provisions of the

¹² Marlina, 2011, *Hukum Penitensir*, Bandung: PT Refika Aditama, p. 41-45

¹³ Marlina, *Op.Cit.*, p. 124-125.

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parole requirements based on the provisions of Article 15 of the Criminal Code is if it has passed the period of detention or 2/3 of the period of detention or at least 9 months of it. Prisoners and correctional students are authorized to obtain parole, one of the conditions that have passed 2/3 of the sentence is not the only requirement for a person to apply for release.¹⁴ The granting of parole in its implementation is not all prisoners can obtain it.

In the implementation of assisting the process of re-integration of prisoners to be able to adjust back in society while still paying attention to the provisions that apply while undergoing guidance at Bapas, because if the prisoner commits a violation or does not comply with the provisions in Bapas, then the revocation of the re-integration program that he has undergone with the consequence of re-serving the remaining period of punishment in prison, revocation of parole, leave before release, and conditional leave as regulated in Ministerial Regulation Number 7 of 2022 concerning Terms and Procedures for Granting Remission, Assimilation, Leave to Visit Family, Parole, Leave Before Release, and Conditional Leave, referred to in Article 138.¹⁵

Parole is one of the rights of prisoners in the development program in correctional institutions, which aims to enable eligible prisoners to interact and socialize with the community outside correctional institutions. The procedure for obtaining parole is carried out in several stages through a coaching program by first fulfilling administrative and substantive requirements. The implementation process sometimes experiences several obstacles in fulfilling its requirements, both in terms of human resources on the officers and the prisoners themselves. In addition, other obstacles are caused by organizational factors, administration and social conditions of the community in supporting the implementation process. Therefore, success in fulfilling the requirements to obtain parole can be influenced by understanding and increasing human resources as a supporting factor.

In addition to the granting of parole, it is also necessary to understand the existing procedures, organization, coordination both within the correctional institution itself and by other related organizations such as the Attorney General's Office and the courts. The implementation of parole is in accordance with Regulation of the Minister of Law and Human Rights Number 7 of 2022. In the implementation of parole there are things that hinder such as the proposal of parole submission files and replies to letters from the Directorate General of Corrections office.

The obstacles that occur while waiting to get Parole are if they violate the discipline or rules of the Penitentiary such as fighting with fellow prisoners, their right to parole will be canceled and the process is long. Parole as the fulfillment of rights for prisoners is carried out by looking at the provisions of the detention period that has been carried out by prisoners, namely at least 2/3 or 9 months of detention. To receive this parole right, prisoners must carry out coaching activities both skills and independence in accordance with the specified time of at least 9 months of detention. In this coaching activity, an assessment is carried out to measure the level of readiness of prisoners to be able to rejoin the outside world and be accepted by citizens and make a good contribution to the nation and state. Not only that, the implementation of coaching is also carried out by implementing observations and supervision carried out by the Correctional Observation Team (TPP) to find out if there are violations committed.

By prisoners during the running of this coaching activity. However, it cannot be denied that in the distribution of parole as the right of prisoners there are still some obstacles that occur.¹⁶ Every implementation of coaching in prison. In coaching has a correctional officer appointed as a TPP officer (Correctional Observation Team) whose role is to oversee the development of prisoners who always behave well after serving 2/3 of their sentence and can make plans for reintegration into society. One of the rights of prisoners is parole which is one of the coaching where good behavior and requirements are given. One of the rights of prisoners is parole, parole in its implementation must be in accordance with Law Number 22 of 2022 concerning corrections in accordance with Article 9 which contains the rights of prisoners. Research with the formulation of the problem of the Application of the Granting of Parole as the Fulfillment of the rights of prisoners and obstacles to the Granting of Parole as the Fulfillment of the rights of prisoners. The application of granting parole must be in accordance with the existing rules where in the process there are still obstacles.

Some factors that hinder the implementation of parole include, among others, the procedure for proposing parole is still too complicated and is considered to take a long time so that it takes a long time to get a decision on parole either accepted or rejected. Prisoners are still limited by the rules and regulations regarding parole. The regulation only regulates the coaching

¹⁴Warmadewa, "Pembebasan bersyarat, Lembaga Masyarakat, Narapidana", Jurnal Analogi Hukum, Vol 1, No 3, 2019, p. 34.

¹⁵ *Ibid.*, p. 6.

¹⁶Muhammad Raja Haholongan, "Lembaga Masyarakat, Pembebasan Bersyarat, Narapidana", Jurnal Pendidikan Tambusai, Vol 6, No , 2022, p. 7.

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process and the procedure for obtaining the coaching. It has not been explained in detail about the supervision and guidance of prisoners in their parole activities in the community. This event often causes a mismatch in the purpose of parole coaching in the community so that it is not implemented and achieved properly and the slow process of proposing administrative completeness files, one of the reasons that inhibits the proposal for parole. parole is the process of releasing prisoners into the community before the expiration of the maximum sentence of prisoners from correctional institutions.

In administering parole from the government, the Correctional Institution carries out a number of functions including: maintaining/managing information on each inmate under the jurisdiction of the Correctional Institution, maintaining/managing records of each inmate during the parole period, guiding inmates during the parole period.

b. Parole in the Correctional System from the Aspects of Justice

In the process of enforcing criminal law, there are provisions regarding criminal sanctions in which the provision of criminal sanctions for convicted criminals has a purpose. The purpose of imposing criminal sanctions must function to foster, namely by making lawbreakers repentant and not functioning as retaliation. This view and understanding is in accordance with the nation's view of life (way of life) contained in Pancasila, which upholds human values.¹⁷

Meanwhile, according to Muladi, the purpose of punishment is to repair individual and social damage caused by criminal acts. This consists of a set of punishment objectives that must be met, with a note that the objectives that are the focus must be casuistic. The set of punishment objectives referred to consists of: Prevention (general and special); Community protection; Maintaining community solidarity; Compensation or balance.

The use of imprisonment as a community reaction to crime is an alternative to deterrence from the purpose of punishment. Because in addition to preventing the community from committing crimes, imprisonment in Article 10 of the Criminal Code is a crime prevention policy which by Sahardjo is adapted to Indonesian society with Pancasila ideology, by formulating the goal is correctional.¹⁸ This means that people sentenced to imprisonment are socialized through rehabilitation and resocialization before returning to society. In connection with the above, the existence of the Correctional Institution as the executor of the purpose of punishment in the correctional system as referred to in the Law, is a series of law enforcement aimed at making correctional prisoners realize their mistakes, improve themselves, and not repeat criminal acts so that they can be accepted back by the community, can actively participate in development, and can live reasonably as good and responsible citizens.

The concept of goals in the Correctional Act is in line with the XIth UN congress in Bangkok, April 18-25, 2005 on Crime Prevention and Criminal Justice which took the main theme of "responsive and synergistic" efforts with a combinative strategy in ways of crime prevention and criminal justice with reference to the restorative justice system.¹⁹

In general, the granting of parole is carried out through the correctional information system which is an integrated system between the correctional technical implementation unit, regional office, and directorate general. The procedure for granting parole is regulated in Regulation of the Minister of Law and Human Rights Number 3 of 2018 concerning Conditions and Procedures for Granting Remission, Assimilation, Leave to Visit Family, Parole, Leave Before Release, and Conditional Leave jo. Regulation of the Minister of Law and Human Rights of the Republic of Indonesia Number 7 of 2022 The following author summarizes the procedures for granting parole, including:

- a) Correctional officers record inmates who will be proposed for parole. Data collection is carried out on the conditions for granting parole and the completeness of documents.²⁰
- b) Completeness of documents must be requested after 7 (seven) days the prisoner is in Correctional Facility/LPKA. Completeness of documents must be fulfilled no later than 1/2 (one-half) of the prisoner's criminal period in the correctional facility.²¹

¹⁷ Petrus Irwan Panjaitan dan Pandapotan Simorangkir, 1995, *Lembaga Pemasyarakatan Dalam Perspektif Sistem Peradilan Pidana*, Jakarta: Pustaka Sinar Harapan, p. 9.

¹⁸ Petrus Irwan Panjaitan dan Wiwik Sri Widiarty, 2008, *Pembaharuan Pemikiran Dr. Sahardjo Mengenai Pemasyarakatan Narapidana*, Jakarta: CV Indhill CO, p. 26.

¹⁹ Kuat puji prayitno, "Restorative justice untuk Peradilan di Indonesia: Perspektif Yuridis Filosofis Dalam Penegakan Hukum", *Jurnal Dinamika Hukum*, Vol. 12, No. 3, 2012, p. 10.

²⁰ Pasal 95 ayat (1) dan (2) Peraturan Menteri Hukum dan Hak Asasi Manusia Nomor 3 Tahun 2018 tentang Syarat dan Tata Cara Pemberian Remisi, Asimilasi, Cuti Mengunjungi Keluarga, Pembebasan Bersyarat, Cuti Menjelang Bebas, dan Cuti Bersyarat.

²¹ Pasal 95 ayat (3) dan (4) Peraturan Menteri Hukum dan Hak Asasi Manusia Nomor 3 Tahun 2018 tentang Syarat dan Tata Cara Pemberian Remisi, Asimilasi, Cuti Mengunjungi Keluarga, Pembebasan Bersyarat, Cuti Menjelang Bebas, dan Cuti Bersyarat.

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- c) Then, the correctional observer team of the correctional facility recommends the proposal to grant parole for prisoners to the head of the correctional facility based on data on prisoners who have met the requirements.²²
- d) In the event that the head of the prison approves the proposal for granting Parole, the Head of the Prison shall submit the proposal for granting Parole to the Director General with a copy to the Head of the Regional Office.²³
- e) Then, the Head of the Regional Office verifies the copy of the proposal for granting Parole, the results of which are submitted by the Head of the Regional Office to the Director General of Corrections.²⁴
- f) The Director General of Corrections shall verify the proposal for granting Parole no later than 3 (three) days from the date the proposal for granting Parole is received from the Head of Correctional Institution.²⁵
- g) In the event that the Director General of Corrections approves the proposal for the granting of Parole, the Director General of Corrections on behalf of the Minister of Law and Human Rights shall issue a decision on the granting of Parole which shall be submitted to the Head of Correctional Institution to be notified to the prisoner or child with a copy to the Head of the Regional Office.²⁶

Therefore, parole can be applied for by fulfilling the requirements in accordance with the rules and following the process until the issuance of a decision to grant parole from the Director General of Corrections of the Minister of Law and Human Rights. In addition to having an obligation to carry out the punishment, prisoners also have rights that should not be ignored. At the stage of the implementation of the decision, human rights (HAM) that become indiscriminately become the rights of prisoners are still guaranteed and protected by law as a form of respect for human dignity. Article 10 of the International Covenant of Civil and Political Rights guarantees that -all persons deprived of their liberty shall be treated with humanity and with respect for the inherent dignity of the human person||, therefore the human rights of prisoners must also be considered. Nowadays, parole has become the concern of the wider community, due to the large number of prisoners who receive parole either because they are considered to have committed a criminal offense that is considered serious by the community or because the case concerned has first received public attention.

The convicts who have obtained parole include the artist Nazriel Irham who is a convict of a pornographic video case, a convict of narcotics smuggling who is an Australian citizen Schapelle Leigh Corby, a convict of bribery against former Buol Regent Amran Batalipu, Sri Hartati Murdaya, and a convict of the murder of human rights activist Munir, Pollycarpus Budihari Priyanto. In addition to being regulated in Article 14 paragraph (1) letter k of UURI No.12 of 1995 concerning Corrections, Parole is also regulated in Article 15 to Article 17 of the Criminal Code.

Where in the implementation in the field in accordance with Article 6 paragraph (3) letter b in conjunction with Article 42 paragraph (1) letter b of UURI No.12 of 1995 concerning Corrections, prisoners who obtain Conditional Release (*voorwaardelijke invrijheidstelling*) will undergo a series of guidance processes carried out by BAPAS so that it is hoped that the prisoner concerned is ready to return to the midst of society. In terms of supervision, Article 15a paragraph (3) in conjunction with Article 14d paragraph (1) of the Criminal Code states that the institution that supervises the implementation of Conditional Release is the institution that orders the execution of a decision that has permanent legal force, namely the Prosecutor's Office.²⁷

The importance of supervision in an implementation of Conditional Release is to ensure that prisoners who obtain Conditional Release can be accepted back by the community in addition to not violating the provisions of Conditional Release. Society in general still views that prisoners are part of society who are no longer wanted because they have committed acts that are reproached by society and the state. The labeling of prisoners directly or indirectly also affects the psychology and life of the prisoners concerned, including prisoners who obtain Parole, therefore supervision and guidance carried out by the Prosecutor's Office and BAPAS is a series of efforts to assist and monitor prisoners who obtain Parole in the community.²⁸

²² Pasal 96 ayat (1) Peraturan Menteri Hukum dan Hak Asasi Manusia Nomor 3 Tahun 2018 tentang Syarat dan Tata Cara Pemberian Remisi, Asimilasi, Cuti Mengunjungi Keluarga, Pembebasan Bersyarat, Cuti Menjelang Bebas, dan Cuti Bersyarat.

²³ Pasal 96 ayat (2) Peraturan Menteri Hukum dan Hak Asasi Manusia Nomor 3 Tahun 2018 tentang Syarat dan Tata Cara Pemberian Remisi, Asimilasi, Cuti Mengunjungi Keluarga, Pembebasan Bersyarat, Cuti Menjelang Bebas, dan Cuti Bersyarat.

²⁴ Pasal 97 Peraturan Menteri Hukum dan Hak Asasi Manusia Nomor 3 Tahun 2018 tentang Syarat dan Tata Cara Pemberian Remisi, Asimilasi, Cuti Mengunjungi Keluarga, Pembebasan Bersyarat, Cuti Menjelang Bebas, dan Cuti Bersyarat.

²⁵ Pasal 98 Peraturan Menteri Hukum dan Hak Asasi Manusia Nomor 3 Tahun 2018 tentang Syarat dan Tata Cara Pemberian Remisi, Asimilasi, Cuti Mengunjungi Keluarga, Pembebasan Bersyarat, Cuti Menjelang Bebas, dan Cuti Bersyarat.

²⁶ Pasal 99 ayat (1) dan (2) Peraturan Menteri Hukum dan Hak Asasi Manusia Nomor 3 Tahun 2018 tentang Syarat dan Tata Cara Pemberian Remisi, Asimilasi, Cuti Mengunjungi Keluarga, Pembebasan Bersyarat, Cuti Menjelang Bebas, dan Cuti Bersyarat.

²⁷ *Ibid.*, p. 25.

²⁸ *Ibid.*, p. 28.

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The implementation of inmate coaching during the parole period will not always be able to run smoothly well and smoothly, however, sometimes there will be obstacles in its implementation and there must be a solution to deal with obstacles. This is recognized by the officer that the submission process is sometimes constrained due to the slow process of other related agencies. For example, they have to wait for the community research report. Also included in this case are changes to some of the laws and regulations governing parole. obstacles in the implementation of parole are as follows:²⁹

- 1) Guarantor The guarantor from the family is unknown;
- 2) Disciplinary Factors;
- 3) For prisoners who violate the discipline or rules of the correctional institution, the prisoner is threatened with parole;
- 4) Community factors.

There is still a lack of public trust in prisoners. So that the local government sometimes rejects prisoners to parole. Because it can make the community uncomfortable and safe. And factors that hinder the implementation of parole outside the Penitentiary. As follows:

1) Community Factors

There are still many people who do not understand about parole and the paradigm of society is that former prisoners are bad people.

2) Prisoners' own factors

The person concerned is not pro-active in this matter, not obliged to report.

3) Employment Factors

Employment or livelihood, former prisoners are difficult to get a job and do not rule out the possibility of repeating criminal acts again.

The obstacles in the implementation of supervision of prisoners on parole in general can be categorized into juridical obstacles and non-juridical obstacles, including:

a) Juridical Constraints There are no clear rules regarding the implementation of supervision of prisoners on Parole by the Public Prosecutor's Office. The Criminal Code (KUHP) clearly regulates the institution of the Prosecutor's Office as a supervisory agency for the implementation of Conditional Release (*voorwaardelijke invrijheidstelling*) so that the Prosecutor's Office can be referred to as a juridical supervisory institution for the implementation of Conditional Release, but in practice in the field there are no clear implementing rules regarding further authority possessed by the Prosecutor's Office in conducting supervision of Conditional Release prisoners.

b) Non-juridical constraints

1) Supervision of Parole prisoners is not only carried out by the Prosecutor's Office, but can also be carried out by BAPAS and other agencies as stipulated in Article 48 of Government Regulation of the Republic of Indonesia No.32 of 1999 concerning Terms and Procedures for the Implementation of the Rights of Prisoners, so that coordination between these agencies is very important. If the coordination does not run optimally, the supervision carried out will also not run optimally. Coordination between agencies plays a very important role both directly and indirectly regarding the supervision of prisoners on parole, the lack of coordination between agencies related to the supervision of prisoners on parole can be seen from the absence of actions or proposals for revocation of parole by the Malang District Attorney against prisoners who do not carry out their obligations.

2) Limited officers available at the Malang State Attorney's Office. Human resources (HR) also play an important role, currently the number of officers at the Malang State Prosecutor's Office, both in the General Crimes Section and the Special Crimes Section who carry out supervision, is not proportional to the number of Parole prisoners being supervised.

Parole allows an inmate to serve part of their prison sentence in the community. During parole, a prisoner will be subject to conditions of parole and under supervision. Parole provides prisoners with a structured, supported and supervised transition so that they can adjust from prison back into society, rather than returning directly to society at the end of their sentence. By supporting prisoners to return to the community under supervision towards the end of their sentence, the primary aim of parole is to improve community safety:³⁰

Article 55

a) The procedure for granting parole is implemented through the correctional information system.

²⁹ W.A. Fauzi, "Pelaksanaan Pemberian Hak Pembebasan Bersyarat Bagi Narapidana Tindak Pidana Umum", *Nusantara : Jurnal Ilmu Pengetahuan Sosial*, Vol. 8, No. 2, 2021, p.229–239.

³⁰ H. Furqan, dan M. Sidiq, 2019, *Efektivitas Pembebasan Bersyarat terhadap Narapidana*, Jakarta: secret, p. 71-89.

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b) Correctional information system as referred to in paragraph (1) is an integrated system between the Technical Implementation Unit of Corrections, Regional Office, with the Directorate General.

Article 56

The correctional observation team of the correctional facility recommends a proposal for granting parole to the head of the correctional facility based on data on inmates and correctional students except civilian children who have met the requirements.

- a) In the event that the head of the prison approves the proposal for granting parole as referred to in paragraph (1), the head of the prison shall submit the proposal for granting parole to the head of the regional office based on the recommendation of the prison correctional observer team.
- b) The head of the regional office shall submit the proposal for granting parole based on the recommendation of the regional office correctional observer team to the director general.
- c) The proposal as referred to in paragraph (3) is in the form of a recapitulation of data on prisoners and correctional students by attaching:
 - 1) The results of the Regional Office correctional observer team hearing;
 - 2) Photo of the judge's decision and the minutes of the implementation of the court decision and;
 - 3) Salina list of changes from the head of the prison;
 - 4) The Director General on behalf of the Minister determines the granting of parole based on the recommendation of the Directorate General's correctional observer team.

Article 57

- a) The correctional observer team of the correctional facility recommends the proposal for granting parole to the Head of the correctional facility based on data on convicts and correctional students except for civilian children who have met the requirements. In the event that the Head of Correctional Facility approves the proposal for granting parole as referred to in paragraph (1), the Head of Correctional Facility shall submit the proposal for granting parole to the Head of Regional Office based on the recommendation of the correctional observer team of the Correctional Facility.
- b) The Head of the Regional Office submits the proposal for granting parole based on the recommendation of the correctional observer team of the Regional Office to the Director General.
- c) The proposal as referred to in paragraph (3) is in the form of a recapitulation of data on prisoners and Correctional Students by attaching:
 - 1) The results of the regional office correctional observer team hearing
 - 2) Copy of judge's decision and minutes of implementation of court decision, and
 - 3) A copy of the list of changes from the head of the correctional center.
- d) The director general on behalf of the minister determines the granting of parole based on the recommendation of the correctional observer team.

Article 58

- a) Correctional officers shall record inmates who have fulfilled the requirements as referred to in Article 51 through Article 53.
- b) Data collection as referred to in paragraph (1) is carried out on the conditions for granting parole and completeness of documents.

Article 59

- a) The correctional observer team of the correctional facility shall recommend a proposal for the granting of parole to the head of the correctional facility based on data of convicts who have met the requirements.
- b) In the event that the head of prison approves the proposal for granting parole as referred to in paragraph (1), the head of prison shall submit the proposal for granting parole to the head of the regional office based on the recommendation of the correctional observer team of the prison.
- c) The head of the regional office shall submit the consideration of granting parole based on the recommendation of the correctional observer team of the regional office to the director general.
- d) The director general submits consideration of parole to the minister based on the recommendation of the Directorate general's correctional observer team and recommendations from relevant agencies for approval.
- e) Recommendations from relevant agencies as referred to in paragraph (4), namely:
 - 1) The National Police of the Republic of Indonesia, the National Narcotics Agency, counter-terrorism, and/or the Attorney General's Office in the case of convicts convicted of terrorism, crimes against state security, serious human rights crimes, and/or other transnational organized crimes.

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- 2) The Indonesian National Police, the National Narcotics Agency, and/or the Attorney General's Office in the event that the inmate is convicted of committing a criminal offense of narcotics and psychotropic drug precursors; and
- 3) the Indonesian National Police, the Attorney General's Office, and/or the Corruption Eradication Commission in the event that the inmate is convicted of a corruption crime.
- 4) Approval of the granting of Conditional Release as referred to in paragraph (4) shall be stipulated by a Ministerial Decree.

Moreover, as stated by Sudarto that, our Criminal Code does not contain general guidelines (*strafosmetingselidraad*), which is a guideline made by the legislator that contains certain principles that need to be considered by the judge in imposing criminal law, there are only rules for imposing punishment (*strafosmetingregels*), for example provisions regarding the reduction of punishment.³¹

Article 33 of the Criminal Code also contains rules on the provision of punishment, namely the provision of deductions from the sentence for the period during which the defendant is temporarily detained. A person needs to be reviewed as to what the essence and purpose of punishment actually is. This raises several theories and brings us to the issues of why a crime is subject to a criminal punishment.

The granting of parole must not only be beneficial for the convict, the child and his/her family, but must also fulfill several requirements such as the following:³²

- a) has served at least 2/3 (two-thirds) of the criminal period, provided that such 2/3 (two-thirds) of the criminal period is at least 9 (nine);
- b) has behaved well during the criminal period of at least 9 (nine) months calculated before the date of 2/3 (two-thirds) of the criminal period;
- c) has followed the coaching program well, diligently, and enthusiastically; and
- d) the community can accept the program of prisoners' coaching activities.

The conditions for granting parole must also be completed with several documents, including.

- a) Judges' verdicts and minutes of the implementation of court decisions;
- b) development report from the correctional facility;
- c) Community research report made by the Community Supervisor which is acknowledged by the Head of the Correctional Center (Bapas);
- d) Letter of notification to the State Attorney regarding the plan to grant parole to the prisoner concerned;
- e) A copy of the register from the Head of Correctional Institution;
- f) Copy of the list of changes from the Head of Correctional Institution;
- g) A statement from the prisoner that he/she will not commit any unlawful act; and
- h) A letter of guarantee from the family, guardian, social institution, government agency, private agency, or foundation known by the village head or village head or other name.

The above-mentioned guarantee letter contains a statement that the family guardian, social institution, government agency, private agency, or Foundation known by the lurah or village head or other name:

- 1) guarantee that the prisoner will not escape and/or not commit unlawful acts; and
- 2) The family will assist in guiding and supervising the prisoner during the Conditional Release program.

In accordance with Schepper's opinion, the granting of parole includes:

- 1) The nature of the offense. Regarding how the public opinion if given parole, whether arbitrary actions that can make justice and public order disturbed, for example consideration of public convention.
- 2) The personality and attitude of the prisoner, relating to the public perspective.
- 3) The behavior and attitude of the prisoner while incarcerated.
- 4) Review of the prisoner's livelihood afterward, regarding moral support and employment based on relatives.

Parole before being given to a convict, must go through careful consideration of the interests of the community receiving the former convict. In addition, it must also prepare employment opportunities that are in accordance with the skills and talents that have been obtained during the guidance provided by the Correctional Institution. Basically, the implementation of parole is the authority of the Correctional Institution, although it is the right of convicts who have fulfilled the administrative and substantive requirements of the Regulation of the Minister of Law and Human Rights of the Republic of Indonesia Number M.01.PK.04.10 of 2007. It is said so because those who conduct guidance and assessment of the behavior of

³¹ Zainal Askin, 2020, *Pengantar Ilmu Hukum*, Depok: PT Raja Grafindo, p. 90.

³² *Ibid.*, p. 82.

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prisoners are the Correctional Institution officers themselves. The procedure for granting parole, if analyzed, can be known:

1. Parole although the right of the convict, but to get it is not easy, many requirements must be met, as well as the Correctional Institution is also not to grant parole because the process involves many parties, in addition to internal corrections, also from external such as BAPAS.

2. (Correctional Center), Attorney, Police, Regional Office of Law and Human Rights and Directorate General of Corrections.

In granting parole, the implementation is carried out objectively, this can be seen from the TPP hearing which examines the requirements that must be met by the convict and takes into account input from various parties present at the TPP hearing. However, there is one thing that still needs to get attention is the absence of a grace period that regulates how long the parole decision comes down from the Ministry of Law and Human Rights. This does not rule out the possibility that the decision will take a long time to come down, considering that there are relatively many people who apply for parole, namely prisoners from all correctional institutions in Indonesia.

To be considered for parole, eligible prisoners must apply to the Penitentiary. An inmate can apply for parole if they are serving a sentence with a term without parole. The prison staff responsible for PB management provides information to eligible prisoners on how and when to apply for parole, and helps prisoners prepare for parole. If a prisoner applies for parole, the Board of Corrections determines whether to grant, deny or suspend parole. If granting parole, the Board will also determine the conditions of parole. Victims of crime can write to the Board at any time and the Board will take the views of victims into account when the Board considers whether to grant parole to a prisoner.

IV. CONCLUSIONS

In general, the granting of parole is carried out through the correctional information system which is an integrated system between the correctional technical implementation unit, regional office, and directorate general. The procedure for granting parole is regulated in Regulation of the Minister of Law and Human Rights Number 3 of 2018 concerning Conditions and Procedures for Granting Remission, Assimilation, Leave to Visit Family, Parole, Leave Before Release, and Conditional Leave jo. Regulation of the Minister of Law and Human Rights of the Republic of Indonesia Number 7 of 2022.

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REFERENCES

- 1) Hafrida, 2016, *Metode Penelitian Hukum*, Jambi: Fakultas Hukum Universitas.
- 2) Iqraq Sulhin, "*Filsafat (Sistem) Pemasyarakatan*", *Jurnal Kriminologi Indonesia*, Vol. 7 No.1, 2010.
- 3) Kamea, H.C., "*Pidana Penjara Seumur Hidup dalam Sistem Hukum Pidana Di Indonesia*", *Lex Crimen*, Vol. 2, No.2, 2013.
- 4) Ksenija Butorac, *et.all*, "*The Challenges in Reducing Criminal Recidivism*", *Public Security and Public Order*, Vol. 18, No. 5, 2017.
- 5) Kuart puji prayitno, "*Restorative justice untuk Peradilan di Indonesia: Perspektif Yuridis Filosofis Dalam Penegakan Hukum*", *Jurnal Dinamika Hukum*, Vol. 12, No. 3, 2012.
- 6) M.Solehuddin, 2003, *Sistem Sangsi dalam Hukum Pidana Ide Dasar Sismtem Double Track dan Implementasinya*, Jakarta: PT granfindo persada.
- 7) Marlina, 2011, *Hukum Penitensir*, Bandung: PT Refika Aditama.
- 8) Muhammad Raja Haholongan, "*Lembaga Pemasyarakatan, Pembebasan Bersyarat, Narapidana*", *Jurnal Pendidikan Tambusai*, Vol 6, No , 2022.
- 9) Nico Ngani, 2012, *Metodelogi Penelitian dan Penulisan Hukum*, Yogyakarta: Pustaka Yustisia.
- 10) Petrus Irwan Panjaitan dan Pandapotan Simorangkir, 1995, *Lembaga Pemasyarakatan Dalam Perspektif Sistem Peradilan Pidana* , Jakarta: Pustaka Sinar Harapan.
- 11) Petrus Irwan Pandjaitan dan Wiwik Sri Widiarty, 2008, *Pembaharuan Pemikiran Dr. Sahardjo Mengenai Pemasyarakatan Narapidana*, Jakarta: CV Indhill CO.
- 12) Retno Saraswati, "*Desain Sistem Pemerintahan Presidensial yang Efektif*", *Jurnal MMH*, Vol. 41 No. 1, 2012.

A Review of Legal Justice: Parole in The Indonesian Prison System

- 13) Rico Vincent, 2010, *Pemberian Hak Pembebasan Bersyarat Bagi Narapidana (Studi Kasus Pada Lembaga Pemasyarakatan Kelas Iia Wirogunan Yogyakarta)*, Yogyakarta: Fakultas Hukum Universitas Atmajaya.
- 14) S. Rahayu, 2017, *Konflik Rasial Antara Etnis Tionghoa Dan Pribumi Di Surakarta*, Jakarta: Buana.
- 15) Saleh Roeslan, 1983, *Stelsel Pidana Indonesia*, Jakarta: Aksara Baru.
- 16) Soedjono Dirjosisworo, 1984, *Fungsi Perundang-Undangan Pidana dalam Penanggulangan Korupsi di Indoensia*, Bandung: PT. Sinar Baru.
- 17) Suyanto, "Efektivitas Pelepasan Bersyarat dalam Pembinaan Narapidana", *Jurnal Pro-Hukum*, Vol 1, No 2., 2016.
- 18) W.A. Fauzi, "Pelaksanaan Pemberian Hak Pembebasan Bersyarat Bagi Narapidana Tindak Pidana Umum", *Nusantara : Jurnal Ilmu Pengetahuan Sosial*, Vol. 8, No. 2, 2021.
- 19) Warmadewa, "Pembebasan bersyarat, Lembaga Pemasyarakatan, Narapidana", *Jurnal Analogi Hukum*, Vol 1, No 3, 2019.
- 20) Zainal Askin, 2020, *Pengantar Ilmu Hukum*, Depok: PT Raja Grafindo.



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Fostering Prisoners in the Correctional System in Indonesia



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ABSTRACT: The correctional system is an order regarding the direction and limits and ways of fostering correctional prisoners based on Pancasila, which is carried out in an integrated manner between the coach, the fostered, and the community to improve the quality of correctional prisoners so that they realize their mistakes, improve themselves, and do not repeat criminal acts so that they can be accepted back by the community, can actively participate in development, and can live reasonably as good and responsible citizens. However, the quality of the implementation of the correctional system is not optimal and is still in the public spotlight. The suboptimal implementation of the correctional system has an impact on the quality of treatment of detainees and prisoners, as well as the emergence of tactical problems that then surface. Various problems such as riots in prisons, drug trafficking networks controlled from within prisons, the growth of radical ideas, service discrimination, overcrowded, and others are very disturbing in achieving the objectives of the correctional system. This research is normative juridical in nature. This research focuses on examining the application of rules or norms in terms of theoretical, principles, conceptions, legal doctrines and the content of positive legal rules. The approaches used in this research and dissertation research are conceptual approach, statute approach, comparative approach and case approach. The results of this research, the development of prisoners can be through policy programs that include, assimilation and social reintegration. In addition, also through revitalization. Revitalization of Correctional Implementation is an effort to optimize the implementation of the correctional as a form of treatment of detainees, prisoners and clients as well as protection of ownership rights to evidence.

KEYWORDS: Prisoners; Development; Correctional System.

I. INTRODUCTION

In Indonesia itself, the history of imprisonment starts from the period of forced labor between 1872-1905, during this period in Indonesia there were two types of criminal law, namely the Special Criminal Law for Indonesians and the Special Criminal Law for Europeans. Furthermore, in the period before the enactment of the "Wetboek van Strafrecht Voor Nederlandsch-Indie" (KUHP 1918/1905-1921), this period was marked by efforts to concentrate convicts of forced labor who were scattered everywhere in regional shelter centers. The implementation of punishment in Indonesia after the enactment of the Criminal Code 1918 was characterized by the enactment of the Prison Regulations, Ordinance V.I and also housing regulations for various penal institutions.

Before the correctional system emerged, the prison system was implemented in Indonesia. The concept of prison originated from Europe and was brought by the Dutch to Indonesia. The concept of imprisonment grew and originated from a liberal view, so that it greatly influenced all components of the prison system.²⁴ The prison system is a system of treatment for the convicted (prisoners), where this system is the purpose of imprisonment for those who have been proven to have committed a criminal offense and then by the court sentenced (criminal). And this prison system emphasizes physical violence against prisoners who have committed crimes.¹

According to Dwidja Priyatno, the correctional system adopted by Indonesia, regulated in law number 12 of 1995 concerning pemasyarakatan, this is the implementation of imprisonment, which is a juridically philosophical change of ideas from the prison system to the correctional system.²

The principle adopted in the correctional system today places detainees and prisoners, state children and other

¹ Harsono, 1995, *Sistem Baru Pembinaan Narapidana*, Jakarta: Djambatan, p. 5-8.

² Dwidja Priyatno, 2006, *Sitem Pelaksanaan Pidana Penjara Di Indonesia*, Bandung: Refika Aditama, p. 3.

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prisoners as subjects and are seen as individuals and ordinary citizens and are faced not with a background of retaliation but with guidance. The differences between the two systems have implications for differences in the ways of guidance and guidance carried out. The correctional system in addition to aiming to restore the prisoners as good citizens also aims to protect the community against the possibility of repetition of criminal acts by prisoners, as well as an application and an integral part of the values contained in Pancasila.

The idea of correctional was initiated by Sahardjo on July 5, 1963 in a speech conferring the title of Doctor Honoris Causa in the field of law by the University of Indonesia. In his speech he gave a formulation of the purpose of imprisonment is in addition to causing pain to the convict due to the loss of freedom of movement, guiding the convict to repent, educating so that he becomes a useful member of the Indonesian social community. In short, the purpose of imprisonment is correctional. The term "Correctional" officially replaced the term imprisonment since April 27, 1964 through the written mandate of President Ir. Soekarno which was read at the conference of the Office of Prison Officials in Lembang Bandung. This mandate was intended in the context of "retooling" and "reshaping" of the prison system which was considered not in harmony with the idea of pengayoman as the conception of national law with the personality of Pancasila.³

The concept of corrections at the beginning of its formation as stipulated in Law Number 12 of 1995 concerning Corrections as a manifestation of a shift in the function of punishment which is no longer just a deterrent, but also an effort to rehabilitate and social reintegration of Prisoners. After twenty-two years of enactment of Law No. 12 of 1995 on Corrections, the implementation of the correctional has developed considerably. Corrections, whose scope of role was originally limited to the adjudication phase, has now developed to the pre-adjudication phase and the post-adjudication phase which is realized in the state detention center (rutan), state confiscated object storage house (rupbasan), correctional center (bapas) and correctional institutions (lapas). Corrections is present not only as a guarantee of protection for the person but also covers the property attached to it.⁴

Based on article 1 number 2, the correctional system is an order regarding the direction and limits and ways of fostering correctional prisoners based on Pancasila, which is carried out in an integrated manner between the coach, the coached, and the community to improve the quality of correctional prisoners so that they realize their mistakes, improve themselves, and do not repeat criminal acts so that they can be accepted back by the community, can actively participate in development, and can live reasonably as good and responsible citizens.

The correctional system has a place to foster prisoners which is commonly called the Correctional Institution (Lapas). Correctional Institution (Lapas) in Indonesia has the meaning as a place to foster prisoners based on the norms of Pancasila which is carried out in an integrated manner between the coach, the coached and the community so that prisoners can realize their mistakes and become better human beings and not repeat criminal acts again. In its development, the correctional system, which aims at social integration, continues to process in an effort to face challenges, the dynamics of rapid changes in the times related to politics, law, science, technology, economics and modernization of social changes in society.⁵

Along with the development, the Correctional Institution is no longer just a prison for convicts but in fact its main tasks and functions also include the fulfillment of services to prisoners, care for state confiscated goods, security, and guidance of prisoners and correctional clients. Therefore, the sub-system of the correctional system is not only the Correctional Institution that carries out guidance, but there is also a State Detention Center intended for detainee services, State Confiscated Goods Storage House intended for the maintenance of state confiscated goods owned by prisoners or used as evidence, and Correctional Center intended as guidance for prisoners and correctional clients.

The function of the correctional system is to prepare correctional prisoners in order to integrate healthily with the community, so that they can be restored to their nature as human beings in their relationship with the creator, with their person, with their neighbors and their environment. More or less since 1954 in Indonesia, especially in Jakarta, the capital city, special judges have been formed to try children with the assistance of prayuwana employees, but detention is generally still united with adults.

Today, the suboptimal quality of the implementation of the correctional system carried out by the Correctional Technical Implementation Unit, in this case the Correctional Institution (Lapas), is still in the public spotlight. The suboptimal implementation of the correctional system has an impact on the quality of treatment of detainees and prisoners, as well as the

³ Andri Rinanda Ilham, "Sejarah Dan Perkembangan Konsep Kepenjaraan Menjadi Masyarakat", Jurnal Kajian, Penelitian dan Pengembangan Pendidikan Sejarah, Vol. 5, No. 1, 2020, p. 2.

⁴ Adi Sujatno, 2004, *Sistem Masyarakat Indonesia Membangun Manusia Mandiri*, Jakarta: Direktorat Jenderal Masyarakat Departemen Hukum dan HAM RI, p. 24.

⁵ Umar Anwar dan Rachmayanthi, 2021, *Politik Hukum dan Masyarakat*, Depok: Rajawali, p. 3-4.

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emergence of tactical problems that then surface. Various problems such as riots in prisons, drug trafficking networks controlled from within prisons, the growth of radical ideas, service discrimination, overcrowded, and others are very disturbing in achieving the goals of the correctional system.⁶

It is also felt that the implementation of correctional facilities does not guarantee legal certainty for the protection and fulfillment of the rights of prisoners in vulnerable groups. This indicates a problem in correctional governance. The overcapacity situation that occurs in prisons in Indonesia today then causes a lot of losses both for individuals who live it such as not fulfilling the basic rights of each detainee / prisoner including his family to the fullest and the State as the organizing party, which this problem has occurred for years in Indonesia. But it seems that until now it has not found the right formulation to overcome this.

Some of the issues that cause the need for correctional revitalization are the increasing number of residents (over crowded) and the limited occupancy capacity in prisons / detention centers, public demands in providing services for prisoners and the emergence of an image that prisons / detention centers are institutions that only spend the state budget. Thus, it is necessary to revitalize the correctional system. The work mechanism in all UPT Corrections must be correlated with the legislation as legal substance so that the correctional is able to work optimally and effectively in engineering the legal culture of correctional prisoners. Structuring and updating correctional management is needed to follow the dynamics of the development of human life so that the purpose of coaching, namely prisoners not repeating legal acts and educating them to have social and entrepreneurial skills can be achieved.

Challenges and demands on prisons due to the complexity of life in society which have implications for the increasing number of residents and make prisons over crowding so as to make the purpose of Corrections for the reintegration of Prisoners difficult to realize need to be addressed immediately. The idea of Correctional Revitalization is considered suitable to answer the existing conditions. Through the Regulation of the Minister of Law and Human Rights of the Republic of Indonesia Number 35 of 2018 concerning Revitalization of the Implementation of Corrections as a form of seriousness and a new round of efforts in overcoming the complexity of correctional problems. Correctional Revitalization is in the spotlight of public attention. Not only in terms of its effectiveness but also in its application related to fulfilling a sense of justice and upholding human rights.

By taking into account this background, the development of prisoners in the correctional system in Indonesia is expected to continue to be improved to create a safer and more dignified environment for the entire community.

II. RESEARCH METHOD

This research is normative juridical in nature. This research focuses on examining the application of rules or norms in theoretical matters, principles, conceptions, legal doctrines and the content of positive legal rules. The approaches used in this research and dissertation research are conceptual approach, statute approach, comparative approach and case approach. The source of legal materials used to review or analyze the subject matter in this dissertation writing consists of primary legal materials, secondary legal materials and tertiary legal materials.

III. RESULT AND DISCUSSION

Development of Prisoners in the Correctional System in Indonesia

The existence of a coaching model for prisoners in the Penitentiary is inseparable from a dynamic, which aims to provide more provisions for prisoners in welcoming life after completion of the sentence (free). As was the case long before, the terminology of the Prison has also undergone changes to become correctional. The birth of the term Correctional Institution was chosen in accordance with the vision and mission of the institution to prepare prisoners to return to society.

According to Gillin and Gillin, some general characteristics of community institutions include:⁷

1. A social institution is the organization of patterns of thought and patterns of behavior manifested through social activities and their results. Social institutions consist of customs, manners, habits and other cultural elements that are directly or indirectly incorporated into a functional unit.
2. A certain degree of permanence characterizes all social institutions. Belief systems and various kinds of actions, will only become part of a social institution after a relatively long time.

⁶ Yuliyanto, et.all., 2021, *Implementasi Peraturan Menteri Hukum Dan Hak Asasi Manusia Nomor 35 Tahun 2018 Tentang Revitalisasi Penyelenggaraan Pemasyarakatan*, Jakarta: Balitbangkumham, p. 2.

⁷ Ismail Pettanase, "Pembinaan Narapidana Dalam Sistem Pemasyarakatan", *Jurnal Universitas Palembang*, Vol. 17 No. 1, 2019, p. 57-58.

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3. Social institutions have one or more specific goals.
4. Community institutions have equipment used to achieve the objectives of the institution concerned, such as buildings, equipment, machinery and so on. The form and use of these tools are usually different from one society to another.
5. Symbols are usually characteristic of social institutions. The symbols symbolically describe the purpose and function of the institution concerned.
6. A social institution has a written or unwritten tradition, which formulates its objectives, applicable rules and others.

Correctional Institution is one of the components in the Criminal Justice System in Indonesia that is tasked with providing guidance to prisoners. Criminal Justice System is a system of law enforcement as an effort to overcome crime. The Criminal Justice System consists of 4 components (sub-systems), namely the police sub-system, the prosecutor's sub-system, the court sub-system and the correctional institution sub-system. The implementation of the correctional system also requires the participation of the community, both by cooperating in coaching and by being willing to accept the return of prisoners who have completed serving their sentences.⁸

The four sub-systems in the Criminal Justice System have different tasks, but they all have the same goal and are closely related. If one of the sub-systems does not perform its duties properly, it can affect the system as a whole. The Penitentiary Institution as the last sub-system directly dealing with prisoners to carry out guidance, has a strategic position in realizing the ultimate goal of the Criminal Justice System. Correctional Institution is expected to be able to realize the ultimate goal of Criminal Justice System, which is to prevent crime.

The Correctional System in addition to aiming to return Prisoners as good citizens, also aims to protect the community against the possibility of repetition of criminal acts by Prisoners, as well as an application and an integral part of the values contained in Pancasila.

In further development, the Correctional System began to be implemented since 1964 supported by Law No.12 of 1995 concerning Corrections. The Correctional Act strengthens efforts to realize a correctional system which is a coaching order for prisoners. With reference to this idea, former Minister of Law and Human Rights Hamid Awaludin said that the correctional system is a coaching process carried out by the state to prisoners and detainees to become human beings who realize their mistakes.

With the use of the correctional system as a method of fostering prisoners, it is clear that there is a change in the function of the Penitentiary Institution, which was previously a place of retaliation, to a place of guidance. In its journey, the form of guidance applied to prisoners includes:⁹

1. Coaching in the form of direct interaction of a familial nature between the coach and the coached;
2. Persuasive coaching, which is trying to change behavior through example;
3. Coaching is planned, continuous and systematic;
4. Personality development which includes awareness of religion, nation and state, intellectual, intelligence, legal awareness, skills, mental and spiritual.

Experts in the field of prison (penolog) recognize that there are 3 (three) main elements if the correctional goal is achieved, namely: 1) officers; 2) prisoners; and 3) the community. The consideration of the community element is something rational and appropriate considering several things that the convict is a member of the community who has violated the law, and the convict will also return to the community after serving the sentence.

The correctional system as a direction for the guidance of prisoners in the penitentiary has not achieved adequate results, with several indicators:

1. Prisoners who escape from the penitentiary.
2. Violation of prisoners' rights.
3. Rejection of former prisoners by the community.
4. Limited facilities and infrastructure in supporting coaching.

The Ministry of Law and Human Rights as the umbrella of the Indonesian correctional system, organizes the correctional system so that prisoners can improve themselves and not repeat criminal acts, so that prisoners can be accepted back into their community, return to actively participate in development and live reasonably as a citizen.

There are several policy programs for the development of prisoners as stipulated in Law Number 12 of 1995 concerning

⁸ Adi Sujatno, *Op.Cit.*, p. 21.

⁹ Departemen Kehakiman, 1990, *Pola Pembinaan Narapidana/Tahanan*, Jakarta: Mahkamah Agung, p. 5.

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Corrections. The policy program includes:¹⁰

1. Assimilation In assimilation, various kinds of coaching programs are packaged, one of which is the provision of work training and production to prisoners.
2. Social Reintegration In social integration, two forms of coaching programs are developed, namely parole and leave before release.
 - a. Conditional release is the granting of release with several conditions to prisoners who have served two-thirds of their sentence, where two-thirds is at least nine months.
 - b. Pre-release leave is the granting of leave to prisoners who have served two-thirds of their sentence, where the two-thirds period is at least nine months.

However, there are problems faced by the ranks of the Ministry of Law and Human Rights under the Directorate General of Corrections (Ditjen PAS) which takes care of prisons throughout Indonesia into a serious problem that must be faced and need to be evaluated on these various issues. The problems that are always faced must have fundamental things faced by the ranks of Corrections both from the direction of policy and prison management that must be addressed. The existence of these problems shows that the correctional system in the form of regulations, policies and good governance, will determine the sustainability of the organization in this case all Correctional Technical Implementation Units (UPT) in order to run in accordance with what is the ideals and objectives by carrying out various strategic policy steps in its management.

In response to this, the Ministry of Law and Human Rights of the Republic of Indonesia made a policy contained in the Regulation of the Minister of Law and Human Rights of the Republic of Indonesia Number 35 of 2018 concerning Revitalization of the Implementation of Corrections, hereinafter referred to as Permenkumham No. 35 of 2018, where all Correctional Technical Implementation Units (UPT) must improve themselves. It cannot be denied that so far, prisons and detention centers have not maximized their functions, and can even be considered to have deviated from the original purpose of their establishment, which aims to foster. In the Permenkumham, it is stated that the Revitalization of Correctional Implementation is an effort to optimize the implementation of correctional services as a form of treatment for detainees, prisoners and clients as well as protection of ownership rights to evidence.¹¹

Correctional revitalization includes 4 (four) main regulatory aspects, namely detention services, inmate development, client guidance and management of state confiscated goods and state booty. In the correctional revitalization program in the aspect of prisoner development, correctional institutions have a classification based on the level of risk of prisoners who inhabit correctional institutions. These classifications include Super Maximum Security prisons, Maximum Security prisons, Medium Security prisons and Minimum Security prisons. The use of the classification of prisoner placement has the aim of being able to categorize according to the needs and risks of prisoners so that the treatment given to prisoners is successful, because this concept emphasizes behavior change. The division of this classification is also a progressive step in implementing individualized treatment as part of evidence-based correctional treatment (evidence or data-based coaching) to encourage objectivity and accountability of prisoner assessments.

The implementation of prisoner development through the Revitalization of the Implementation of Corrections is divided into 4 stages as a classification of placement. First, the Super Maximum Security Prison is a classification of prisons intended for prisoners with high risk levels.¹² As in the rules of Correctional revitalization, elements that classify high-risk prisoners include prisoners at risk of endangering state security and or endangering public safety. The purpose of imprisonment at the Super Maximum Security stage is to raise the self-awareness of prisoners, which focuses on changing the attitudes and behavior of prisoners which has implications for reducing the level of risk and protecting the community. In the coaching system, the method used is individual separation. The placement of prisoners is placed in each room or one man one cell. In terms of restrictions, in accordance with the provisions in Article 27 paragraph (2) of Permenkumham No. 35/2018 concerning Revitalization of the Implementation of Corrections that prisoners who are in this stage are not given reintegration rights such as remission, assimilation, leave to visit family, parole, pre-release leave and conditional leave.

Second, the Maximum Security Prison is a classification of prisons that emphasizes the pattern of guidance to encourage prisoners to obey and order the law, be aware of their violations and internalize disciplinary attitudes and behavior. Prisoners who are placed at this stage are prisoners who are transferred from Super Maximum prisons who qualify with a decrease in the level of risk and behavioral changes based on Litmas and recommendations at the TPP Session. The coaching pattern applied

¹⁰ Harsono, *Op.Cit.*, Jakarta: Djambatan, p.32.

¹¹ Yuliyanto, et.all., *Op.Cit.*, p. 4.

¹² *Ibid.*, p. 4.

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with the limited observation method, where the placement of prisoners has been put together with other prisoners or in groups. At this stage, inmates are not limited in their reintegration rights but still consider the provisions and Litmas and recommendations at the TPP hearing.

Third, Medium Security prisons are prisons with treatment that focuses on preparing the return of prisoners to society and prisoners as subjects strengthened by the existence of guidance that directs the interests and talents by exploring the potential of prisoners to be developed. Where in the treatment of prisoners can develop themselves in harmony with the right to develop themselves. Therefore, in the method of coaching inmates in order to optimize their potential, there is a classification of coaching, namely education and training for entry-level skills, education and training for advanced skills, and education and training for advanced skills. So that the pattern used by Medium Security Prisons is to assimilate and apprentice prisoners.

Fourth, the Minimum Security Prison is a prison with treatment that emphasizes the provision of reintegration and coaching outputs that lead to the production of industrial-scale goods or services. Therefore, prisoners are given leeway in security and given trust and responsibility due to changes in attitude and behavior. This is done to motivate prisoners to increase their independence and productivity. The embodiment of the Minimum Security Prison is an open prison. Where in the concept applied by open prisons with Community Based Corrections, namely the method of coaching by involving elements of the community and by providing looser security even without iron bars like prisons in general which aims at reintegration (reunification) with the community.

The revitalization of the correctional system has strengthened the role of Community Research (Litmas) in carrying out correctional duties and functions. Litmas is carried out in an effort to reveal the background of criminal acts to determine the level of risk and needs of lawbreakers, determine detention service programs, processes and stages of WBP development, evaluate the implementation of development programs, and determine the success of handling WBP. In addition, as an implementation of the Regulation of the Minister of Law and Human Rights of the Republic of Indonesia Number 35 of 2018 concerning Revitalization of the Implementation of Corrections, the Directorate General of Corrections of the Ministry of Law and Human Rights launched the Prisoner Development Assessment System (SPPN) which functions as an instrument for assessing changes in prisoner behavior which will then be used as primary supporting data in providing rights and coaching programs to prisoners.¹³

IV. CONCLUSIONS

There are several prisoner development policy programs as stipulated in Law Number 12 of 1995 concerning Corrections. The policy program includes assimilation and social reintegration. In assimilation, various kinds of coaching programs are packaged, one of which is the provision of work training and production to prisoners. Whereas in social reintegration two kinds of coaching programs are developed, namely parole and leave before release, namely: (1) parole is the granting of release with several conditions to prisoners who have served two-thirds of their sentence, where two-thirds is at least nine months; and (2) leave before release is the granting of leave to prisoners who have served two-thirds of their sentence, where the two-thirds period is at least nine months. In addition, the implementation of prisoner development through the revitalization of the Correctional Institution is divided into 4 stages as a classification of placement, namely the Super Maximum security prison is a classification of prisons intended for prisoners with a high level of risk; Maximum Security prison is a classification of prisons that emphasizes the pattern of guidance to encourage prisoners to obey and order the law, be aware of their violations and internalize disciplinary attitudes and behavior; Medium Security prisons are prisons with treatment that focuses on preparing for the return of prisoners to society and prisoners as subjects are strengthened by the existence of guidance that directs the interests and talents by exploring the potential of prisoners to be returned; and Minimum Security prisons are prisons with treatment that focuses on providing reintegration and coaching outputs that direct the production of industrial-scale goods or services.

REFERENCES

- 1) Adi Sujatno, 2004, *Sistem Pemasyarakatan Indonesia Membangun Manusia Mandiri*, Jakarta: Direktorat Jenderal Pemasyarakatan Departemen Hukum dan HAM RI.
- 2) Andri Rinanda Ilham, "Sejarah Dan Perkembangan Konsep Kepenjaraan Menjadi Pemasyarakatan", *Jurnal Kajian*,

¹³ Yudha Cahyo Prabowo, "Perlakuan Terhadap Narapidana Terorisme Risiko Tinggi di Lapas Super Maximum Security", *Jurnal Gema Keadilan*, Vol. 7, No.2, 2020, p. 111.

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Penelitian dan Pengembangan Pendidikan Sejarah, Vol. 5, No. 1, 2020.

- 3) Departemen Kehakiman, 1990, *Pola Pembinaan Narapidana/Tahanan*, Jakarta: Mahkamah Agung.
- 4) Dwidja Priyatno, 2006, *Sitem Pelaksanaan Pidana Penjara Di Indonesia*, Bandung: Refika Aditama.
- 5) Harsono, 1995, *Sistem Baru Pembinaan Narapidana*, Jakarta: Djambatan.
- 6) Ismail Pettanase, "Pembinaan Narapidana Dalam Sistem Pemasarakatan", *Jurnal Universitas Palembang*, Vol. 17 No. 1, 2019.
- 7) R. Soegondo, 2006, *Sistem Pembinaan Napi di Tengah Overload LAPAS Indonesia*, Yogyakarta: Insania CitaPress.
- 8) Umar Anwar dan Rachmayanthi, 2021, *Politik Hukum dan Pemasarakatan*, Depok: Rajawali.
- 9) Yudha Cahyo Prabowo, "Perlakuan Terhadap Narapidana Terorisme Risiko Tinggi di Lapas Super Maximum Security", *Jurnal Gema Keadilan*, Vol. 7, No.2, 2020.
- 10) Yuliyanto, et.all., 2021, *Implementasi Peraturan Menteri Hukum Dan Hak Asasi Manusia Nomor 35 Tahun 2018 Tentang Revitalisasi Penyelenggaraan Pemasarakatan*, Jakarta: Balitbangkumham.



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Factors Influencing Adoption of System of Rice Intensification among Smallholder Farmers in Mvomero District, Tanzania



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ABSTRACT: Adoption of the System of Rice Intensification among Smallholder Farmers (SRI) is important due to its extraordinary potential in production and productivity but there are factors which influence its adoption in different places including Tanzania. This research was conducted in Mvomero District, Morogoro, Tanzania to determine the extent of adoption of innovations in paddy production and analyzed factors influencing this adoption. A cross-sectional research design was adopted and 299 respondents were sampled using simple random technique while the Key Informants were sampled purposively. Data were collected using questionnaire and in-depth interviews. Qualitative data were analyzed using content analysis while quantitative data based on the factors influencing adoption of SRI were analyzed using a Two-limit Tobit model. It was found that Marital status, land ownership, availability of paddy markets, knowledge, age and education level had significant influence on adoption of SRI ($p < 0.05$). It is concluded farmers' knowledge is an important variable in adoption of SRI and hence enhancement of paddy production and productivity. Extension workers are advised to deliver regular extension programmes to farmers to enable them adopt new paddy innovations including SRI. In this case, farmers will be well-informed about the introduced innovations to their setting.

KEYWORDS: SRI, adoption, innovation, paddy, smallholder farmer.

INTRODUCTION

Adoption of paddy innovations is important to rural farmers. It is the decision by the farmers to accept and make use of paddy innovation which is perceived beneficial towards achieving a sustainable increase in farm productivity and leading to improved well-being of respective farmers (Roggers, 2003). Adoption in this case occurs when there is a continued use of paddy innovations by farmers. The concept of innovation includes an application of advanced idea, method, farm practices and inputs which replace the conventional ones. Scholars define innovation as an idea, farming practice, and or a system that is perceived new by individuals (Rogers, 2003; Leeuwis, 2004).

In this study, SRI is defined as a set of paddy production practices which involves twelve practices namely; selection of seeds using floating-sink method, raising seedlings in nursery, transplanting seedlings of 8-15 days old, uprooting and transplanting within 15-30 minutes, keeping uprooted seedlings in moist conditions, single transplanting, transplanting at shallow depth, spacing at 25cm x 25cm, early and regular weeding, water control by alternate flooding and wetting, application of compost manure and disuse of herbicides.

Adoption of SRI is an important aspect which is anticipated to deliver positive results to the rural paddy farming community. However, a few scholarly studies in Tanzania especially the study area have been conducted in this area. Literature show that, adoption of SRI to paddy growers have the following benefits; yields per hectare increases usually by 50% to 200% or more; water requirements are reduced by 25% - 50%; cost of production is reduced by 8% - 20%; minimal capital costs make SRI methods more accessible to poor farmers, who do not need to borrow money; the rice plants under SRI have been noted to be more robust against extreme weather events, pests, and diseases due to plant vigour and strength (Katambara *et al.*, 2013).

Effort has been undertaken by the government of Tanzania (GoT) to introduce and promote paddy innovations to rural farmers including Mvomero District aiming at improving production, productivity and farmers' wellbeing. Since 2005, GoT introduced paddy innovations to farmers including rice varieties – SARO 5 (TXD 306), IR05N 221 (named *Komboka*, be liberated) and IR03A 262 (named *Tai*, eagle); best agronomic practices - SRI, water-saving irrigation technologies, rice planting techniques, Integrated

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Pest Management (IPM), However, the practice shows that paddy farmers do not readily accept innovations immediately. Up to 2015, the GoT through Agricultural Sector Development Strategy (ASDP) phase one and two has been promoting better access and use of agricultural knowledge, technologies, and infrastructure to paddy farmers in 20 irrigation schemes including Mkindo and Dakawa. Similarly, extension agents have been advocating these innovations to ensure that smallholder paddy farmers take in full adoption. Despite the efforts done by the government and extension agents, factors influencing of adoption of SRI in Mvomero District is not yet established. Therefore, this study intended to analyze the factors influencing adoptions of SRI in the area of study.

This study adapts a sociological model of adoption of innovation. The model considers adoption as a learning process and that every person goes through mental steps during that learning process about innovation (Semgalawe *et al.*, 1998). The process involves four stages; awareness, evaluation, trial and adoption. In awareness stage, a farmer learns about the new idea; evaluation stage involves comparison of the expected benefits of the innovation with his/her conventional ones, while in trial stage a farmer decides to try an innovation in a small plot/quantity of paddy and then use it on a larger plot/ quantity of paddy. Adoption stage involves complete application (confirmation) or otherwise discards of the innovation.

METHODOLOGY

The study used cross-sectional data to measure the extent of adopt of each innovation and analyse factors influencing adoption of selected innovations among paddy farmers in Mvomero District in Morogoro Region. Two paddy irrigation schemes in the District namely Mkindo and Dakawa were selected. These schemes are the only smallholder schemes where SRI was introduced upon its arrival to Tanzania. Cross-sectional research design was adopted whereby simple random technique was used to obtain 299 respondents from two schemes and estimated by Yamane’s formula (Yamane, 1973). Proportionate sampling technique was used to obtain 96 and 203 respondents from Mkindo and Dakawa respectively. The study deployed a mixed methods approach which facilitated the deployment of both qualitative and quantitative methods in data collection. Primary data were gathered using questionnaire and in-depth key informant’s interviews (KIIs). Two KIIs were conducted using checklist of questions. Analysis of qualitative data was done through content analysis in which pieces of information from the KIIs were condensed, coded and organized into different themes and compared based on study objective.

The factors influencing adoption of SRI were analyzed using a Two-limit Tobit model. Adoption of SRI was limited between 0 to 12 practices meaning (0) lower limit score and (12) upper limit score. Adoption of SRI involved 12 practices whereby a numerical score of 0 was assigned for non-adoption and 1 was assigned for adoption in each practice. The model used a limited dependent variable whereby the value of the adoption of SRI ranged between 0 and 12 scores. The model was specified as follows:

$$Y_i^* = \beta X_i + \varepsilon_i \dots \dots \dots (1)$$

$$\varepsilon_i \sim \text{Normal } [0, \sigma^2].$$

Denoting Y_i as the censored observed adoption of SRI practices,

$$Y_i = \begin{cases} 0 & \text{if } Y_i^* \leq 0 \\ Y_i^* = X_i \beta_i + \varepsilon_i & \text{if } 0 < Y_i^* < 12 \dots \dots \dots (2) \\ 12 & \text{if } Y_i^* \geq 12 \end{cases}$$

Where:

Y_i = the observed dependent variable, i.e. adoption of SRI, measured in scores upon adopted SRI practices by a farmer ranging from 0-12.

Y_i^* = the latent variable (unobserved for values smaller than 0 and greater than 12).

X_i = is a vector of independent variables (factors influencing adoption and intensity of adoption) which are described in Table 1.

β_i = Vector of unknown parameters.

ε_i = error terms that are assumed to be independently and normally distributed with zero mean and a constant variance σ^2 , and $i=1, 2, \dots, n$ (n is the number of observations).

$X_1 - X_{15}$ = are the predictor variables which are described in Table 1.

The coefficients in Tobit model were farther disaggregated to estimate the expected value of Y_i (Sileshi *et al.*, 2012; Mc Donald and Moffit, 1980) as follows:

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The change in the probability of adopting SRI practices as an independent variable χ_i changes is:

$$d\Phi(\delta)/d\chi_i = \phi(\delta) \frac{\beta_i}{\sigma} \dots\dots\dots(3)$$

The change in intensity of adoption of SRI practices with respect to a change in an explanatory variable among SRI adopters is:

$$\frac{\partial E(Y_i/U)Y_i^*L, X}{\partial X_i} = \beta_i \left(1 + \frac{\delta_L \phi(\delta_L) - \delta_U \phi(\delta_U)}{\Phi(\delta_U) - \Phi(\delta_L)} - \left[\frac{\phi(\delta_L) - \phi(\delta_U)}{\Phi(\delta_U) - \Phi(\delta_L)} \right]^2 \right) \dots\dots\dots(4)$$

Where:

χ_i = explanatory variables,

$\Phi(\delta)$ =the cumulative normal distribution

$(\delta) = \frac{\beta_i \chi_i}{\sigma}$ = the Z-scores for the area under normal curve

β_i = vector of Tobit maximum likelihood estimates

σ = the standard error of the error term

$$\delta_L = \frac{L - \chi_i \beta}{\sigma}$$

$$\delta_U = \frac{U - \chi_i \beta}{\sigma}$$

L and U are threshold values ($L=0$ and $U=12$)

Φ and ϕ are probability density and cumulative density functions of the standard normal distribution, respectively.

Decision-making (DM) and Knowledge were the composite variables that involved procedure in measurement. DM fitted in a two-limit Tobit regression model was determined using scores whereby 3 statements representing DM were assigned scores i.e. 1 =yes and 0=otherwise and decision-making index (DMI) was developed in a range of 0 to 1 for each innovation. The formula was adapted from Meena *et al.* (2012);

$$DMIndex = \frac{TscoreObt}{Maxscore} \dots\dots\dots(6)$$

Where:

$TscoreObt$ = Total scores obtained

$Maxscore$ = Maximum expected score

Knowledge as a variable in this study involved farmers' awareness of SRI. It was determined using scores whereby statements were made to represent knowledge for SRI and assigned scores i.e. 1 =yes and 0=otherwise. There were 13 statements representing knowledge for SRI.

Table 1: Variable Definition, Unit of Measurement and Assumed Influence

Variable	Variables definition and unit of measurement	Expected sign
X ₁	Sex of the paddy farmer (1 if Male, 0 if Female)	+
X ₂	Age of the paddy farmer in years	+/-
X ₃	Marital status of the paddy farmer (1 if married , 0 if otherwise)	+
X ₄	Education of the paddy farmer in terms of years spent schooling	+/-
X ₅	Household size in terms of number of people in the household	+
X ₆	Labour availability (1 if available, 0 if Not)	+
X ₇	Land ownership (1 if owned, 0 if otherwise)	+
X ₈	Farm size for paddy production in hectares	+

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X ₉	Access to extension advisory (1 if yes received, 0 if not)	+
X ₁₀	Access to credit facilities (1 if yes, 0 If Not)	+
X ₁₁	Market availability (1 if yes, 0 if Not)	+
X ₁₂	Relative advantage for adopting SRI (1 if yes, 0 if otherwise)	+
X ₁₃	Total revenue per hectare per production season in 2015 in TZS	+
X ₁₄	Decision making (index score in continuous from 0 to 1).	+
X ₁₅	Knowledge for SRI (in scores; ranging from 0-13 scores).	+

RESULTS AND DISCUSSION

Factors Influencing Adoption of SRI

The overall results of the two-limit tobit regression indicate that adoption of SRI was influenced by marital status, land ownership, market availability, age of the respondents ($p < 0.05$), education level and knowledge of SRI ($p < 0.01$) (Table 2).

The results indicates significant association between marital status and adoption of SRI practices at $p < 0.05$ significance level (Table 2). The chance of adoption of SRI increased for married farmers as compared to unmarried farmers. Further, it was found out that a probability for the marital status is 2.21 and unconditional expected value is 84.38 (Table 2). This means that the probability a married farmer being an adopter of SRI is greater than for unmarried farmer by 2.21 percent and adoption rate increased by 84.38 percent for all respondents. These results imply that married farmers are better positioned to assist each other compared to unmarried farmers. Given the fact that smallholder farmers in rural areas do not rely on hired labour, spouses help each other in production and domestic activities hence facilitates easy practice of the SRI techniques. This is in agreement with Johnson and Vijayaragavan (2011) observation that adoption of SRI practices requires high labour in case of accomplishing activities related to adoption of SRI practices.

The study also found that the association between adoption of SRI practices and farmers' land ownership was significant ($p < 0.05$) (Table 2). The model results similarly indicate that land ownership increased farmers' probability to adopt SRI by 1.48 percent and it increased the rate of adoption of SRI practices by 79.90 percent. This result suggests that farmers with land ownership had higher adoption of SRI than those without ownership by the factor of 1.48 and adoption rate of SRI practices by increased by 79.90 percent. Thus, since land ownership acts as a security which increases farmers' incentives to adopt, it is obvious that land ownership influences adoption decision whereby farmers with land ownership are more likely to adopt SRI practices than those without ownership. In the same manner, Ogotu *et al.* (2015) confirmed that land ownership significantly affects adoption decision of Sustainable Agricultural Intensification technologies (SAI) in multiple ways in Kenya.

Availability of paddy markets is found to be significant determinant factor for the adoption of SRI practices at $p < 0.05$ significant level (Table 2) in the study area as expected. Equally, availability of paddy markets increased probability of adopting SRI practices by 1.99 percent and increased the rate of adoption on average by 77.05 percent (Table 2). This result implies that the availability of paddy markets increased the likelihood of farmers to adopt SRI practices. The reason for increased likelihood of farmers to adopt SRI in light with markets availability is the fact that commercial paddy farmers would like to have high production so as to realize profit. Katambara *et al.* (2013) documented that adoption of SRI practices in Mkindo area produces 6.3 tons/ha compared to 3.83 tons/ha when conventional practices are used.

Moreover, farmers' knowledge has an influence on the adoption of SRI practices. It was expected that farmers' knowledge on SRI to be significant and positively associated with adoption of SRI practices. This study result matches with the expectation at $p < 0.01$ significant level (Table 2). The results also show that for a unit increase in knowledge of SRI, a probability of adopting SRI increased by 1.19 percent and the rate of adoption increased by 56.67 percent for all respondents. This implies that farmers who were aware and knew how SRI techniques are applied had higher chance to adopt this package of innovations compared to farmers who were not knowledgeable on SRI practices. Similar result on the significant and positive relationship between knowledge and adoption of innovations has been reported by other scholars (Ngwira *et al.*, 2014; Sarada and Kumar, 2013; Fita *et al.*, 2012). For instance, Sarada and Kumar (2013) observe that as farmers' knowledge increases, the adoption levels of farmers on recommended production practices also increases.

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Table 2: Two-limit Tobit Model Estimates for Factors Influencing Adoption of SRI (n=299)

Variable	β	SE	t-value	Sig.	Probability	Unconditional expected value
Sex (X ₁)	.100	.3170	0.31	0.753	.0021	.0977
Age (X ₂)	-.022*	.0134	-1.66	0.099	-.0005	-.0217
Marital status (X ₃)	.866**	.3740	2.32	0.021	.0221	.8438
Education level (X ₄)	-.179***	.0579	-3.10	0.002	-.0037	-.1758
Household size (X ₅)	-.044	.0716	-0.61	0.542	-.0009	-.0428
Labour availability (X ₆)	-.189	.3126	-0.61	0.546	-.0038	-.1854
Land ownership (X ₇)	.814**	.3329	2.45	0.015	.0148	.7990
Land size (X ₈)	-.075	.1016	-0.74	0.462	-.0015	-.0733
Access to extension advisory (X ₉)	-.429	.3495	-1.23	0.221	-.0099	-.4185
Access to credit facilities (X ₁₀)	.014	.2907	0.05	0.962	.0003	.0136
Market availability (X ₁₁)	.791 **	.3251	2.43	0.016	.0199	.7705
Perceived relative advantage of SRI (X ₁₂)	-.004	.3510	-0.01	0.992	-.0001	-.0036
Total revenue per hectare per production season in 2015 (X ₁₃)	-1.350e-08	8.61e-08	-0.16	0.876	-2.76e-10	-1.32e-08
Decision making power index (X ₁₄)	-.384	.5923	-0.65	0.517	-.0079	-.3763
Knowledge of SRI (X ₁₅)	.579***	.0434	13.34	0.000	.0119	.5667
_cons	2.798	1.0581	2.64	0.009		
Number of obs	299					
LR chi ² (15)	222.37					
Prob> chi ²	0.000					
Pseudo R ²	0.152					
Log likelihood	-620.9655					

β = Coefficient; SE= Standard error

Note: *, ** and *** indicate statistical significance at 10%, 5% and 1% significance levels respectively.

Age was significantly associated with adoption of SRI practices ($p < 0.1$) (Table 2). Two-limit Tobit regression results also indicate that for a unit increase in age, a probability of adoption of SRI practices decreased by 0.05 percent and on average decreased the rate of adoption by 2.17 percent for all respondents. In addition, during the focus group discussions it was revealed that age of a farmer has an influence on adoption of SRI practices. A Key Informant at Dakawa scheme emphasized:

"...some practices like transplanting seedlings within 15-30 minutes, keeping uprooted seedlings in moist conditions, single transplanting, careful transplanting at shallow depth and transplanting at spacing of 25cm x 25cm are technical and laborious" (KII One at Dakawa village, 13th June, 2016).

This means that as age of a farmer increases, the adoption of SRI practices decreases. Thus, the likelihood of a younger farmer to adopt SRI practices is higher than an older farmer. This could be due to the fact some practices within SRI practices are technical which require measurements, timing and intensive care such that they become hectic and cumbersome for old aged farmers to accomplish. The older farmers, unlike younger farmers who have more propensities in learning and adopting innovations, become unable and unwilling to apply SRI techniques. Similarly, Nayak *et al.* (2016); Akinbode and Bamire (2015); Martey *et al.* (2013); Howley *et al.* (2012) reported that age was negatively associated with the adoption of innovations.

Education level of the respondents is an important aspect in the adoption of an innovation. The evidence from the regression analysis shows that education level was significantly associated with the adoption of the SRI practices at $p < 0.01$ significant level (Table 2). The negative sign of the coefficient shows that as the education level increases, the probability of adopting SRI practices decreases. The two-limit tobit model results also indicate that probability of adoption was 0.0037 and unconditional expected value was 0.1758 (Table 2), meaning that an increase in education level decreased farmers' probability to adopt SRI practices by 0.37 percent and adoption rate declined by 17.58 percent for all respondents. This means, farmers with low level of education were more willing to adopt SRI practices than the farmers with high level of education. Farmers with high level of education tend

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to have off-farm (professional or entrepreneurial) activities and therefore would prefer less tedious and time saving farm techniques. The same is true for Shah *et al.* (2014) and Martey *et al.* (2013) who asserted a negative relationship between education level and adoption of rice innovations in Northern Ghana and Bangladesh respectively. These researchers pointed out that educated farmers deflect their skills to off-farm employment opportunities and are unwilling to adopt farm innovations.

This suggestion is supported by the field observation and KII made during the data collection. A paddy farm of one farmer, a Masters Degree holder, and a researcher in Cholima Agro-Scientific research centre was planted paddy using broadcasting system instead of adopting SRI practices. He gave the following reason for not using SRI practices;

“...the SRI practices like transplanting at spacing of 25cm x 25cm and transplanting single seedling per hole is laborious and costly to hire labourers for large plots like mine” (KII Two, 24th May, 2016).

This finding indicates that though a farmer had relatively higher education, he opted for conventional practices than adopting SRI practices. The laborious nature of innovation consumes a lot of time that a farmer could spend for other off-farm activities. Nirmala and Vasantha (2013) had similar observation. They described that non-adoption of SRI practices such as seed treatment, preparation of raised seed bed, application of organic manure, planting single seedling at 25 cm x 25 cm spacing at shallow depth was due to laborious nature of practices.

CONCLUSION AND RECOMMENDATIONS

This study indicates that only farmers' knowledge is an important variable in adoption of each innovation. Therefore, farmers' knowledge to practice SRI is imperative towards increased paddy production and productivity. The land ownership gives a farmer the right and security which is a motivation to adopt innovations. It further revealed that although extension services are crucial in promoting paddy farming, if not well programmed to promote innovations, there is a possibility to constrain adoption of such innovations. Available paddy markets at farm level are an opportunity that motivates farmers to adopt innovations and eventually raise their production and productivity.

Since knowledge was an important aspect in the adoption of innovations, therefore extension officers are advised to educate and train farmers to clearly understand and eventually practice the innovations. In order to avoid negative influence of extension services, extension officers and agricultural interventionists should design farm-level innovations that reflect the paddy production and processing attributes of the potential recipients in the rural farmers' communities.

REFERENCES

- 1) Akinbode, W. O. and Bamire, A. S. (2015). Determinants of adoption of improved maize varieties in Osun State, Nigeria. *Journal of Agricultural Extension and Rural Development* 7(3): 65 – 72.
- 2) Fita, L., Trivedi, M. and Tassew, M. (2012). Adoption of improved dairy husbandry practices and its relationship with the socio-economic characteristics of dairy farmers in Ada'a District of Oromia state, Ethiopia. *Wudpecker Journal of Agricultural Research* 4(14): 392 – 395.
- 3) Howley, P., Donoghue, C. O. and Heanue, K. (2012). Factors affecting farmers' adoption of agricultural innovations: A panel data analysis of the use of artificial insemination among dairy farmers in Ireland. *Journal of Agricultural Science* 4(6): 171 – 179.
- 4) Katambara, Z., Kahimba, F. C., Mahoo, H. F., Mbungu, W. B., Mhenga, F., Reuben, P., Mugo, M. and Nyarubamba, A. (2013). Adopting the system of rice intensification in Tanzania: A review. *Agricultural Sciences* 4(8): 369 – 375.
- 5) Leeuwis, C. (2004). *Communication for Rural Innovation: Re-thinking Agricultural Extension*. (3rd Ed.), Blackwell Science Ltd., Oxford, UK. 412pp.
- 6) Martey, E., Wiredu, A. N., Asante, B. O., Annin, K., Dogbe, W., Attoh, C. and Al-Hassan, R. M. (2013). Factors influencing participation in rice development projects: The case of smallholder rice Farmers in Northern Ghana. *International Journal of Development and Economic Sustainability* 1(2): 13 – 27.
- 7) McDonald, J. and Moffit, R. (1980). The use of Tobit Analysis. *Review of Econometrics and Statistics* 62: 318 – 321.
- 8) Meena, D. K., Ram, H. and Meena, B. S. (2012). Adoption of improved animal husbandry practices by the members and non-members of dairy cooperative societies in Bikaner. *Indian Journal of Dairy Science* 65(4): 356 – 358.
- 9) Nayak, C., Mahunta, R. and Dash, S. (2016). Economic benefits of system of rice intensification in Kendrapara District of Odisha, *International Journal of Applied and Pure Science and Agriculture* 2(6): 220 – 225.

Factors Influencing Adoption of System of Rice Intensification among Smallholder Farmers in Mvomero District, Tanzania

- 10) Ngwira, A., Johnsen, F. H., Aune, J. B., Mekuria, M. and Thierfelder, C. (2014). Adoption and extent of conservation agriculture practices among smallholder farmers in Malawi. *Journal of Soil and Water Conservation* 69(2): 107 – 119.
- 11) Nirmala, K. and Vasantha, R. (2013). Extent of adoption of system of rice intensification cultivation by farmers of Mahabubnagar District of Andhra Pradesh: A critique. *Journal of Research Angrau* 41(4): 79 – 53.
- 12) Ogutu, W. N., Obare, G. A. and Kassie, M. (2015). *Farm Plot Level Determinants of the Number of Sustainable Agricultural Intensification Practices Adopted in a Maize-Legume Cropping System in Kenya*. Discussion Paper No. 9. Adoption Pathways Project, Nairobi, Kenya. 13pp.
- 13) Rogers, E. M. (2003). *The Diffusion of Innovations*. (5th Ed.), The Free Press, New York, London, Toronto, Sydney and Singapore. 543pp.
- 14) Sarada, O. and Kumar, D. G. V. S. (2013). Knowledge and adoption of recommended production technology by cotton farmers, *Journal of Research Angrau* 41(4):54 – 60.
- 15) Semgalawe, Z. M., Folmer, H. and Heijman, W. J. M. (1998). Household adoption behaviour and Agricultural sustainability in the Northeastern Mountains of Tanzania. The case of soil conservation in the North Pare and West Usambara Mountains. Thesis for Award of PhD Degree at Wageningen Agricultural University, Wageningen, the Netherlands, 189pp.
- 16) Sileshi, M., Nyikal, R. and Wangia, S. (2012). Factors affecting loan repayment performance of smallholder farmers in East Hararghe, Ethiopia, *Journal of Developing Country Studies* 2(11): 205 – 213.
- 17) Shah, M. M., Grant, W. J. and Stocklmayer, S. (2014). Adoption of hybrid paddy in Bangladesh: Farm level Experience. *Journal of Agricultural Science* 6(7): 157 – 171.
- 18) Johnson and Vijayaragavan (2011). Diffusion of System of Rice Intensification (SRI) Across Tamil Nadu and Andhra Pradesh in India. *Indian Research Journal of Extension and Education* 11 (3): 72-79.
- 19) Yamane, T. (1973). *Statistics, an Introductory Analysis*. (2nd Ed.), Harper and Row, New York. 1130pp.



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Exploration and Evaluation of PFA (Psychological First Aid): Potential for Development of PFA Online Services in Academic Setting



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ABSTRACT: In Indonesia, PFA (Psychological First Aid) services are primarily employed in distress situations; however, a relatively small number are used in crisis situations, mainly in academic settings through the use of digital media, or what is commonly referred to as PFA online services. Teman Sehati, a PFA online service provided by UIN Prof. K.H. Saifuddin Zuhri Purwokerto, will be addressed in this study. In order to encourage the use of mental health services in academic settings, this research attempts to present an overview of PFA online services. The CIPPO approach (Context Evaluation, Input Evaluation, Process Evaluation, Product Evaluation, and Outcome) was used in the research to apply qualitative evaluation. Research collection methods include documenting, interviewing, and observation. Sorting, classifying, summarising, indexing, and researching primary and secondary sources are all methods used in data analysis. The results of the study indicate that since rooms, networks, and electronic devices serve as the main method of maintaining the service, it is necessary to increase the availability of reliable internet. Every semester, increasing numbers of individuals are in need of this service due to a variety of issues, including physiologic disorders, bullying, financial difficulties, sexual harassment, work-related issues, psychological disorders, academic difficulties, romantic issues, family issues, and personal issues. The online PFA service at UIN Prof. K.H. Saifuddin Zuhri Purwokerto is deemed highly helpful by 92% of service users. Online PFA services can aid in treating students' mental health, despite certain technological challenges; for this reason, it is crucial to implement them in the academic setting.

KEYWORDS: PFA, Online PFA, Academic setting

I. INTRODUCTION

Every aspect of human existence was negatively impacted by the Covid-19 pandemic. One of them is related to human mental health, which is a trending topic that worries mental health professionals. Environmental conditions are changing so quickly and rapidly, making it difficult for society to adapt to changes. One of the disorders experienced by people as the result of this situation is fear, anxiety, boredom, stress and the emergence of psychosomatic disorders (Nasrullah & Sulaiman, 2021). Not only does society in general experience this, but also the students, especially individuals who are currently pursuing higher education. Students as individuals who are entering a transition period in the developmental stages of late teenagers to early adulthoods (Kaligis et al., 2021) are in critical period prone to mental health disorders (Dwi Marsela & Supriatna, 2019). It is further explained that students' mental health continues to change for the worse. Students experience depression and high anxiety stemming from academic pressure, self-esteem, body image, relationships with friends and family (Emmertson, Camilleri, & Sammut, 2024). However, existing mental health services do not meet students' needs (Osborn, Li, Saunders, & Fonagy, 2022). Consequently, universities as organisations have a significant role in supporting society's mental health, mainly for its students (Goodman, 2017). However, in response to the shift from offline to online services, mental health services are also evolving (Feijt et al., 2020). Due to these demands and problems, Teman Sehati is established at UIN Prof. K.H. Saifuddin Zuhri Purwokerto (UIN Saizu) providing mental health services of Psychological First Aid (PFA) for students.

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Psychological First Aid is a psychological intervention model that requires providing immediate assistance and support to individuals experiencing difficulties when facing a crisis situation (Minihan, Gavin, Kelly, & McNicholas, 2020). This crisis situation also happens to students. Therefore, if students' mental health needs are not handled properly, it will affect academic performance, in particular for students who experience depression, anxiety and stress, in contrast to students with good mental health who tend to have good academic performance (Rehman, Jabeen, Joseph, & Hina Bhutto, 2023). It is further explained that mental health problems can also interfere relationships with peers, (Ari Setyawan, 2019) and can make their mental health worse (Kaligis et al., 2021). The existence of PFA in the academic setting can help provide initial psychological assistance which has the potential to reduce the risk of more severe mental health problems by identifying individual needs and connecting them with other parties based on their needs (Suresh, Alam, & Karkossa, 2021). Thus, PFA in an academic setting is a service for students that is organized to help resolve student mental health problems and optimize development and academic achievement functions.

Teman Sehati is psychology service that uses principles of online PFA. This service is intended for UIN Saizu students. Teman Sehati is established since June 2020 until now. Teman Sehati continues to strive to improve its services. Therefore, it needs a systematic evaluation regarding this matter as an effort to provide the best service for students. The evaluation of the service uses CIPPO model (Context, Input, Process, Product, Outcome) (Arikunto & Jabar, 2018). Evaluation of Teman Sehati using CIPPO model aims to determine the steps that need to be taken in developing Teman Sehati services in terms of service context, input, process, products and output. The results of this evaluation are the main guideline in improving and developing Teman Sehati services to be even better. Furthermore, evaluation of Teman Sehati UIN Saizu Purwokerto PFA service can be a model for implementing PFA services in the academic setting, as a form of contribution to the society's mental health, mainly students.

II. METHODS

The qualitative method is used in this research, which is including the process of creating, reporting, applying, and characterizing descriptive data in addition to offering insights into a service (Stufflebeam & Zhang, 2017). Application of PFA online services in academic contexts at UIN Prof. K.H. Saifudiiin Zuhri is the subject of the evaluation. This approach is crucial because it can serve as a catalyst for modifications to academic services that were previously implemented in a traditional manner (Flick, Uwe dkk, 2017). Documentation, observations, and interviews are used to acquire data. Call center (CC) and peer counselor (PC) interviews were done, observations were taken during the service, and quantitative data was documented in service documents and monthly assessment records. Model of evaluation based on the research's impact and influence quantitative data recorded in Teman Sehati's service menu is examined using an evaluation model based on the influence and impact of the study program. The service data from July 2020 to June 2023 was used in this study. Clients as service users, online PFA services, CC and PC as service providers, and auxiliary tools make up the evaluation components. CIPPO (Context Evaluation, Input Evaluation, Process Evaluation, Product Evaluation, Outcome Evaluation) is the model used for evaluation.

III. RESULTS AND DISCUSSION

A. Context Evaluation

The disturbance in mental health care started with the Covid-19 epidemic. Online mental health treatments are replacing offline ones, ready or not. Online PFA is a way for individualized mental health services to deal with this. This is because PFA services are available to everybody, at any time, in any location, and in the event of a crisis or other difficult situation (Naya Prianka, Laras, & Sirait, 2022). The primary target audience is UIN Saizu Purwokerto students, but along the route, other types of clients, such those from other colleges and the general public, are also served. This service's initial goal is to help students maintain their mental health throughout COVID-19, but it will continue long beyond despite the fact that Covid-19 has passed, because service demand is still rising.

UIN Saizu Purwokerto's Career Development Unit (UPTPKarir) is home to Teman Sehati. Teman Sehati works at this unit's Human Capital section, which is in charge of assisting students with their careers and mental health. Two smartphones for the CC (Call Center) and PC (Peer Consellor) are among the facilities in this service, along with an administration computer and printer, a filing cabinet for documents, and other items. Other than that, there are two service rooms: one for operating credit cards and another for using PCs to assist clients who are online. It is intended that by having these two rooms, CC and PC can concentrate on serving clients.

B. Input Evaluation

Peer counsellors (PCs), call centres (CCs), and the communication tools used to deliver these services are the key elements of PFA services. While CC assists clients with administration, PC is in charge of PFA service. Important components of the online PFA

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service procedure are PC and CC. As a result, it's critical to guarantee that human resources can deliver the best possible service. The human resources were drawn from UIN Saizu Purwokerto students, particularly those majoring in Islamic Guidance Counselling (BKI) in the fourth and sixth semesters for PC and CC, respectively. It is taken into account that the student already knows the fundamentals of counselling from the classes he is enrolled in.

Open recruitment is used to complete the recruitment process, with a focus on BKI students. Administrative selection, interviews, and case study observations are all part of the candidate selection procedure. Selected candidates receive outstanding service, PFA material, and administration-related training. The assessment in the training process focuses on comprehending the service process, discipline, and perseverance (Flick & Dkk, 2017). The lecturer overseeing the programme and the recruitment team do the final evaluation. It is intended that by implementing this very stringent hiring procedure, we will reduce potential roadblocks and deliver the best possible service.

C. Process Evaluation

All UIN Saizu students have access to online PFA services through Teman Sehati. It is accessible from 09.00 to 12.00 WIB every Monday through Friday. This service is available on schedule and is continuously tracked by manual and digital absences. The service can be provided in compliance with their respective responsibilities by PC, who oversees PFA services, and CC, who handles administration.

Regarding the service flow, it can be described as follows:

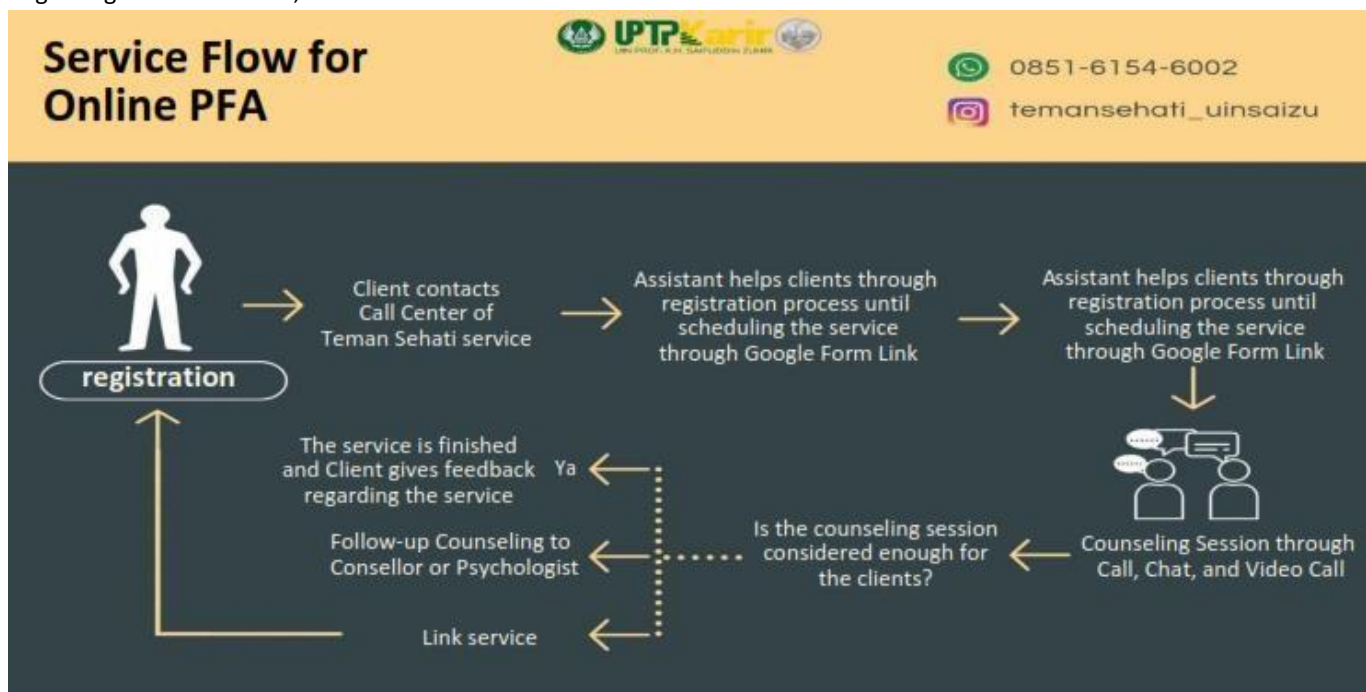


Figure 1. Online PFA Service Flow

In this instance, CC is the officer who guides the client in accordance with the service flow. For clients, this service flow works fairly well. The steps in this service flow that need to be reviewed have to do with follow-up counselling that is sent to UIN Saizu's psychologists and counsellors. However, because there aren't enough psychologists and counsellors to offer clients exceptional care, this follow-up service has been stopped. It is advised that clients follow up by looking for services in the Purwokerto area.

PFA services can be supported by making the best use of resources and equipment, such as service rooms and communication systems for administrative requirements. The following are the issues that CC encountered in the administration section during the service process: 1. Because two administration devices—a computer and a cellphone—are being used, the client code is out of sync, 2). Some clients discontinue their services by failing to complete the service link;3) Some clients abruptly alter their schedules; and4) It can be challenging to manage multiple incoming service requests at once. However, the issues that PC faces are as follows: 1. Internet access for both the client and the service provider; 2. marital issues that make it challenging for PC to offer their services because PC lacks the necessary knowledge or experience in marriage (when clients are not students); and 3. PC feels less at ease offering services to clients who share their difficulties, and 4. delivering treatment that deviates from PFA norms without the client's knowledge. The issues that the entire team is dealing with include 1. Three things go wrong in a team:1)

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poor communication among members;2) poor physical and psychological health; and3) the team doesn't show up for work on time.

The existence of a routine evaluation programme known as "Resik-resik Jiwo" (mental purification) instantly removes these barriers. It aims to give CC and PC the chance to communicate their feelings as a kind of self-care (Coaston, 2017), exchange client service experiences, carry out ongoing system enhancements so that they can effectively serve, and foster teamwork and dedication. This is an outdoor exercise that lasts 180 minutes and involves a casual talk. The process's evaluation is based on the requirement that this meeting be held regularly in order to conduct Resik-Resik Jiwo for 180 minutes once a month. But Resik-resik Jiwo's duration is insufficient for PC and CC to adequately convey their needs.

D. Product Evaluation

Programme accomplishments, such as a description of the issues consumers confront and the quantity of support requests received each semester, are used to gauge the quality of the product. The following graph provides an overview of the issues clients are facing and support requests:

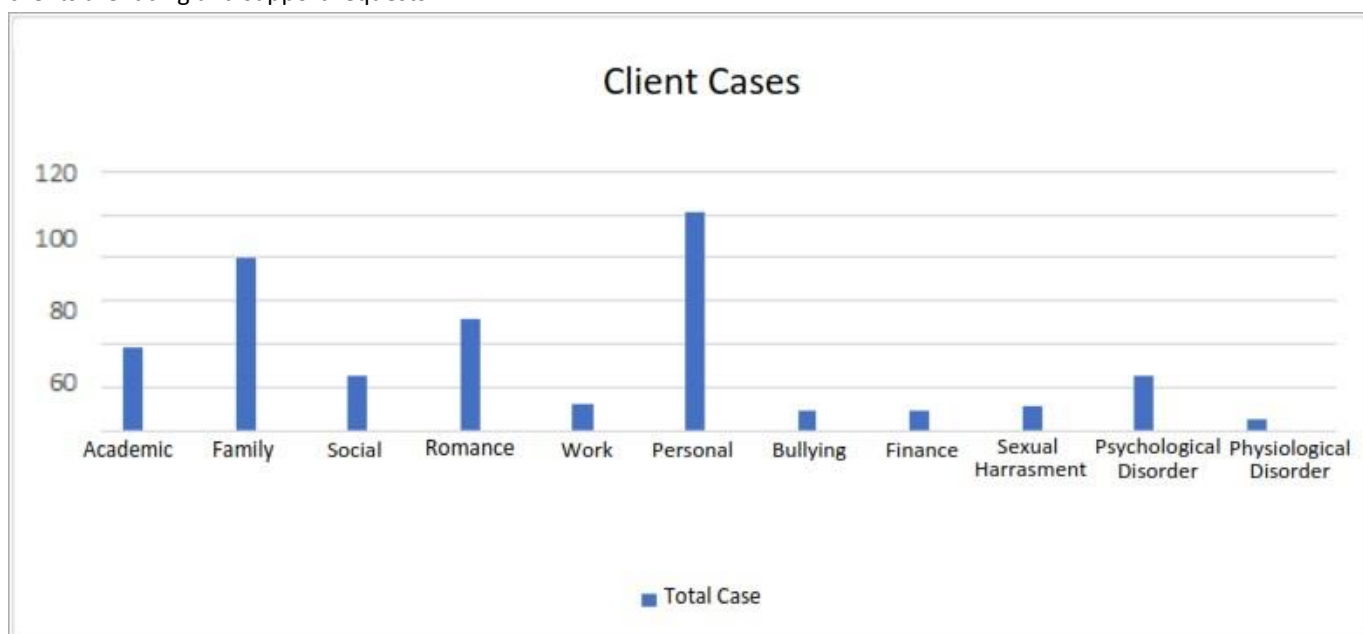


Figure 2. Graphic for PFA Service Cases

This graph shows the problems that clients suffer in order from least to most, including physiological disorders, bullying, finances, sexual harassment, employment, psychological disorders, romance, family, and the most prevalent issue, personal issues. In summary, the issues that clients encounter most frequently are personal issues, such as encompassing their selfevaluation, whereas physiological disorder represent the rarest difficulty that clients encounter. This physiological disorder comprises physical responses from the client's body to the issues they are going through, like nausea, breathing problems, and sleep disorder.

This section also includes a summary of the service requests made each semester, as seen by the customer graph from June 2020 to June 2023.

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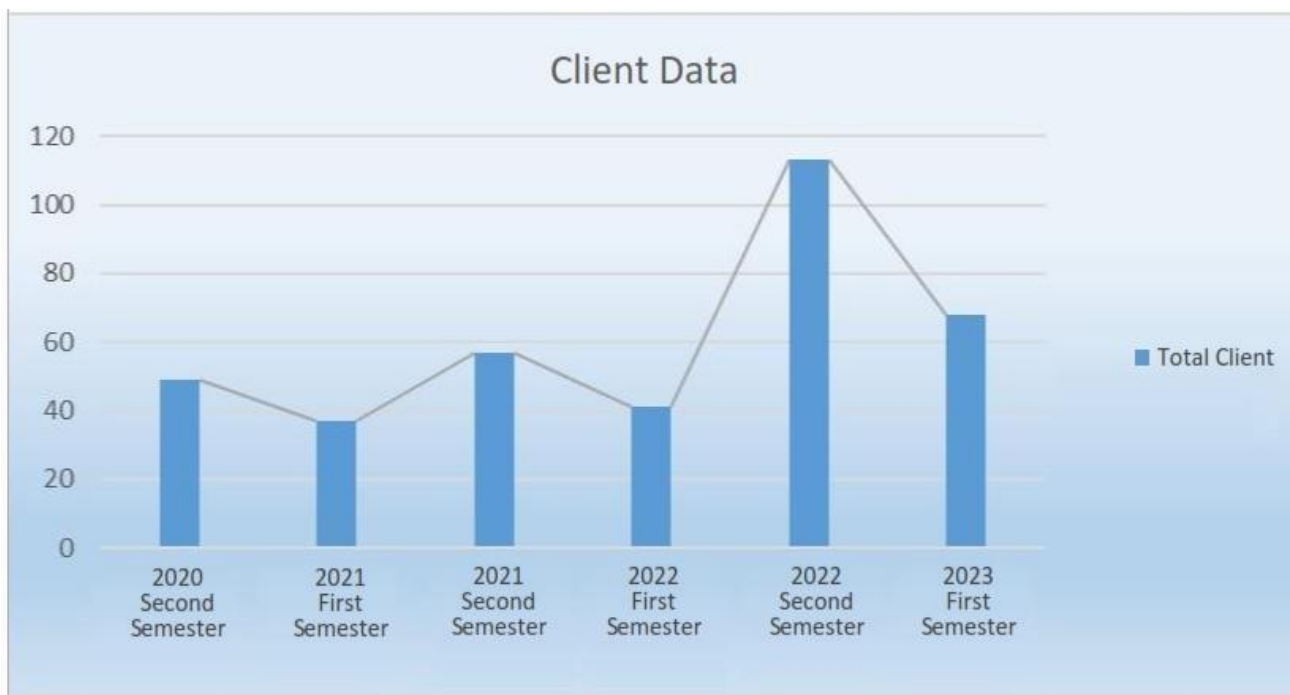


Figure 3. Graphic of PFA Service Request

This graph explains why there tend to be more people using the PFA service each semester. Thus, PFA services are necessary for students at UIN Saizu Purwokerto. Additionally, there are obvious differences in the trends of PFA clients between first and second semesters of the year. It seems that the percentage of clients is higher in the second semester than in the first semester.

E. Outcome

After receiving the service, clients are asked to complete the feedback form available on the provided link. This is how the service is evaluated. When answering the "After receiving PFA Services, how helpful is this service to you rated on a scale of 1–10?" question contained on the link, clients must provide an explanation for their response. The largest scale indicates that the service actually benefits the client, while the smallest scale indicates that the client is not helped at all. 110 clients out of the 362 who received PFA services completed the evaluation form. The graph below displays the outcomes of this service evaluation :

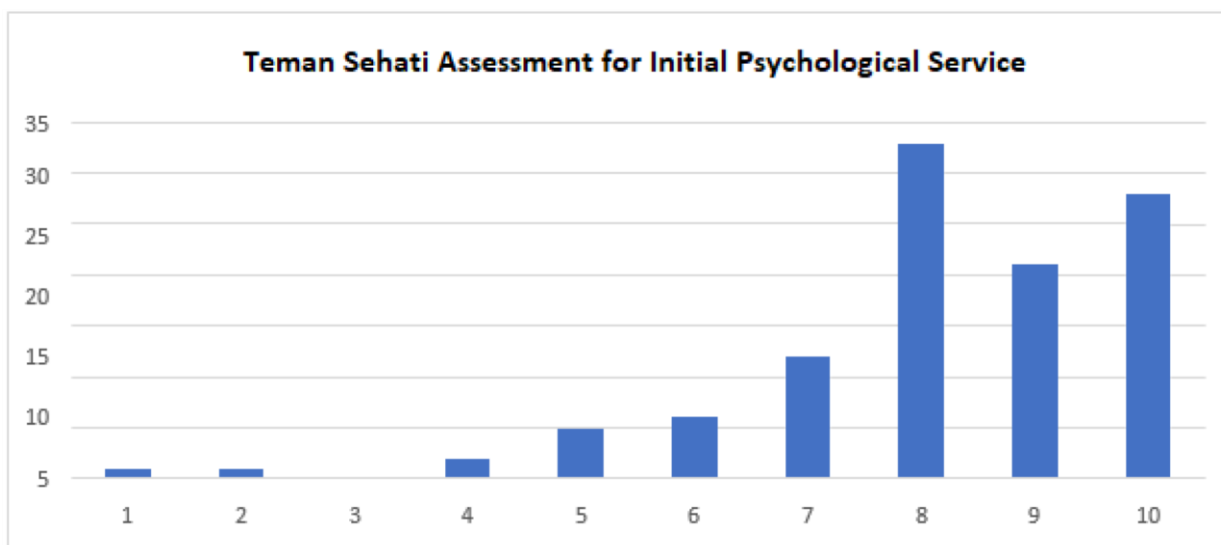


Figure 4. Graphic for PFA Service Assessment

Three types can be identified on the feedback result graph: a). Extremely helpful scoring a 9 out of 10 for 45.5%, b). 46.4% of respondents said it was helpful, and b). 8.1% evaluated as less helpful on a scale of 1 to 5. Based on the comments provided, the client believed that the PFA service at UIN Saizu Purwokerto assisted them in overcoming a psychological crisis.

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In summary, clients feel helped because, with the help of PFA services, they are able to recognise and express unpleasant emotions, feel at ease and unjudged for the issues they are going through, and ultimately solve their problems. Positive behavioural changes also improve their psychological state, and knowing about advanced psychological treatments helps clients feel at ease in receiving services that are tailored to their individual needs. Some clients believe that the 60-minute duration is still short when assessing this service. The clients believe they are still working through the process of comprehending their emotions. In this case, offering additional services at different times is the answer.

IV. CONCLUSION

Every aspect of life, including the management of mental health, are negatively affected by the current technological changes and advancements, particularly in academic settings. If mental health therapy is delayed, it can lead to more serious psychological issues along with a decline in academic achievement. PFA offered in an academic setting is an attempt to deal with this issue.

PFA has assisted students in resolving mental health issues and has been offered at UIN Saizu Purwokerto for six semesters. The CIPPO method is used to analyse this process. This evaluation can be explained as follows **a) Context evaluation**, In this case, the service is considered appropriate with the presence of communication devices and room facilities, but in terms of room privacy, it still needs to be improved **b) Input evaluation**, In order to assess potential service providers' level of commitment and expertise, a very stringent recruitment process is used to identify them. Following the hiring process, PCs (Peer Counsellors) and CCs (Call Centres) receive specialised training on service standards and client-facing PFA skills. **c) Process evaluation**, To ensure that services are provided effectively, Standard Operating Procedures (SOP) are developed, understood, and followed by all participants. However, there are a number of factors that must be taken into account, including the service provider's physical and mental health, the technical issues that both the client and the service provider face, and the regularity with which "Resik-resik jiwa" (mental cleansing) is evaluated as a means of addressing issues that arise during the course of providing the service. **d) Product evaluation**, Every semester, there is a growing trend in the number of requests for PFA services. These requests are related to 11 different problems, which range in frequency from uncommon to common: physiological disorders, bullying, finances, sexual harassment, work, psychological disorders, romance, family, and personal issues, which are the most common. **e) Outcome** In summary, 92% of the clients said that the PFA services they had gotten could assist in resolving the psychological issues they were having.

Based on the previously mentioned explanation, it can be concluded that the availability of online PFA services in academic settings can assist students in resolving psychological issues they are facing. To deliver a more optimal service, communication between service providers, facilities, and evaluation needs to be improved. Online PFA services are therefore important in the academic setting.

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REFERENCES

- 1) Ari Setyawan, D. (2019). Peran Konselor dalam Menghadapi Perilaku Temper Tantrum. *Konseling Edukasi "Journal of Guidance and Counseling,"* 3(1), 123–132. <https://doi.org/10.21043/konseling.v3i1.5580>
- 2) Arikunto, S., & Jabar, C. S. A. (2018). *Evaluasi Program Pendidikan: Pedoman Teoritis Praktis Bagi Mahasiswa dan Praktis Pendidikan* (2 ed.). Jakarta: Bumi Aksara.
- 3) Coaston, S. C. (2017). Self-Care Through Self-Compassion: A Balm for Burnout. *The Professional Counselor*, 7(3), 285–297. <https://doi.org/10.15241/scc.7.3.285>
- 4) Dwi Marsela, R., & Supriatna, M. (2019). Kontrol Diri : Definisi dan Faktor. *Journal of Innovative Counseling : Theory, Practice & Research*, 3(2), 65–69. Diambil dari http://journal.umtas.ac.id/index.php/innovative_counseling
- 5) Emmerton, R. W., Camilleri, C., & Sammut, S. (2024). Continued deterioration in university student mental health: Inevitable decline or skirting around the deeper problems? *Journal of Affective Disorders Reports*, 15(October 2023). <https://doi.org/10.1016/j.jadr.2023.100691>

Exploration and Evaluation of PFA (Psychological First Aid): Potential for Development of PFA Online Services in Academic Setting

- 6) Feijt, M., Kort, Y. De, Bongers, I., Bierbooms, J., Westerink, J., & Ijsselsteijn, W. (2020). Mental Health Care Goes Online : Practitioners' Experiences of Providing Mental Health Care During the COVID-19 Pandemic. *Cyberpsychology, Behavior, and Social Networking*, 23(12), 1–5. <https://doi.org/10.1089/cyber.2020.0370>
- 7) Flick, U., & Dkk. (2017). *Buku Induk Penelitian Kualitatif: Paradigma, teori, Metode, Prosedur dan Praktik*. Yogyakarta: Cantrik Pustaka.
- 8) Goodman, L. (2017). Mental Health on University Campuses and the Needs of Students They Seek to Serve. *Building Healthy Academic Communities Journal*, 1(2), 31–44. <https://doi.org/10.18061/bhac.v1i2.6056>
- 9) Kaligis, F., Ismail, R. I., Wiguna, T., Prasetyo, S., Indriatmi, W., Gunardi, H., ... Magdalena, C. C. (2021). Mental health problems and needs among transitional-age youth in Indonesia. *International Journal of Environmental Research and Public Health*, 18(8), 1–14. <https://doi.org/10.3390/ijerph18084046>
- 10) Minihan, E., Gavin, B., Kelly, B. D., & McNicholas, F. (2020). COVID-19, mental health and psychological first aid. *Irish Journal of Psychological Medicine*, 37(4), 259–263. <https://doi.org/10.1017/ipm.2020.41>
- 11) Nasrullah, N., & Sulaiman, L. (2021). Analisis Pengaruh Covid-19 Terhadap Kesehatan Mental Masyarakat Di Indonesia. *Media Kesehatan Masyarakat Indonesia*, 20(3), 206–211. <https://doi.org/10.14710/mkmi.20.3.206-211>
- 12) Naya Prianka, F., Laras, I. A., & Sirait, W. D. (2022). Perancangan Kampanye Psychological First Aid (PFA) Sebagai Penanggulangan Distress pada Remaja. *Jurnal Ilmu Komunikasi*, 5(2), 2614–0373. Diambil dari <https://journal.unpas.ac.id/index.php/linimasa/article/view/5205/2395> Osborn, T. G., Li, S.,
- 13) Saunders, R., & Fonagy, P. (2022). University students' use of mental health services: a systematic review and meta-analysis. *International Journal of Mental Health Systems*, 16(1). <https://doi.org/10.1186/s13033-022-00569-0>
- 14) Rehman, I., Jabeen, R., Joseph, V., & Hina Bhutto, G. (2023). Exploring The Relationship Between Mental Health And Academic Performance: An Analysis Of Depression, Stress, And Anxiety In Cambridge School Students. *Journal of Positive School Psychology*, 2023(6), 407–419. Diambil dari <https://www.researchgate.net/publication/371904572%0AExploring>
- 15) Stufflebeam, D. L., & Zhang, G. (2017). *The CIPP Evaluation Model by (9 ed.)*. New York: The Guilford Press. Suresh, R., Alam, A., & Karkossa, Z. (2021). Using Peer Support to Strengthen Mental Health During the COVID-19 Pandemic : A Review Database Search for Literature Review. *Frontier in Psychiatry*, 12(July), 1–12. <https://doi.org/10.3389/fpsy.2021.714181>



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Development of a Simple Game-Based PJOK Learning Model to Improve Locomotor Basic Movements and Cooperation of Lower Grade Elementary School Students



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ABSTRACT: This study aims to determine the correlation between the Problem-Based Learning learning model and the Discovery Learning model with students' creativity and learning motivation. This research uses a quantitative approach of correlation type. The sample in this study used purposive sampling, namely grade 6 with a total of 40 students, consisting of 19 students at SD Negeri Awu Awu and 21 students at SD Negeri Wingkoharjo. Data collection using observation sheets and questionnaire statements. Data analysis in this study used Product moment Correlation Test and t-Independent Test.

The results of this study indicate that there is a significant correlation between the application of the Problem-Based Learning learning model and the learning creativity of students at SD Negeri Awu Awu with a pearson correlation value = 0.660 and a p-value (sig-2tailed) of 0.002. There is a significant correlation between the application of the Problem-Based Learning learning model and student learning motivation at SD Negeri Awu Awu with a pearson correlation value = 0.834 and a p-value (sig-2tailed) of 0.000. There is a significant correlation between the application of the Discovery Learning learning model and students' learning creativity at SD Negeri Wingkoharjo with a pearson correlation value = 0.660 and a p-value (sig-2tailed) of 0.001. There is a significant correlation between the application of the Discovery Learning learning model and student learning motivation at SD Negeri Wingkoharjo with a pearson correlation value = 0.501 and a p-value (sig-2tailed) of 0.021. There is no significant difference between creativity and motivation of students in the application of both learning models with a significance value of 0.064 for learning creativity and with a significance value of 0.477 for learning motivation.

KEYWORDS: Discovery Learning, Learning Creativity, Learning Motivation, Problem-Based Learning.

I. INTRODUCTION

Education is essentially one of the basic human needs in order to improve the quality of human resources for the achievement of an increasingly advanced and prosperous level of national life. Achieving quality education is one of the factors that influence the success of students in the future. Schools have an important role as a place for learners to process to develop the knowledge, skills and competencies needed for their development in adulthood in order to have a positive contribution to life in society. Through the scope of the school will provide learning experiences that are not obtained at home.

Sagala (2013, p. 42) "education is a process of training students designed in the form of learning experiences to develop knowledge, skills and competencies that can be used as capital to meet the needs of their lives and their families". While Muchlisin (2017, p. 49) "early childhood education should have an educational philosophy that touches on all child development and is supported by learning that is tailored to the world of early childhood. Children will develop properly if they get good attention and stimulation from schools".

Suherman (2004, p. 23) "physical education is a learning process carried out through physical activity, which is designed to improve physical fitness, develop motor skills, develop knowledge and behavior of a healthy and active life, develop sportive attitudes, and emotional intelligence of students". Meanwhile, according to Rosdiani (2012, p. 21) "physical education is a medium to encourage the development of motor skills, physical abilities, knowledge, reasoning, appreciation of values (attitudes, mental, emotional, and social) and habituation of a healthy lifestyle which leads to stimulating balanced growth and development".

Childhood is an excellent opportunity for learning, namely optimizing the development of basic locomotor movements and cooperation. It is during this period that children get more movement experience by playing both individually and in groups

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according to their age characteristics. Motor development is the process of growth and development of a person's ability to move. Every movement a child makes is the result of a complex pattern of interactions from various parts and systems in the body controlled by the brain.

Motor skills consist of gross motor skills and fine motor skills. According to Rejeki (2021, p. 2) "basic movement has an important role in learning physical education, basic movement skills can be applied in various games, sports, and physical activities carried out daily". Basic movement skills consist of locomotor movements, non-locomotor movements and manipulative movements. Gross motor skills include walking, running, jumping and jumping. Through motor learning in elementary school, it will affect several aspects of students' lives such as: (1) through motor learning children get entertainment and get pleasure, (2) through motor learning children can move from a weak condition to a weak condition independent conditions, (3) through motor learning children can adjust to the environment, (4) through motor learning will support children's skills in various ways, (5) through motor learning will encourage children to be independent, so they can solve all the problems they face (Decaprio, 2013, p. 24).

The characteristics of children's motor development vary greatly. According to Burhein (2017, p. 57) "the characteristics of elementary school-age children love to play, move, group, and practice directly". The current situation with the health conditions of school-age children, which exist today in the world, is associated with motor activities in the world that need games to improve motor skills (Kashuba, et al., p. 2018). Therefore, related to these activities adapted to the development of manipulative movements and cooperation. Thus, through appropriate physical activity and according to the expected period, it will have an impact on locomotor development and cooperation.

The movement experience gained in physical activity is manifested in physical education learning. One aspect of character that children have is cooperation. Nancy Stevenson (2013, p. 45) "cooperation is an attitude that understands that the power of many people working together will be greater than individual abilities". Cooperation is one of the values that is often trained by sports coaches, especially game sports that require more than one player. Cooperation is also an important factor in achieving an achievement goal.

From the explanation above, it can be concluded that cooperation is the value of a character that identifies that togetherness is superior to individuals in achieving goals in a group. From the observations so far, children are often selfish when in the field. Therefore it is very necessary to provide a game model to children so that children have a soul or character of cooperation among friends. In physical education, the value of cooperation is also very much needed in PE learning, considering that PE learning often uses groups in every lesson. For example: big ball game material, small ball, traditional games, outdoor activities, and so on.

Through this physical education learning, besides we can find out the locomotor and cooperation of students. Of course, we can find out the physical development of the child. Rohmatin (2019, p. 22) states that "the physical development of children is not the same as one another, even though they are relatively the same age or the same school level".

Given that the growth of children from various ethnicities and races also shows differences. This is delayed. Therefore, motor stimulus must be developed because children who receive directed and regular stimulus will develop faster than children who do not / lack stimulus.

Games are physical activities that provide fun as well as learning. The game should not be monotonous so that students do not quickly feel bored. In the game students will get and improve their physical fitness skills, the game is also based on the abilities and characteristics of students so that their achievements are in accordance with the expected physical education goals.

The form of the game designed refers to the locomotor development and cooperation of students.

Games that provide opportunities for students to socialize and cooperate, with the socialization between children will create a relationship or inner bond about togetherness tolerance mutual respect and many more good values that will be created and do not miss the value of cooperation will also be created well.

Based on the 2013 Curriculum in the core competencies and basic competencies of physical education, sports, and health for grade 3 elementary school students, students can achieve and practice physical fitness activities in various forms of simple games. As well as applying the values of sportsmanship, honesty, cooperation, never giving up, responsibility, discipline and others.

According to Rosdiani (2012, p. 22) "in the process of learning physical education teachers are expected to teach a variety of basic movement skills, techniques and strategies of games and sports, internalization of values (sportsmanship, honesty, cooperation etc.) and habituation to healthy living". In this case, games can be used as a medium in improving students' multilateral skills which include physical fitness activities and cooperation. The importance of developing physical activity in physical education. So the researcher wants to try to make a game model to improve basic locomotor movements and

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cooperation in lower grade students. The research was conducted on lower grade elementary school students, especially in grade 3 students.

In developing game model activities to improve locomotor and cooperation of lower grade students, it still integrates the realm of education which includes cognitive aspects, affective aspects and psychomotor aspects. With this game model, it is hoped that it can increase the teacher's knowledge in applying new variations for learning that are not monotonous and help students to be actively involved with a sense of pleasure, confidence, and can achieve the desired learning objectives.

Researchers found that social values such as compassion, empathy, helpfulness, generosity, and sharing and tolerance begin to develop in elementary school-age children. These social values are part of prosocial behavior that is important for children's socio-emotional development. One form of prosocial behavior that can be developed in elementary school children is cooperation skills.

Based on the results of observations and interviews with 4 PE teachers in elementary schools in Muntilan sub-district, Magelang district, the problem is that teachers have not maximized elementary school physical education learning using various games, therefore researchers are asked to develop various games, especially on locomotor material.

Therefore, researchers want to create a game model activity to improve basic locomotor movements and children's cooperation for lower grade elementary school students with the aim that students can improve multilateral skills and master basic motor development skills first so that it can be used as a provision for students in recognizing and understanding their motor development to the next level of education.

II. METHOD

This research uses the 4D research and development model, 4D stands for Define, Design, Development, Dissemination. Define is a stage of analyzing the needs carried out through literature studies and through research and a stage of determining what products are developed and their specifications. Design is a stage of designing a product that has been determined, development is a stage of making designs into products and testing the validity of products repeatedly so as to produce products that have been determined, Dissemination is an activity to disseminate products that have been produced based on expert validation tests.

The type of data obtained from the development of qualitative and quantitative data. Qualitative data is obtained from: (1) input data and suggestions from experts for product improvement, (2) data from trial assessment results from observations of the model from material experts, (3) data from observations of the effectiveness of the model from experts. These data are used to evaluate the game model for the development of basic locomotor movements and cooperation of elementary school students.

Time and Place of Research

This research was conducted in November 2023 3 elementary schools, namely: SD Muhammadiyah Gunungpring, SD Muhammadiyah 1 Muntilan, SD Muhammadiyah Tamanagung.

Population and Research Sample

The population in this study were 3rd grade students at SD Muhammadiyah 1 Muntilan, SD Muhammadiyah Gunungpring, and SD Muhammadiyah Tamanagung.

The type of data obtained from the development of qualitative and quantitative data. Qualitative data were obtained from: (1) input data and suggestions from experts for product improvement, (2) trial assessment data from observations of the model from material experts, (3) observation assessment data from the effectiveness of the model from experts. These data are used to evaluate the game model for the development of basic locomotor movements and cooperation of elementary school students.

Research Instruments and Data Collection Techniques

1. Data Collection Technique

Data collection techniques are the means used to obtain data. Qualitative data collection techniques are obtained during literature studies, field studies (field observations), interviews. Quantitative data is obtained using a questionnaire or assessment questionnaire used by experts or experts to assess the model developed in order to provide suggestions and criticisms. The effectiveness test uses observations using a rubric for assessing learning outcomes to obtain data. Furthermore, the data collection technique used aims to measure the achievement of student learning outcomes and student responses to the game model.

2. Data Collection Instruments

The data collection instruments in this study were general guidelines for interviews and field notes from questionnaires.

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Research Data Analysis Technique

The data analysis technique used in the research is quantitative and qualitative descriptive data analysis research. Quantitative descriptive data analysis techniques were carried out on: (1) results validation assessment with a scale of material expert scores on the game model before the trial; (2) data on the assessment of trial results; (3) data on the results of the effectiveness of the basic locomotor and cooperation game model for elementary school students in the learning process. According to Sugiyono (2018: 147) "Descriptive statistics are statistics used to analyze information by describing the information that has been collected as it is with no intention of making generalizations. Calculating all the average total scores of the assessment components carried out using the formula:

$X = \sum X/n$ Description: X = Average score $\sum X$ = number of average scores n = number of assessors. Quantitative data from the validation of material experts, learning experts and teacher respondents are then converted into 5-scale quantitative data using Sukarjo's conversion reference (2006: 52) in the following table:

No	Criteria	Score Formula
1	Very Good	$X > X_i + 1,80 S_{bi}$
2	Good	$X_i + 0,60 S_{bi} < X \leq X_i + 1,8 - S_{bi}$
3	Quite Good	$X_i - 0,60 S_{bi} < X \leq X_i + 0,60 S_{bi}$
4	Less Good	$X_i - 1,80 S_{bi} < X \leq X_i - 1,80 S_{bi}$
5	Very Less Good	$X \leq X_i - 1,80 S_{bi}$

Based on the results of the score conversion to the final score, the value of the product that has been developed will be obtained. From this value, it can be seen whether the product is suitable for use or not.

III. RESEARCH RESULT

At this stage researchers designed the initial stage of developing a game method that could be used to improve locomotor basic movements and cooperation of lower grade elementary school students. Small-scale trials in this study were conducted in only one school, namely 1 teacher. The results of the small-scale trial can be seen in the table below:

a. Small Scale Teacher Trial Table

Grain	Game Model		
	Poison Ball	Wristband Relay	Picture Search
1	5	5	4
2	4	5	4
3	5	5	5
4	5	4	4
5	4	5	5
6	5	3	4
7	4	5	5
8	5	4	4
9	4	3	4
10	5	4	5
11	5	5	5
12	5	5	4
Total	57	53	53
Average	4,75	4,42	4,42
%	95	88,33	88,33
Category	Very Good	Very Good	Very Good

Based on the results of the small-scale trial from the teacher, it shows that the poison ball game model is in the excellent category, the bracelet relay game model is in the excellent category and the image search game model is in the excellent category.

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b. Small Scale Learner Trial Table

Grain	Game Model		
	Poison Ball	Wristband Relay	Picture Search
1	5	5	4
2	5	5	5
3	4	5	5
4	5	4	5
5	5	5	4
6	5	5	5
7	5	5	5
8	5	5	5
9	5	4	4
10	4	4	5
11	5	5	4
12	5	4	4
Total	58	56	56
Average	4,83	4,67	4,67
%	96,67	93,33	93,33
Category	Very Good	Very Good	Very Good

The results of the small-scale trial of students show that the poison ball game model is in the excellent category, the bracelet relay game model is in the excellent category and the image search game model is in the excellent category.

c. Large Scale Trial Results

The large-scale trial stage was conducted in 3 schools, namely SD Muhammadiyah, SD Gunungpring and SD Tamanagung. This large-scale trial was conducted with teachers and students. the results of the large-scale trial can be described as follows:

A. Teacher Assessment

1. Toxic Ball Game

The results of the assessment from teachers at Muhammadiyah Elementary Schools in Muntilan District on the Poison Ball Game can be seen in the table below:

Items	Teacher		
	Muhammadiyah Elementary School	Gunungpiring Elementary School	Taman Agung Elementary School
1	5	5	5
2	5	5	5
3	4	4	4
4	5	5	5
5	5	5	4
6	4	4	5
7	5	5	5
8	5	5	5
9	4	4	4
10	4	4	4
11	5	5	5
12	5	5	5
Total	57	55	58
Average	4,75	4,58	4,83
%	95	91,67	96,67

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Category	Very Good	Very Good	Very Good
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Based on the results of the teacher's assessment above, it shows that the toxic ball game model developed to improve locomotor movements and cooperation is very good.

2. Bracelet relay game

The results of the assessment from teachers at Muhammadiyah Elementary Schools in Muntilan District on the bracelet relay game can be seen in the table below:

Items	Teacher		
	Muhammadiyah Elementary School	Gunungpiring Elementary School	Taman Agung Elementary School
1	5	5	5
2	5	5	5
3	5	5	5
4	5	5	4
5	5	5	5
6	5	5	5
7	5	5	5
8	5	5	5
9	4	4	4
10	4	4	4
11	5	5	5
12	5	5	4
Total	58	58	56
Average	4,83	4,83	4,67
%	96,67	96,67	93,33
Category	Very Good	Very Good	Very Good

Based on the results of the teacher assessment above, it shows that the toxic ball game model developed to improve locomotor movements and cooperation is mostly stated as very good.

3. Mencar Game (Looking for Pictures)

The results of the assessment from teachers at Muhammadiyah Elementary Schools in Muntilan Sub-district on the scatter game (looking for pictures) can be seen in the table below:

Items	Teacher		
	Muhammadiyah Elementary School	Gunungpiring Elementary School	Taman Agung Elementary School
1	4	4	4
2	4	5	5
3	5	5	5
4	5	5	5
5	4	4	4
6	5	5	5
7	5	5	5
8	5	5	5
9	5	5	5
10	4	5	5
11	4	4	4
12	4	4	4
Total	54	55	56

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Average	4,5	4,67	4,67
%	90	93,33	93,33
Category	Very Good	Very Good	Very Good

Based on the results of the teacher assessment above, it shows that the scatter game model (looking for pictures) developed to improve locomotor movements and cooperation is mostly stated as very good.

B. Students

1. Poison Ball Game

The results of the assessment of students at Muhammadiyah Elementary Schools in Muntilan District on the Poison Ball Game can be seen in the table below:

Items	Student		
	Muhammadiyah Elementary School	Gunungpiring Elementary School	Taman Agung Elementary School
1	4	4	5
2	4	4	4
3	5	5	5
4	4	4	5
5	4	4	4
6	4	4	5
7	4	4	4
8	5	5	5
9	5	4	4
10	5	5	5
11	5	5	5
12	4	5	5
Total	54	53	56
Average	4,5	4,47	4,67
%	90	88,33	93,33
Category	Very Good	Very Good	Very Good

Based on the results of the assessment of the students above, it shows that the Toxic Ball game model developed to improve locomotor movements and cooperation mostly states that it is very good.

2. Bracelet relay game

The results of the assessment of students in Muhammadiyah Elementary Schools in Muntilan District on the bracelet relay game can be seen in the table below:

Items	Student		
	Muhammadiyah Elementary School	Gunungpiring Elementary School	Taman Agung Elementary School
1	5	5	5
2	5	5	5
3	5	5	5
4	4	4	4
5	5	5	5
6	4	4	4
7	5	5	5
8	5	4	4
9	5	5	5

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10	4	4	4
11	5	5	5
12	5	5	5
Total	57	56	56
Average	4,75	4,67	4,67
%	95	93,33	93,33
Category	Very Good	Very Good	Very Good

Based on the results of the assessment of students above, it shows that the Bracelet Estafet Game model developed to improve locomotor movements and cooperation mostly states that it is very good.

3. Scatter Game

The results of the assessment of students in Muhammadiyah Elementary Schools in Muntilan District on the Scatter Game (Looking for Pictures) can be seen in the table below:

Items	Student		
	Muhammadiyah Elementary School	Gunungpiring Elementary School	Taman Agung Elementary School
1	4	4	4
2	4	4	4
3	5	5	5
4	4	4	4
5	5	5	5
6	4	5	5
7	5	5	5
8	4	4	4
9	4	4	4
10	5	5	5
11	5	5	5
12	4	4	4
Total	53	54	54
Average	4,42	4,5	4,5
%	88,33	90	90
Category	Very Good	Very Good	Very Good

Based on the results of the assessment of students above, it shows that the scatter game model (looking for pictures) developed to improve locomotor movements and cooperation, most of them stated that it was very good.

d. Large Scale Trial Analysis

At the large-scale trial analysis stage, researchers conducted a content validation test with Aiken'V. After creating a simple game-based PJOK learning model development product, a large-scale trial was conducted to determine the content validity with Aiken'V, the validation results can be seen in the table below:

No.	Desain items	Poison ball validity results	Relay bracelet validity results	Picture finding validity results
1	Items 1	0,917	1,00	0,75
2	Items 2	1,00	1,00	0,917
3	Items 3	0,75	1,00	1,00
4	Items 4	1,00	0,917	1,00
5	Items 5	1,00	1,00	0,75
6	Items 6	0,833	1,00	1,00
7	Items 7	0,75	1,00	1,00

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8	Items 8	1,00	1,00	1,00
9	Items 9	1,00	0,75	1,00
10	Items 10	0,833	0,75	0,916
11	Items 11	1,00	1,00	0,75
12	Items 12	1,00	1,00	0,75
Average		0,923	0,951	0,902
Description		Valid	Valid	Valid

Based on the results of the analysis above, it is known that the validation value for the poison ball game is 0.923, the validation for the relay bracelet is 0.951 and the validation for finding pictures is 0.902. While the reliability value can be seen in the table below:

Game	Reliability	Description
Poison Ball	0,754	Reliabel
Relay Bracelet	0,845	Reliabel
Picture Finding	0,845	Reliabel

e. Effectiveness Test

The results of the calculation and comparison of the average value between small scale and large scale will be able to know the effectiveness of the development of a simple game-based PJOK learning model. The results of the calculation of effectiveness in the development of a simple game-based PJOK learning model can be seen in the table below:

	Average		
	Small Scale	Large Scale	Effectiveness (%)
Poison Ball Game	4,5	4,72	4,88
Relay Bracelet	4,42	4,78	8,14
Picture Finding	4,42	4,61	4,30

From the results of the average calculation for the value of the small scale and large scale, it shows that the effectiveness of the poisonous ball game is 4.88% and in the bracelet relay game is 8.14% and the effectiveness of the picture finding game is 4.30%.

DISCUSSION

a. Simple Game Model to Improve Locomotor Basic Movements of Lower Grade Elementary School Students.

Locomotor movement is a movement of moving places, where certain body parts move or move places. Locomotor basic movement is one of the domains of fundamental basic movement. Some forms of locomotor movement include walking, running, tiptoeing, jumping and jumping, galloping, creeping and climbing. This locomotor movement is a basic movement whose development has started at an early age. The importance of locomotor movements in a person can improve advanced movements in adulthood. Therefore, locomotor movements in children must be trained and developed from an early age. Most locomotor skills develop as a result of a certain level of maturity, but practice and experience are also important to achieve mature skills. Locomotor skills form the basis or foundation of gross skill coordination and involve large muscle movements. Locomotor movements are movements that go anywhere. This locomotor movement is then the basis for the development of coordination of movements involving large muscles (gross-muscles), muscle growth, endurance and stamina, in addition to being an exciting part of the child.

To improve locomotor movements in children, in this study, the development of a Simple Game-Based PJOK Learning Model was carried out as one of the learning models so that the learning process could run pleasantly. The Simple Game-Based PJOK Learning Model made by researchers is a product that aims to assist teachers or trainers in delivering locomotor basic motion learning material, improving locomotor basic motion skills, and as a reference for learning materials. This basic motion learning model is made based on the level of children's needs in physical education activities, especially in teaching and learning activities for basic locomotor movements for elementary school students.

b. Results of Teacher and Learner Assessment of Simple Games

a) Results of Teacher Assessment of Simple Games

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Based on research on the development of a simple game-based physical education learning model to improve locomotor basic movements and cooperation of lower grade elementary school students, the teacher gave an assessment of the Poison Ball Game in the excellent category with a percentage of 94.44%. The Bracelet Relay Game is in the excellent category with a percentage of 95.55% and the Looking for Pictures Game is in the excellent category with a percentage of 92.22%. So it can be concluded that the three simple games given get an assessment from the elementary school teacher in the excellent category.

b) Results of Student Assessment of Simple Games

Based on research on the Development of a Simple Game-Based PJOK Learning Model to Improve Locomotor Basic Movements and Cooperation of Lower Grade Elementary School Learners, students gave an assessment of the Poison Ball Game in the excellent category with a percentage of 90.55%. The Bracelet Relay Game is in the excellent category with a percentage of 93.88% and the Looking for Pictures Game is in the excellent category with a percentage of 89.44%. So it can be concluded that the three simple games given get an assessment from elementary school students in the excellent category.

V.CONCLUSIONS

Conclusions

Based on the analysis of descriptive data, testing of research results and discussion, it can be concluded that:

- a. The process of developing a simple game-based PJOK learning model for this study uses the 4D research and development model, namely Define, Design, Development, Dissemination.
- b. The results of the validity and reliability tests show that the simple game-based PJOK learning model developed is declared valid and reliable, so that the product is suitable for use in learning models.
- c. Based on the results of the assessment of teachers and students, it shows that the simple game-based PJOK learning model developed to improve locomotor movements and overall cooperation states that it is very good, with the results of the Teacher giving an assessment of the Toxic Ball Game with a percentage of 94.44%, the Bracelet Relay Game with a percentage of 95.55% and the Looking for Pictures Game with a percentage of 92.22%. While the Learners gave an assessment of the Toxic Ball Game with a percentage of 90.55%, the Bracelet Relay Game with a percentage of 93.88% and the Looking for Pictures Game with a percentage of 89.44%, it can be concluded that the game model can be used to develop locomotor movement skills and cooperation for elementary school students.

Suggestion

Based on the results of the research that has been conducted, there are several research suggestions as follows:

- a. For students to be able to improve their locomotor movements with a simple game model, this game can be done at home
- b. For teachers, the simple game-based PJOK learning model is an alternative to the learning process.
- c. For teachers to always monitor the development of their students, because lower grade elementary students are a potential period in their motor development.
- d. For further researchers can develop other media as an alternative to the PJOK learning model.

REFERENCES

- 1) Afandi, M., Chamalah, E., & Wardani, O. P. (2013). Model dan metode pembelajaran di sekolah. Semarang: UNISSULA Press
- 2) Anggraini, Fina Surya, Siti Makhmudah, Ainna Amalia FN. 2020. Perkembangan Motorik AUD. Nganjuk: Guepedia
- 3) Ardini, P.P & Anik L. 2018. Bermain dan permainan anak usia dini. Nganjuk: CV.Adjie Media Nusantara
- 4) Asmawi, M., Dlis, F., & Gustiawati, R. (2020). need analysis to develop fundamental model of movement based on team games tournament (tgt) for students in the elementary school. jipes-journal of indonesian physical education and sport, 6(01), 23-29.
- 5) Astini, N, et. all. (2017). Identifikasi pemanfaatan Alat Permainan Edukatif (APE) dalam mengembangkan motorik halus anak usia dini. Mataram: Jurnal Pendidikan Anak Volume 6 Edisi 1
- 6) Astuti, lie, 2016, Quality Time With Kids: Cerdas Kilat Tingkatkan Prestasi Belajar dan Semangkin Dekat dengan Anak. Yogyakarta: CV. Andi Offset
- 7) Aunurrahman. (2016). Belajar dan pembelajaran. Bandung: alfabeta
- 8) Awang, I.S. all. (2019). Kecerdasan emosional peserta didik sekolah dasar. Jurnal profesi pendidikan dasar Vol.6, No 1.
- 9) Blegur, Y., & M. Rambu P. (2018). Permainan kecil: teori dan aplikasi. Kupang : Jusuf aryani learning
- 10) Budiartati, S. (2014). Problematika Pembelajaran di Sekolah Dasar. Yogyakarta: Deepublish Publisher

Development of a Simple Game-Based PJOK Learning Model to Improve Locomotor Basic Movements and Cooperation of Lower Grade Elementary School Students

- 11) Bulut, D., Samur, Y., & Cömert, Z. (2022). The effect of educational game design process on students' creativity. *Smart Learning Environments*, 9(1), 8.
- 12) Burhaein. E. (2017). Aktivitas fisik olahraga untuk pertumbuhan dan perkembangan siswa sd. *Indonesian Journal of Primary Education*, Vol 1 No 1 (2017) 51-58. <https://ejournal.upi.edu/index.php/IJPE/article/view/7497/0>
- 13) Chen, J., Wang, X., Zhang, Z., & Chen, W. (2021). Assessing elementary school students' manipulative skill competency in china. *International Journal of Environmental Research and Public Health*, 18(6), 3150
- 14) Cocca, A., Espino Verdugo, F., Ródenas Cuenca, L. T., & Cocca, M. (2020). Effect of a game-based physical education program on physical fitness and mental health in elementary school children. *International Journal of Environmental Research and Public Health*, 17(13), 4883
- 15) Danim, Sudarwan. 2011. *Perkembangan Peserta Didik*. Bandung: Alfabeta
- 16) Danniels, E., & Pyle, A. (2018). Defining play-based learning. *On Encyclopedia Early Childhood Development*
- 17) Decaprio, R. 2013. *Aplikasi Teori Pembelajaran Motorik di Sekolah*. Yogyakarta: Diva Press
- 18) Engles, E.S & Philipp. 2020. Effects of cooperative games on enjoyment in physical education—How to increase positive experiences in students? 1 (12). e0243608. <https://doi.org/10.1371/journal.pone.0243608>
- 19) Farias, C. F. G., Harvey, S., Hastie, P. A., & Mesquita, I. M. R. (2019). Effects of situational constraints on students' game-play development over three consecutive Sport Education seasons of invasion games. *Physical Education and Sport Pedagogy*, 24(3), 267-286.
- 20) Febrianto, F. A., Kartiko, D. C., & Sriwahyuni, E. (2020). The Effect of Animal Hunting and Rounders Games on Locomotor and Manipulative Motion Capabilities. *International Journal for Educational and Vocational Studies*, 2(1), 98-102
- 21) García-González, L., Abós, Á., Diloy-Peña, S., Gil-Arias, A., & Sevil-Serrano, J. (2020). Can a hybrid sport education/teaching games for understanding volleyball unit be more effective in less motivated students? An examination into a set of motivation-related variables. *Sustainability*, 12(15), 6170.
- 22) Hasanah, U. (2016). Pengembangan Kemampuan Fisik Motorik Melalui Permainan Tradisional Bagi Anak Usia Dini, (Lampung: Jurnal Pendidikan Anak, 2 (1). 117-119.
- 23) Helmiati. (2016). *Model Pembelajaran*. Yogyakarta: Aswaja Pressindo Irianto.
- 24) Hendra, Jhony dan Ghazali I P. (2019). Mengembangkan Keterampilan Gerak Dasar Manipulatif bagi Anak melalui Permainan Olahraga di Taman Kanak-kanak. *Jurnal Muara Pendidikan*.4 (2)
- 25) Isti Dwi P.W & Touvan J.S. (2013). *Pendidikan karakter melalui pendidikan jasmani*. Bandung: CV Bintang Warli Artika.
- 26) Julien, C., Castelli, D., Bray, D., Lee, S., Burson, S., & Jung, Y. (2021). Project SMART: A cooperative educational game to increase physical activity in elementary schools. *Smart Health*, 19, 100163.
- 27) Karim, M. B., dan Wifroh, S. H. (2014). Meningkatkan Perkembangan Kognitif Pada Anak Usia Dini Melalui Alat Permainan Edukatif. *Jurnal Pendidikan Dan Pembelajaran Anak Usia Dini*, 1(2), 103–113
- 28) Kashuba, V., Futorny, S. E. R. G. E. Y., Andrieieva, O., Goncharova, N., Carp, I., Bondar, O., & Nosova, N. (2018). Optimization of the processes of adaptation to the conditions of study at school as a component of health forming activities of primary school-age children
- 29) Latar, I. M., & Hasbullah, B. (2020, August). Development of Manipulative Models Based on Play and Games in Physical Education for Elementary School in Ambon City. In *1st Progress in Social Science, Humanities and Education Research Symposium (PSSHRS 2019)* (pp. 228-234). Atlantis Pres
- 30) Lestari, D F. (2020). Pengembangan Model Pembelajaran Aktivitas Jasmani Melalui Permainan Tradisional Bagi Siswa sekolah dasar. *Jurnal pendidikan jasmani olahraga dan kesehatan*. Vol 8 (1)
- 31) Libertus, K., & Violi, D. A. (2016). The relation between motor skills and language development in Infancy. *Frontiers in Psychology*, 7(75). *Journal of Physical Education and Sport (JPES)*, Vol 19 (Supplement issue 1), Art 21, pp.143 - 147, 2019. <https://efsupit.ro/images/stories/ianuarie2019/Art%2021.pdf>
- 32) L, Zulkifli. (2009). *Psikologi Perkembangan*. Bandung: PT. Remaja Rosdakarya
- 33) Mahendra, Agus. (2001). *Pembelajaran Senam: Pendekatan Pola Gerak Dominan*, Jakarta. Dirjen Olahraga dan Dikdasmen, Depdiknas.



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The Influence of Learning Capability and Sensing Capability on Digital Entrepreneurship with Market Orientation as Moderation



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ABSTRACT: The Influence of Learning Capability and Sensing Capability on Digital Entrepreneurship with Market Orientation as Moderation. Thesis. Yogyakarta: Faculty of Economics and Business, Yogyakarta State University 2024. This research aims to determine the influence of learning capability and sensing capability on digital entrepreneurship with market orientation as moderation.

This research is quantitative descriptive. The subjects in this research were students in Yogyakarta. This research population applies to all students at D.I Yogyakarta who have the desire to build a digital business. The number of samples in this research was 358 students. The sampling technique uses non-probability sampling techniques. Data collection techniques using questionnaires. The validity of the questionnaire was tested using factor analysis (loading factors) and the reliability was tested using Croanbach's Alpha. The data analysis techniques used are multiple regression analysis and moderated regression analysis (MRA).

The results of this research are as follows. (1) Learning capability has no effect on digital entrepreneurship with a parameter coefficient value of 0.196 with a significant level of 0.566 > 0.05 (2) Sensing capability has an effect on digital entrepreneurship with a parameter coefficient value of 0.882 with a significant level of 0.000 < 0.05 (3) Market Orientation as a variable moderating (learning capability*market orientation) is not able to moderate the influence of learning capability on digital entrepreneurship with a parameter coefficient value of 0.004 with a significant level of 0.769 (4) Market orientation as a moderating variable (sensing capability*market orientation) is able to moderate the influence of sensing capability on digital entrepreneurship with a parameter coefficient value of 0.030 with a significant level of 0.044 < 0.05.

KEYWORDS: *learning capability, Sensing capability, Digital Entrepreneurship, Market Orientation.*

I. INTRODUCTION

Globalization has a very different look today, as digitalization has partly introduced three new phenomena. First and foremost, large-scale internet platforms have devalued communications or services and interactions between cultures or regions. Second, digital goods and services are now traded virtually and instantly. And finally, the value of digital use in traditional products has greatly increased (Dobbs et al., 2016). Seeing the urgent need for information in the current era, information and communication technology continues to be developed in the digital realm. At that time, the media and information available were considered inadequate to meet society's demands for fast and relevant information. In the 1940s, the presence of computers finally emerged as an answer to this need. As intelligent computing machines, computers have the ability to create, design, store and process data into information needed by the wider community. Then, the development of this technology continued rapidly, reaching its peak with the emergence of the internet in the 1970s, and continues to be updated today (Sulianta, 2020).

In the information era like now, the role of the internet is very crucial in various aspects of human life. Students widely rely on the internet to fulfill their information needs to support their studies and other activities. This happens because individual needs vary, encouraging them to seek information through the media they deem most appropriate. As a result, various strategies and methods are used to obtain this information. The internet is the main choice because it provides easy access to various literature and scientific references according to the needs of academics. In this information era, the internet has become an information center that can be accessed from various locations without being bound by time and space limitations. The internet is considered a barrier-free information center because it can connect one information site with other information sites in a short time. As an alternative to searching for information, the internet is an option for students besides the library (Tharob et al., 2017).

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Based on the Survey of the Indonesian Internet Service Providers Association (APJII), internet users in Indonesia have reached 78.19 percent as of January 2023 or reached 215.63 million people out of a total population of 275.77 million people. This number increased by 2.67% compared to the previous period of 210.03 million people (APJII, 2023). Although it is currently known that internet usage in Indonesia has reached 275.77 million people, this shows that Indonesia has great potential in utilizing digital technology. Therefore, encouragement and motivation are needed so that the Indonesian population can actively use available technology for entrepreneurial activities. With the increase in internet users in Indonesia, especially in the current circle of life, students who live in the modern era 4.0 are required to be able to think more critically and creatively. Quoted from Okezon, Achmad Zaki, CEO of BukaLapak and as a young man who is successful in running a digital business, advised the younger generation, especially students, to be responsive in taking advantage of existing opportunities. For him, college is a golden period for creativity. Students can freely create by using their time to study and try various things. After that, don't hesitate to take the plunge. Therefore, in this increasingly developing era, there are many opportunities for success for students, active and creative students can easily make money in various ways through gadgets (Roykhan & Millendy, 2020).

The internet has become one of the most popular media sources of information among university students in the world. According to Murtonen, an information source is considered trustworthy and provides satisfaction in meeting information needs. Internet use has become a lifestyle for most students in universities throughout the world. For them, the internet is a functional tool that has changed the way they interact and search for information. Many students use the internet for academic purposes, such as exchanging e-mails with faculty or peers, and even for online business purposes, either as sellers, resellers or buyers. In other words, individuals who have internet access can communicate directly with other people, disseminate useful information, find various information provided by other people, or engage in product buying and selling transactions at minimal costs through a global network (Tharob et al., 2017).

Building a business in the digital era has challenges that require your own foresight and abilities. Therefore, before building a digital business, it is mandatory to have good learning capability, sensing capability and market orientation. (Junita et al., 2020). If a digital entrepreneur wants to do digital business, the individual must understand several elements that must be used in a business context, namely learning capability. In the business context, learning capability refers to the ability of an organization to learn from past experiences and apply this new knowledge to improve performance and achieve strategic goals in the future (Anderson et al., 2009). And someone who has good sensing capability tends to be better able to anticipate market changes, develop appropriate business strategies, and take advantage of existing business opportunities. Thus, sensing capability is an important key in individual business success because it allows them to adapt and compete in a dynamic business environment (Alshanty et al., 2019). Therefore, learning capability and sensing capability can be important factors in the success of digital entrepreneurs.

And coupled with the role of market orientation, it allows companies to learn about customers, competitors and distribution channel members, thereby enabling companies to collect relevant information and utilize it to improve learning capabilities and detect opportunities in the external environment. In this case, individuals can utilize this information to improve their learning capability and sensing capability and develop more effective business strategies. Apart from that, individuals can also utilize market orientation to understand customer needs and develop products or services that better suit customer needs. Therefore, market orientation can be a factor in increasing learning capability and sensing capability in individual businesses (Hernándezlinares et al., 2020)

Based on the explanation above, there are still several studies that state the obstacles for students who want to start a digital business include: (1) Limited knowledge about online business, (2) The large number of frauds in cyberspace, making consumer confidence in online business still lacking, (3) Competition very high online business. (4) Internet connection problems, (5) Supplier problems are problems that can occur at the beginning of starting an online shop business, or can occur in the middle of this business journey.

It can be concluded that globalization in the digital era has had a significant impact, especially seen through the decline in the value of intercultural communication, instant digital trade, and the increase in digital use of traditional products. In Indonesia, internet user growth reached 78.19 percent in January 2023, creating an urgent need for fast information, especially among students who rely heavily on the internet. Opportunities in digital entrepreneurship are increasingly wide open, especially with the positive message from Achmad Zaki, CEO of BukaLapak, who encourages students to be creative and take risks in the college era, where students' potential in utilizing digital technology can bring financial success. However, challenges arise, especially related to learning capability, sensing capability, and market orientation needed in digital entrepreneurship. Students are faced with the constraints of limited digital skills, lack of practical experience, and lack of understanding of dynamic digital markets, requiring effective strategies to overcome these obstacles in building successful and sustainable digital businesses.

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II. METHODOLOGY

This type of research is descriptive research using a quantitative approach and then analyzed using multiple linear regression and MRA (moderating Regression Analysis). Researchers in this study used a sampling technique which was used in this research using a non-probability sampling technique, namely judgmental sampling. Judgmental sampling or purposive sampling is a sampling technique from a population based on criteria in the form of certain considerations (Sugiyono, 2017). The location of this research was carried out at 2 State Universities and 2 Private Universities in the Special Region of Yogyakarta. The sample used in this research was 358 respondents. The respondents are students who want to become digital entrepreneurs and are located in the Kita area, Special Region of Yogyakarta. The selection of respondents was in accordance with the sample requirements set by the researcher.

III. RESEARCH RESULT

Variable	B	t Count	Sig.	Information	R ²	F
(Constant)	12,918					
<i>Learning Capabilities</i>	0.196	0.575	0.566	Not significant	0.742	202.130
<i>Sensing Capabilities</i>	1,492	3,600	0,000	Significant		
<i>Market Orientation</i>	1,557	2,321	0.021	Significant		
<i>Learning Capability*Market Orientation</i>	0.004	0.293	0.769	Not significant		
<i>Sensing Capability*Market Orientation</i>	0.030	2,022	0.044	Significant		
a. Digital Entrepreneurship						

a) The influence of Learning Capability on Digital Entrepreneurship

The results of model 2 regression testing show that there is a significance value of 0.566 ($0.566 > 0.05$) or in other words the t-count result is smaller, $0.575 < 1.649$. This value can provide a rejected hypothesis, which means that "There is no influence of learning capability on digital entrepreneurship. So the hypothesis H0 is rejected.

b) The Influence of Sensing Capability on Digital Entrepreneurship

The results of model 2 regression testing show that there is a significance value of 0.000 ($0.000 < 0.05$) or in other words the tcount results are more prominent than ttable, namely $3,600 > 1,649$. This value can prove that the hypothesis is accepted, which means that "There is an influence of sensing capability on digital entrepreneurship". So the hypothesis H0 is accepted.

c) *Market Orientation Moderates the Effect of Learning Capability on Digital Entrepreneurship*

The results of testing model 2 show that there is a significance value of 0.769 ($0.769 > 0.05$), in other words tcount is smaller than ttable, namely $0.293 < 1.649$. So the coefficient of learning capability on digital entrepreneurship is 0.196 with a significance value of $0.566 > 0.05$, so the result is not significant, while the results of moderation with a coefficient value of 0.004 with a significance value of $0.769 > 0.05$, the result is not significant. Because both cases are not significant, Homologizer Moderation is included, meaning that the potential variable becomes a moderating variable that influences the strength of the relationship between the predictor variable and the dependent variable. However, this variable does not interact with the predictor variables and does not have a significant relationship with the dependent variable. So these results show that market orientation influences learning capability on digital entrepreneurship. then this value can prove that the 3rd hypothesis is rejected.

d) *Market Orientation Moderates the Effect of Sensing Capability on Digital Entrepreneurship*

The results of testing model 2 show that there is a significance value of 0.044 ($0.044 < 0.05$), in other words tcount is greater than ttable, namely $2.022 > 1.649$. So the sensing capability coefficient for digital entrepreneurship is 1.492 with a significance value of $0.000 < 0.05$, so the results are significant, while the moderation results with a coefficient value of -0.030 with a significance value of $0.044 < 0.05$ then the results are significant. Because both occur significantly, it is included in Quasi Moderation, meaning that the variable moderates the relationship between the predictor variable and the dependent variable, where the moderating variables all interact with the predictor variable and become predictors. So this value can prove that the 4th hypothesis is accepted.

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IV. DISCUSSION

The F significance test basically shows whether all the independent variables intended in the model have a joint influence on the dependent variable. The F test is used to test whether the two independent variables and one moderating variable simultaneously influence the dependent variable. In this research, the method used is to compare the F-count and F-table values. If F-count < F-table, then the independent variable simultaneously has no effect on the dependent variable (hypothesis is rejected). If F-count > F-table, then the independent variable simultaneously influences the dependent variable (hypothesis is accepted).

Based on the table above, it can be seen that the F-count has a value of 202.130 which is greater than the F-table, namely 2.026 and a significance value of 0.000 ($p < 0.05$). Thus, it can be said that learning capability, sensing capability and market orientation simultaneously influence digital entrepreneurship.

From the R2 test results, the adjusted R2 value was obtained at 0.738 or 73.8%. This shows that local government performance can be explained by 73.8% by the independent variables, namely learning capability and sensing capability and also the moderating variable, namely market orientation. Meanwhile, 26.2% of the variation in digital entrepreneurship is explained by variables outside the independent variables of this research.

V. CONCLUSION

The results of this research are as follows. (1) Learning capability has no effect on digital entrepreneurship with a parameter coefficient value of 0.196 with a significant level of $0.566 > 0.05$ (2) Sensing capability has an effect on digital entrepreneurship with a parameter coefficient value of 0.882 with a significant level of $0.000 < 0.05$ (3) Market Orientation as a variable moderating (learning capability*market orientation) is not able to moderate the influence of learning capability on digital entrepreneurship with a parameter coefficient value of 0.004 with a significant level of $0.769 > 0.05$ (4) Market orientation as a moderating variable (sensing capability*market orientation) is able to moderate the influence of sensing capability on digital entrepreneurship with a parameter coefficient value of 0.030 with a significant level of $0.044 < 0.05$.

REFERENCES

- 1) Alshanty, A. M., Emeagwali, O. L., Ibrahim, B., & Alwashdeh, M. (2019). The Effect of Market-Sensing Capability on Knowledge Creation Process and Innovation Evidence from SMEs in Jordan. *Management Science Letter*, 9, 727–736. <https://doi.org/10.5267/j.msl.2019.1.016>
- 2) Anderson, B. S., Covin, J. G., & Slevin, D. P. (2009). Understanding The Relationship Between Entrepreneurial Orientation and Strategic Learning Capability : An Empirical Investigation. *Strategic Entrepreneurship Journal*, 3, 218–240. <https://doi.org/10.1002/sej>
- 3) APJII. (2023). *Survey Penggunaan Internet oleh UMKM & Korporasi 2023*.
- 4) Dobbs, R., Manyika, J., & Woetzel, J. (2016). *Digital Globalization: The New Era Of Global Flows*.
- 5) Hernández-linares, R., Kellermanns, F. W., & Concepción, M. (2020). Dynamic capabilities and SME performance : The moderating effect of market orientation Dynamic capabilities and SME performance : The. *Journal of Small Business Management*, 00(00), 1–34. <https://doi.org/10.1111/jsbm.12474>
- 6) Junita, A., Musnaini, Wijoyo, H., & Indrawan, I. (2020). *Digital busines* (Pertama, Issue September). CV. Pena Persada.
- 7) Roykhan, F., & Millendy, O. (2020). *Digital Entrepreneurshi: Peluang Sukses Mahasiswa Milenial 4.0*. Genta FKIP Cerdas Dalam Pemberitaan. <https://genta.fkip.unja.ac.id/2020/04/07/digital-entrepreneurship-peluang-sukses-mahasiswamilenial-4-0/>
- 8) Sugiyono. (2017). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. CV. Alfabeta.
- 9) Sulianta, F. (2020). *Buku Literasi Digital , Riset dan Perkembangannya dalam Perspektif Social Studies*.
- 10) Tharob, G. , Mingkid, E., & Paputungan, R. (2017). Analisis Hambatan Bisnis Online Mahasiswa UNSRAT. *E-Journal "Acta Diuma," VI(2)*.



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Evaluation Study of West Muna Kumite Karate Athlete Performance Coaching Program



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ABSTRACT: Coaching achievements in karate athletes provides guidance to athletes starting from an early age, finding and achieving athlete talent in all sports in order to have maximum performance. This study aims to evaluate the implementation of the West Muna Kumite Karate achievement coaching program using the CIPP (Contexts, Input, Process, Product) evaluation model. This research is an evaluation research. The sample of this study was administrators, coaches and athletes of the West Muna Kumite Karate Dojo with a total of 27 people. Data was collected through questionnaires, interviews, observations and documentation. The data analysis techniques used in this study used quantitative and qualitative descriptive analysis. The results showed that the overall evaluation results of the West Muna Kumite Karate coaching program were still not good. In the evaluation of the Kumite Karate sports performance coaching program in West Muna, in terms of context, it has been going well. In terms of input, it is still not good because the facilities and infrastructure of the West Muna Kumite Karate sport are still very lacking. Likewise with funding that has not been distributed as a whole. In terms of input, there are coaches and athletes as expected. In terms of process, it is still very lacking because the implementation of the coaching and monev (monitoring and evaluation) program has not been carried out in accordance with the provisions, even though the implementation of the training program has been running well. In terms of overall product, the achievements that have been achieved have been good, it can be seen from the results of documentation of achievements that have been achieved by West Muna Kumite Karate athletes.

KEYWORDS: Evaluation, Achievement Coaching, CIPP, Karate Kumite, Athletes.

I. INTRODUCTION

Achievement sports coaching aims at progress in all fields of sports in Indonesia, each sport has its own program to be able to promote the achievements of each individual at the regional and national levels [1]. The focus of the achievement coaching program is to provide guidance to athletes starting from an early age, finding and achieving athlete talent in all sports in order to have maximum performance. One of the factors that support the achievement of the greatest sports achievements comes from coaching and building the sport itself [2]. In achieving maximum success in sports, there is more and more fierce competition on both sides both nationally and internationally. Sports achievements at national and international levels are no longer private property, but have been linked to the value and honor of the nation. To be able to achieve this goal, various manpower owned by a regional, provincial and national club try to place their best athletes in regional, national, and prestigious events such as PON, Asean Games, and Sea Games and even to championships between students of other universities [3].

The process of coaching achievements that have been carried out in a planned, regular and mutually continuous manner must continue to be evaluated because in a field of sports can run well or badly after the completion of an evaluation [4]. So that from the above explanation, in order to realize the objectives of the evaluation, programs that have been arranged in a structured and directed manner are needed. In fostering and developing every sport that exists, it certainly requires hard work and extra attention from various parties. The establishment of sports clubs also needs to be pursued in matters related to resources which include three aspects, namely human resources, facilities and infrastructure and sources of funds [5]. Athlete is a term for someone who pursues a certain sport and competes in an event or match. Athletes are sportsmen, especially those who participate in competitions or matches. In some sports, there is a need for coaching or coaches who can bring out the potential of these athletes so that the training process can run optimally.

Karate is a martial sport using bare hands and feet to knock out opponents [6]. Karate is a martial sport where the form of movement activities using the feet and hands such as punches, punches and kicks. And is a martial art from Japan where in its activities it requires a movement of punches, kicks, deflections, slams, agility, with power and both in kata and kumite [7]. The

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Muna Barat karate dojo has a six-day training schedule program in the afternoon. Athletes usually increase their training hours by doing individual exercises outside the training schedule according to each athlete's needs. The number of kohai in West Muna is 200 people, but currently experiencing a very drastic decline which began in 2015, plus in 2020 due to Covid-19 which impacted all branches closed so that athletes' interest in training decreased and decreased athletes' performance. But in 2022 it reopened, the number of kohai is only 30% left from before. Where the potential for orbit is around 20 people and who have become professional athletes as many as 20 people.

Dojo Muna Barat has participated in several championships, both at the provincial and national levels. To achieve good achievements certainly requires hard work and intensive training. Several supporting factors must be met in order to achieve proud achievements. One of the most important is the supporting element. As a developing sport, it should be equipped with adequate supporting facilities in the form of facilities and infrastructure, the availability of training places for athletes, and the presence of coaches who accompany during training. Apart from all that, it should be supported by the management and organization that houses the karate dojo in West Muna Regency, namely the Indonesian Karate-Do Sports Federation (FORKI), community participation, especially the government's role in it. Based on observations and interviews given to several administrators of the West Muna Karate Dojo in West Muna Regency on February 10, 2023, it is known that the general achievements of West Muna karate athletes are still not optimal due to the lack of a good training program for kumite athletes, in particular. It is proven that there has been no evaluation of the coaching program at the Karate Dojo in West Muna Regency, where the evaluation process has not been carried out comprehensively in the sport of karate, besides that there has not been a preparation of coaching on prospective seeds for new athletes, funding for events that have not been realized, there has not been a good training program, facilities and infrastructure that are still included in the sufficient category, Even to the extent that long-term and short-term coaching programs have not been properly arranged and the recruitment process is not optimal due to insufficient financial factors. So from this, the final data obtained from the chairmanship of the West Muna district karate dojo at the 2022 Provincial Conference in Buton Regency, the West Muna Dojo only obtained 1 Women's Class -50 Kumite Bronze and 1 Women's Team Kumite Bronze. While in the 2018 Porprov in Kolaka Regency, Dojo Muna Barat won 3 Bronze from the Kumite class 60 Boys and Girls, and 1 Bronze Kumite team.

Based on the problems that exist in the case, there are several components that are very important and play a role in creating the success of karate achievements. So this problem needs to be overcome immediately because based on previous research that evaluation, training programs, funding, training programs and even facilities and infrastructure are parts that cannot be ruled out in the process of sports coaching, especially karate [1]. Evaluation in general has a very important role in the process of determining future steps to be better. That's because, according to [3] Evaluation is an argument in the sense that it requires a set of premises that lead to different evaluative conclusions. The premise of an evaluative argument consists of parts evidence, belief, and interpretation in an explicitly value-laden context. New knowledge must be formed from the product of research-theoretical arguments. This does not mean that new information cannot be generated through evaluation, but the creation of new information is not the main purpose of evaluation. The evaluation process must be carried out comprehensively, so that the results in the form of information are really valid and reliable [4]. This information is then used to build a training program, which means a thorough review must be carried out to determine the supporting elements of the program. A program is not just an activity that can be implemented in a short time, but a mutually continuous activity to be able to implement a policy. Therefore, sports coaching programs should be evaluated in such a way that sports activities can improve from year to year [4]. By evaluating the program, you will get information about the implementation of steps in a problem, the results of which can be positive or negative.

In line with that, according to [6] stated that in a problem that exists in the field of achievement must be immediately considered and resolved. This is in line with the research that will be carried out at the West West West Karate Dojo because there are several factors that inhibit the achievement in the West Muna karate dojo from declining, including; (1) Achievements of the Kumite Karate Dojo Muna Barat Regency has not implemented a training program, (2) The management system is not yet optimal (3) has facilities and infrastructure that is not optimal. From this research, it is the same as the research examined by [8] in his research on "The Importance of Sports Management on the Development of Achievements and Coaching of the Waru Well Volleyball Team" in the study explained that the management system in the management and optimization of these facilities and infrastructure is very important, because management management is the root of achieving an achievement for athletes [9].

The evaluation process must be carried out holistically so that the results can really be used as a basis for determining the quality of the program [9]. This means that the overall evaluation is used to evaluate the supporting elements of the program. A program is not just a single activity that can be completed in a short period of time, but is an activity that is continuous throughout the process. Therefore the program can take a relatively long time. The implementation of the program always takes

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place in the organization, meaning that there must be a group of people participating in it. The implementation of program evaluation aims to find facts about the implementation of organizational policies in areas whose results can be positive or negative [9]. Professionally conducted assessments produce objective results, that is, results as they are: Data, analysis, and conclusions are not manipulated, which in turn can benefit everyone involved in the training program.

The evaluation in this study will use the CIPP Model because the CIPP Model is an evaluation model that is carried out in a complex manner which includes Context, Input, Process, and Product [10]. The CIPP model is a model that has been developed by Stufflebeam and colleagues at Ohio State University, the CIPP model is seen as a very comprehensive evaluation model [11]. The CIPP model is an assessment model that provides the benefit of being able to see if the program can run as planned / desired and produce products as planned [12]. In the CIPP model, it is usually not directly related to the program to be evaluated, but can work with someone who is directly visible in the program. In addition, the evaluator must be able to work closely with people working as staff in the implementation of the program, this must be done in such a way that the evaluator can determine and receive all information and interpret what implements the CIPP model [10].

II. METHOD

This research is an evaluation study research. The research method uses the CIPP evaluation method (context, input, process, and product) to see the results of the West Muna Kumite Karate Dojo. Data will be collected using interviews, direct observation, document studies and questionnaires. It is hoped that the results of this study can provide advice for West Muna Kumite karate athletes in the achievement coaching program in order to produce maximum output. The population in this study amounted to 27 and the sample of this study was the trainer of the management of FORKI Muna Barat and 27 samples using the total sampling method.

III. RESULT

The results of this study will explain the general description of the results that have been obtained in West Muna Kumite Karate, followed by data from the entire research subject, related to the results of the study will be explained in more detail in the results of analysis and discussion.

Table 1. West Muna Karate athlete Data Analysis Summary

Aspects	Management	Coach	Athlete	Average	Category
Context					
Background	3,372	3,423		3,322	Good
Purpose	3,340	3,655		3,427	Good
Program	3,340	3,088		3,178	Good
Input					
Coach	3,466	3,540	3,525	3,517	Good
Athlete	3,548	3,323	3,471	3,423	Good
Facilities and Infrastructure	1,478	1,621	1,942	1,725	Very Lacking
Funding	1,266	1,433	1,528	1,423	Very Lacking
Process					
Exercise		3,422	3,219	3,233	Good
Coaching	1,492	1,545		1,482	Very Lacking
Monitoring	1,723	1,528	1,340	1,521	Very Lacking
Product					
Achievement	3,241	3,379	3,149	3,283	Good

1. Context Evaluation

The discussion of the aspects contained in the following evalusai contexts is taken from several respondents who have been studied by questionnaire, interview, observation and documentation methods. All discussions or data in this contexts evaluation have authenticity because researchers go directly to the field to get real data.

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Table 2. Results of Context Evaluation of West Muna Karate athletes

Aspects	Achievement		
Context	Average	Category	Information
Background of the Coaching Program	3,322	Good	It is in accordance with the coaching program
Purpose of the Coaching Program	3,427	Good	The goals to be achieved have been fulfilled
Purpose of the Coaching Program	3,178	Good	It has been arranged according to existing needs

Based on the results of the data above, there are many inputs and suggestions from each respondent, but from all the data that has been taken both in the form of questionnaires, interviews and observations of the Karate martial arts coaching program in West Muna Karate athletes has been well arranged, all existing shortcomings will be further improved for the progress of West Muna Karate athletes.

2. Input Evaluation

The evaluation of inputs here will explain the aspects contained in it in accordance with the results of quantitative analysis and the results of interviews / qualitative data from respondents that have been carried out. The following is the discussion in the evaluation of input:

Table 3. Results of Input Evaluation of West Muna Karate athletes

Aspects	Achievement		
Input	Average	Category	Information
Coach	3,517	Good	Already good with experience as a former athlete and coaching license
Athlete	3,423	Good	Both because the potential of Western Muna Karate athletes is very much and many also train even though there is no championship.
Facilities and Infrastructure	1,725	Very Lacking	Very lacking because there is no training ground that has not been standardized.
Funding	1,423	Very Lacking	It is still very inconsistent with the data taken

Based on the results of input evaluation tables, interviews and observations, there are many problems from both management, coaches and athletes. Likewise with complaints from coaches, and athletes about the problem of facilities and infrastructure that are still very lacking. According to the data obtained in the field, in West Muna Karate there is still no good synergy between all the people concerned in the Karate performance coaching program, there are internal problems that are brought into the coaching program. However, with so many problems that exist, all West Muna Karate coaches and athletes have more motivation to achieve maximum achievement, all of which is done as proof that the branch of karate martial arts in West Muna needs to be taken seriously.

3. Process Evaluation

The process in this evaluation includes aspects of the implementation of the training program, the implementation of the coaching program and the monev (monitoring and evaluation) of the West Muna Karate management. The following are the opinions of respondents about the aspects contained in the evaluation process.

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Table 4. Hasil Evaluasi Process atlet Karate Muna Barat

Aspects	Achievement		
Process	Average	Category	Information
Implementation of training programs	3,233	Good	It went well under the leadership of the coach who sacrificed his energy to produce Karate athletes in West Muna
Implementation of coaching programs	1,482	Very Lacking	Very lacking because there are still many internal problems that exist in West Muna Karate
Monev (Monitoring and Evaluation)	1,521	Very Lacking	There is very little local competition to find new talent

Based on the results of the process evaluation table, interviews and observations, it can be concluded that the implementation of the coaching and monev (monitoring and evaluation) program is still very lacking, due to internal regional factors and the lack of attention from the local government for Karate in West Muna. For the implementation of the training process has gone well, because it is under the leadership of coaches who are willing to sacrifice their energy to train athletes for the progress of West Muna Karate athletes.

4. Product Evaluation

Product evaluation discusses the achievements that have been achieved by West Muna Karate athletes in various events, both from the regional level to the regional level, achievements are a benchmark for the success of a coaching program that has been run by the West Muna Karate club, although the coaching program in West Muna Karate is still lacking, West Muna Karate always produces the best athletes in Karate sports, It can be seen from the achievements that have been achieved.

Table 5. Product Evaluation Results of West Muna Karate athletes

Aspects	Achievement		
Product	Average	Category	Information
Achievement	3,283	Good	The achievements of West Muna Karate athletes have been good.

Based on product evaluation table data, interviews and observations obtained by researchers, the overall achievements of West Muna Karate athletes are included in the good category. All of that can be proven by the large number of West Muna Karate athletes who are able to compete at the provincial level. Despite the irregular coaching program and problems faced, West Muna Karate coaches and athletes continue to be consistent in producing maximum performance at the provincial level.

IV. DISCUSSIONS

The discussion here concerns a summary of the results of the overall analysis and evaluation in contexts, inputs, processes and products (CIPP) in the West Muna Karate athlete performance coaching program, all the results obtained become a benchmark to improve performance that is felt to be still lacking or has not been done in a coaching program because with a good coaching program, qualified coaches and talented athletes will produce maximum performance.

The advantages of the CIPP model provide a comprehensive evaluation format at each stage of evaluation, CIPP is an evaluation model that uses a management-oriented evaluation approach or referred to as a form of program management evaluation (evaluation in program management). The CIPP model rests on the view that the most important goal of program evaluation is not to prove, but to improve. Therefore, this model is also categorized into an evaluation-oriented approach to

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program improvement (improvement-oriented evaluation) or a form of development evaluation (evaluation for development). That is, the CIPP model is applied in order to support the development of the organization and help the leaders and staff of the organization obtain and use input systematically in order to better meet important needs or, at a minimum, work best with available resources.

According to [13] the evaluation process can be said to be good if the evaluation uses criteria utility, timely, feasibility, propriety, and accuracy. Utility is intended so that the evaluation is informative. Timely means that the evaluation should have a time span and be useful for directing people. Feasibility is intended so that the evaluation design is arranged in accordance with the field to be evaluated and in a cost-effective manner. Propriety is intended so that the evaluation is carried out legally and upholds ethics. Accuracy, evaluation is expected to be accurate and valid, reliable, and comprehensive information. According to [14] evaluation is a process that describes, obtains, and provides information about objectives, design, implementation that is useful for consideration in making a decision.

Another opinion of [15] evaluation as an activity to collect information about the work of something, which then the information is used to determine the right alternatives in making a decision. Evaluation in a more specific sense is concerned with the production of information regarding the value or benefit of policy outcomes. When policy outcomes in reality have value, it is because they contribute to the goal or objectives, in which case it is said that the policy or programme has achieved a meaningful level of performance, meaning that policy issues are made clear or addressed.

According to [16] The program is a system, while the system is a unit of several parts or components of the program that are interrelated and work together with each other to achieve the goals that have been set in the system, thus the program consists of components that are interrelated and support each other in order to achieve a goal. So program evaluation is a process to find out whether educational goals can be realized.

Program evaluation is an intrinsic ongoing process for academic programs, an effective program evaluation can be measured by its success in the presence of decisive outcomes and quality based on standards for the profession and for education in general. Academic programs often use internal reviews and external institutions as evidence of the quality produced [17]. The types of evaluation concepts are formative and summative evaluation. Formative evaluation is an evaluation that is carried out during the program to provide useful information to the program leader for program improvement, while summative evaluation is carried out at the end of the program to provide consumers with information about the benefits or usefulness of the program. Formative evaluation provides continuous feedback to aid program development and pays ample attention to questions surrounding content, validity, vocabulary mastery, readability, and more. Overall formative evaluation is an evaluation from within that presents for improvement or improvement of the results developed. While summative evaluation is carried out to assess the benefits of a program so that from the results of the evaluation it will be determined that a particular program will be continued or stopped.

Summative evaluation focuses on variables that are considered important to the program sponsor and decision makers. Outside evaluators or review teams are often used because they are internal evaluators.

In addition, there are many success factors for a coaching process, including: According to [18] Sports Coaching that is carried out systematically, diligently and continuously, is expected to be able to achieve meaningful achievements. This refers to the understanding of coaching itself, coaching is The process of sports coaching must have started from a young age, because at a young age the child has a high level of flexibility, his physical and mental condition is in a stable state and his motivation to exercise is high, so that it is possible to be able to improve his ability to a higher direction, and in making decisions can be done quickly.

Through the CIPP model approach, the results of a study are expected to provide a real picture of how the state of an organization and ongoing programs, whether the results are satisfactory, moderate or lacking. Based on research that has been conducted using the CIPP approach, there are very real results. Among them are 1) Context is concluded with good categories. 2) Input regarding aspects of human resource availability is concluded with good categories. For aspects of the availability of facilities and infrastructure as well as funding sources, it is concluded with the medium category. 3) The process regarding aspects of training program implementation, athlete admission system and coordination is concluded with good categories while aspects of coach admission system and use of facilities and infrastructure are concluded with medium categories. 4) Products regarding aspects of performance and welfare are concluded with medium categories.

V. CONCLUSION

Based on the description of the analysis and evaluation data of the West Muna Karate athlete achievement coaching program, it can be concluded that the overall evaluation according to the CIPP model in the West Muna Karate Dojo athletes shows that there are still many shortcomings in the West Muna Karate Dojo athlete performance coaching program, ranging

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from facilities and infrastructure, funding, implementation of the coaching program and Monev (monitoring and evaluation). Accommodating from various aspects such as facilities and infrastructure, funding, implementation of coaching programs and Monev. Managed in an accountable, professional and structured management manner. This is contained from the concept of management is 1) management serves to improve the efficiency and effectiveness of programs, 2) the terms management and administration are interpreted the same, but preferably use the term management, 3) management is a process that involves planning, organizing, moving and supervising. If aspects of facilities and infrastructure, funding, implementation of coaching programs and Monev are managed professionally, it will facilitate achieving maximum achievement in the sport of karate martial arts.

REFERENCES

- 1) A. Triyasari, Soegiyanto, and Soekardi, "Evaluation of Artistic Gymnastics Sports Coaching in Pati Regency and Rembang Regency Gymnastics Clubs," *J. Phys. Educ. Sport*, vol. 5, no. 1, pp. 2–4, 2016.
- 2) S. Wandu and A. R. Tri Nurharsono, "Coaching Extracurricular Sports Achievements at SMA Karangturi Semarang City," *J. Phys. Educ. Sport. Heal. Recreat.*, vol. 2, no. 8, pp. 524–535, 2015.
- 3) A. Muryadi, "Program Evaluation Model in Evaluation Research," *J. Ilm. PENJAS*, vol. 3, no. 1, pp. 1–14, 2017.
- 4) H. Yuniartik, T. Hidayah, and Nasuka, "Evaluation of Sports and Health Physical Education Learning in SLB C in Yogyakarta City," *J. Phys. Educ. Sport.*, vol. 6, no. 2, pp. 148–156, 2017, [Online]. Available: <https://journal.unnes.ac.id/sju/index.php/jpes/article/view/17389>
- 5) S. R. Wahyu Hidayat, "Evaluation of the Football Achievement Coaching Program of Persibas Banyumas Club," *J. Sport Sci. Fit.*, vol. 4, no. 2, pp. 10–15, 2015.
- 6) D. E. Prasetyo, D. Damrah, and M. Marjohan, "Evaluation of Local Government Policies in Sports Achievement Development," *Gelangg. Olahraga J. Pendidik. Jasm. dan Olahraga*, vol. 1, no. 2, pp. 32–41, 2018, doi: 10.31539/jpjo.v1i2.132.
- 7) E. Purnomo, "The Effect of Training Programs on Improving the Physical Condition of Volleyball Athletes in Porprov Kubu Raya," *JSES J. Sport Exerc. Sci.*, vol. 2, no. 1, p. 29, 2019, doi: 10.26740/jses.v2n1.p29-33.
- 8) A. Mulyadiono and Y. P. Sari, "The importance of sports management to the development of achievements and coaching of the Sumur Waru volleyball team," *J. Edukasimu*, vol. 1, no. 3, pp. 1–9, 2021, [Online]. Available: <http://edukasimu.org/index.php/edukasimu/article/view/47>
- 9) A. Sunarno, S. Damanik, and Z. Heri, "Capacity Building of Sports Management of Sports Provincial Administrators in North Sumatra," *J. Ilmu Keolahragaan*, vol. 19, no. 1, pp. 35–41, 2020, [Online]. Available: <file:///C:/Users/User/Downloads/18452-41452-1-PB.pdf>
- 10) J. Irmansyah, "Evaluation of the beach volleyball achievement coaching program," *J. Keolahragaan*, vol. 5, no. 1, p. 24, 2017, doi: 10.21831/jk.v5i1.12759.
- 11) D. Ratna, S. J. Tangkudung, and A. S. Hanif, "Evaluation of the Regional Training Center Program (Pelatda) of Pasir Putri Volleyball Dki Jakarta," *J. Ilm. Sport Coach. Educ.*, vol. 2, pp. 8–16, 2018.
- 12) P. C. P. Dewi and K. D. Vanagosi, "Evaluation of Archery Performance Development Program of Perpani Karangasem Regency," *J. Pendidik. Kesehat. Rekreasi*, vol. 5, no. 2, pp. 101–111, 2019.
- 13) A. P. Munthe, "The Importance of Program Evaluation in Educational Institutions: An Introduction, Understanding, Objectives and Benefits," *Sch. J. Pendidik. dan Kebud.*, vol. 5, no. 2, p. 1, 2017, doi: 10.24246/j.scholaria.2015.v5.i2.p1-14.
- 14) M. Pratiwi, Ridwan, and Waskito, "Evaluation of Teaching Factory Model CIPP," *J. Imiah Pendidik. dan Pembelajaran*, vol. 3, no. 1, pp. 414–421, 2019.
- 15) R. Novalinda, A. Ambiyar, and F. Rizal, "Tyler's Program Evaluation Approach: Goal-Oriented," *Edukasi J. Pendidik.*, vol. 18, no. 1, p. 137, 2020, doi: 10.31571/edukasi.v18i1.1644.
- 16) I. Gunawan, "Learning Program Evaluation," *J. Ilmu Pendidik.*, no. 1, pp. 1–13, 2018.
- 17) Wahyudhiana and Darodjat, "Education Program Evaluation Model," *Islamadina*, vol. 1, no. 1, pp. 1–28, 2015.
- 18) I. P. Suardipa and K. H. Primayana, "The Role of Learning Evaluation Design to Improve Learning Quality," *Widyacarya*, vol. 4, no. 2, pp. 88–100, 2020, [Online]. Available: <http://jurnal.stahnmpukuturan.ac.id/index.php/widyacarya/article/view/796>



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Strategies and Ways to Improve Organizational Culture through Strengthening Management Knowledge, Pedagogical Competence, Work Ethic, Organizational Commitment and Work Motivation



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ABSTRACT: The values and norms formed and implemented by the organization must be adhered to by employees and leaders in the organization to shape the character of employees in their daily attitudes and behavior in carrying out their respective tasks and functions to achieve organizational goals what is called Organizational Culture. Based on preliminary research, it is known that the organizational culture at PGRI Vocational Schools in Bogor Regency is relatively not optimal. Therefore, research is needed to obtain information on variables related to improving organizational culture. This research aims to carry out strategies and ways to improve organizational culture by researching the influence of the variables of Management Knowledge, Pedagogical Competency, Work Ethic, Organizational Commitment, and Work Motivation. This research uses the path analysis method to determine the influence between the variables studied and the SITOREM method for indicator analysis to obtain optimal solutions in efforts to improve Organizational Culture.

KEYWORDS: Organizational Culture, Management Knowledge, Pedagogical Competency, Work Ethic, Organizational Commitment, Work Motivation, SITOREM Analysis

INTRODUCTION

Organizational culture is a variety of values that envelop the typical patterns of thought, ideas, and behavior held and carried out by human resources in an organization to achieve its goals. Organizational culture is the result of the process of merging the cultural styles and behavior of each individual that were brought before into a new norm and philosophy, which has the energy and pride of the group in facing certain things and goals.

Meanwhile, according to Torang (2014), organizational culture can also be said to be habits that are repeated over and over again and become values and lifestyles of a group of individuals in an organization which is followed by subsequent individuals. This means that culture can be intentionally or unintentionally held and passed down from generation to generation within an organization. Darodjat (2015) further stated that organizational culture is a system of values, beliefs, assumptions, or norms that have long been in effect, agreed upon, and followed by the members of an organization as a guide for behavior and solving problems. organization.

Culture will influence the extent to which and in what way organizational members assume, behave, and interpret values in achieving organizational goals. Thus, organizational culture becomes an influential factor in shaping and giving meaning to organizational members to act and behave.

A good culture will influence the performance of organizational members in carrying out and carrying out their duties better. As concluded from previous research conducted by Susanti et al (2020) in their scientific research journal, organizational culture has a positive influence and is an important factor that can explain variations in organizational members. Shared cultural values can bind an organization to its members. Thus, these strong ties can create motivation for organizational members to improve the performance of organizational members in completing work optimally.

Based on a preliminary survey conducted on January 2-15 2024 by distributing questionnaires to 30 PGRI Vocational High School (SMK) school stakeholders in Bogor Regency, the data obtained were: 1). There were 35.5% of respondents who had not met expectations regarding innovation at work, 2). There were 42.7% of respondents who did not meet expectations in being

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oriented towards work results, 3) There were 37.8% of respondents who did not meet expectations in being team-oriented, and 4). There were 41.5% of respondents who had not met expectations in empowering human resources in the organization, and 5). There are 45.8% of respondents who have not met expectations in being consistent with the rules that have been set, and 6). There were 40.8% of respondents who had not met expectations in adapting to changes.

The survey results above show that the organizational culture at PGRI Vocational High Schools (SMK) in Bogor Regency still needs to be improved and considering that organizational culture is an important element related to achieving educational goals, this Organizational Culture is interesting to research.

The research aims to produce strategies and methods for improving organizational culture, namely by strengthening independent variables that have a positive influence on organizational culture. These variables are management knowledge, pedagogical competency, work ethic, organizational commitment, and motivation. the optimal solution found is then used as a recommendation to related parties, namely teachers, school principals, school supervisors, school organizing institutions, and education offices.

LITERATURE REVIEW

1. Organizational Culture

Every organization has a set goal, vision, and mission, achieving this through an activity or work program involving leadership, employees, and the organization. This organizational culture plays a role in providing direction for members or leaders to act or behave and act at work.

Robbins, S. P., & Judge, T. (2018), define organizational culture as referring to the system adopted by its members that differentiates it from other organizations. The indicators are: (a) Innovation and risk-taking. The degree to which workers are encouraged to be innovative and take risks; (b) Pay attention to details. Level workers are expected to demonstrate precision, analysis, and attention to detail; (c) Results orientation. The management level focuses on acquisition or results and not on the techniques and processes used to achieve them; (d) Orientation to the individual. The level of decision-making by management taking into account the effect of the results on people within the organization; (e) Team orientation. The degree to which work activities are organized in teams rather than individuals; (f) Aggressiveness. The degree to which people will become aggressive and competitive instead of relaxed; (g) Stability. The level of organizational activity emphasizes maintaining the status quo in contrast to growth.

Organizational culture according to Schein, E. H. (2017), is defined as the accumulation of shared learning from an organization in solving problems originating from external adaptation and internal integration; which has been validated and then taught to new members as the correct way to understand, think, feel and behave about the problem. The dimensions are (a) Artifacts: Visible and felt structures and processes, observed behavior, difficult to describe; (b) Adhered Beliefs and Values: Ideals, goals, values, aspirations, ideologies, rationalizations, may or may not be consistent with other behaviors and artifacts; (c) Basic Underlying Assumptions: Unconscious and taken-for-granted beliefs and values that determine behavior, perceptions, thoughts, and feelings.

Gibson, et al (2012), describes that organizational culture is what is perceived by employees and how this perception creates patterns of beliefs, values, and expectations. Organizational culture has the following dimensions: (a) Artifacts and creations: Technology, art, visible and audible patterns of behavior, (b) Values: Testable, in the physical environment and (c) Basic Assumptions: Relationship to the environment, - Nature of creativity, time and space, human nature, the nature of human activity and the nature of human relationships.

Referring to the various concepts, theories, and research results that have been expressed, it can be synthesized as follows, that organizational culture is a set of values and norms that are formed and implemented by an organization that must be adhered to by employees and leaders in the organization to shape the character of employees in their behavior and behave daily in carrying out their respective tasks and functions to achieve organizational goals. The indicators of organizational culture are as follows: 1) innovation in work, 2) orientation towards work results, 3) team oriented, 4) empowerment of human resources in the organization, 5) consistent with established rules, and 6) adaptation to there is change.

2. Management Knowledge

Marquardt, Michael J. (2012), knowledge management is the activity of an organization (organization members) in collecting, organizing, storing, transferring, and using knowledge and experience inside and outside the organization. Dimensions include: 1) Collecting: gathering knowledge; 2) Storing: documentation and storage of knowledge; 3) Transfer among members: exchange

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and transfer of knowledge between members of the organization; 4) Application: application of knowledge in work; and 5) Distribution / Dissemination: distribution of knowledge that has been successfully applied.

Murray, E. Jennex. (2008), knowledge management is the acquisition of the right knowledge for the right people at the right time. The dimensions are as follows: 1) Knowledge acquisition: acquisition of knowledge from knowledge sources; 2) Knowledge storing: storage and documentation of knowledge files; 3) Knowledge evaluating: evaluating the usefulness and relevance of knowledge; 4) Knowledge dissemination: dissemination of information about the successful application of knowledge; and 5) Knowledge application: practical instructions on how to apply knowledge.

Aulawi, et al (2009), knowledge management is a management function that can create knowledge, manage the flow of knowledge, and ensure that knowledge is used effectively and efficiently for the long-term interests of the organization. Dimensions include: 1) Collecting and reusing structured knowledge; 2) Collect and sharing lessons learned from practices; 3) Creating and sharing lessons learned from practices; 4) Creating a structure and mapping the knowledge needed to improve performance; 5) Measuring and managing the economic value of knowledge; and 6) Compile and disseminate knowledge from external sources.

Based on the theoretical explanation from several expert opinions above, it can be synthesized that Knowledge Management is an individual's activity in accessing, collecting, storing, processing, utilizing, and developing personal knowledge to support the progress of himself and the organization. Indicators: 1) Acquisition of knowledge, 2) Collection of knowledge, 3) Storage of knowledge, 4) Processing of knowledge into new knowledge, 5) Utilization/application of knowledge, and 6) Sharing and distribution of knowledge.

3. Pedagogical Competency

Competency is a teacher's ability to carry out his teaching profession. From the description above, it appears that competence refers to the ability to do something that is obtained through education. Teacher competency refers to performance and rational actions to meet certain specifications in the implementation of educational tasks. It is said to be rational because it has direction and purpose, while performance is real behavior in the sense that it is not only observable but includes something that is not visible. One of the most important components that must continue to be considered in improving the quality of education is teachers (Sudargini & Purwanto, 2020).

Slocum et.al defines competence as a combination of knowledge, skills, behaviors, and attitudes that contribute to personal effectiveness. Competency is a combination of knowledge, skills, behavior, and attitudes that contribute to personal effectiveness. Teachers who have good competence in teaching can be seen in the form of mastery of knowledge, skills, and professional attitudes in carrying out a work profession.

Colquitt et.al. (2019) views competency as... the skills, abilities, and areas of expertise that enable an authority to be successful in some specific area. Competence is a form of confidence in skills, abilities, and areas of expertise that enable authority to be specifically successful and can be accounted for rationally in efforts to achieve goals.

From the various theories above, it can be synthesized that pedagogical competence is the teacher's ability to manage student learning in the teaching and learning process from planning to evaluation as fulfilling certain roles of the teaching profession. The indicators of servant leadership are as follows: 1) mastering the characteristics of students, 2) the ability to manage learning, 3) use of learning technology, 4) implementation of evaluations and learning outcomes, and 5) development of students to actualize the various potentials they have.

4. Work Ethic

According to Usman, (2009), work ethic is an attitude that arises from one's own will and awareness which is based on a system of cultural value orientation towards work. Work ethic can be interpreted as a concept about work or a work paradigm that is believed by a person or group of people to be good and correct, which is manifested through their typical work behavior.

Triguno, (2005) states that the creation of a high work ethic which he calls a work culture will increase job satisfaction, more intimate relationships, increase discipline, reduce functional supervision, reduce waste (efficiency), decrease absenteeism levels, want to continue learning, want to give what is best for the organization and others. According to Gregory (2003), history proves that countries that today are developed countries and continue to compete with high technology/information started with a very strong work ethic to succeed. This opinion explains that progress and success are the impact of a strong work ethic.

Work ethic is a belief in work, thereby eliminating feelings of laziness. Work ethic makes a person believe that if they work hard they will get the reward they deserve. According to Nitisemito (2001), several indicators to determine whether the work ethic in a company is high or low are as follows: 1. employee attitude, consisting of sub-indicators: flexibility at work, work

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adjustment; 2) an employee's feelings, which consist of the following sub-indicators: Job mastery; and Enjoy working; 3) employee willingness to carry out their work, which consists of the following sub-indicators: Work compliance; and willingness to complete the job; and 4) The employee's seriousness when working, which consists of sub-indicators of seriousness at work.

From several definitions of work ethic that have been put forward, it can be concluded that work ethic is the individual attitude of a person who has the characteristics and beliefs of good behavior so that they can provide more value and perform better in carrying out their work. The work ethic variable can be grouped into 5 indicators, (1) independence with sub-indicators (a) creativity, (b) initiative, (c) able to face challenges at work, (2) honesty with sub-indicators (a) admitting one's mistakes, (b) honesty in words and deeds, (3) totality with sub-indicators (a) integrity, (b) dedication and (c) loyalty, (4) quality of work with sub-indicators (a) compliance in completing tasks, (b) compliance with procedures, (c) work output, (5) career mobility with sub-indicators (a) education and training, (b) job level and (c) extrinsic rewards.

5. Organizational Commitment

Teacher commitment to the profession is the level of loyalty and individual confidence in the profession which is the individual's willingness to be actively involved in a job based on the goals and values of the profession, consisting of dimensions: 1) Affective commitment with indicators: a) having an emotional attachment to the profession, b) self-involvement in the interests of the profession; 2) continuity commitment with indicators: c) awareness of the losses if you leave the profession, d) desire to maintain the profession; 3) normative commitment with indicators: e) willingness to do something for the advancement of the profession, f) attitude of obligation towards professional duties (Djuanda, 2021).

Professional commitment is an individual's attachment to a professional organization, with indicators, namely: 1). Acceptance and similarity with the organization's values and goals (values and goals); 2). Willingness to be actively involved in organizational activities (involve); 3). The desire to try and work hard in the name of the profession by the wishes of the organization (effort); 4). Loyalty; 5). Desire to maintain membership (Widyastuti, 2016).

Professional commitment is a psychological relationship between teachers and their work which is based on affective and normative reactions to their work and ongoing professional development. With dimensions: a). The Affective Commitment dimension is the level to which an employee wants to stay in his work career because this is related to his career goals and helps him achieve his career goals; b). The Continuance Commitment dimension is the degree to which an employee feels he will remain in his current profession due to the lack of professional and rewarding alternatives; and c). The Normative Commitment dimension is the level of employees who feel they stay in the current organization because of a sense of responsibility and loyalty (Khan & Qazi, 2017).

Commitment to a profession is a person's belief in accepting the values of the profession, a willingness to exert effort on behalf of the profession, and a willingness to persist in membership in the profession. Commitment to the profession includes dimensions and indicators a). Affective Dimension Commitment to the Profession, with indicators: (1) Career drive (2) Feelings of involvement in the profession (3) Accepting organizational values b). Continuous dimension of commitment to the profession, with indicators: (1) Calculation of costs if you change jobs (change profession) (2) Calculation of the effects of the professional environment c) Normative dimension of commitment to the profession, with indicators: (1) Confidence to stay in the profession, (2) Obligations to the profession (Putra & Taopik, 2016).

Based on the theories above, it is synthesized that Professional Commitment is a psychological relationship between a person and his work which is proven through the level of loyalty and confidence of the individual to be actively involved in a job based on his professional goals and values through the willingness to exert effort in the name of the profession and being willing to persist in their professional membership. The dimensions and indicators of professional commitment are as follows: a. Dimensions of affective commitment to the profession, with indicators: 1) strong affection for the profession and the organization, 2) having strong motivation to remain in the job, 3) being selfless and devoted in carrying out their duties, b. Dimensions of ongoing commitment to the profession, with indicators: 4) individual assessment of the cost of living if they leave their job, 5) lack of other professional alternatives, 6) having obligations in their work, c. Dimensions of normative commitment to the profession, with indicators: 7) maintaining stability/togetherness between the morals of society and the profession as well as a sense of responsibility to uphold the values of the profession, and 8) the moral obligation of teachers to remain in their organization.

6. Work Motivation

George and R. Jones, (2012), Work motivation is a psychological force that determines the direction of a person's behavior in an organization, a person's level of effort, and a person's level of persistence. The elements of work motivation are: 1) Direction of Behavior, meaning what behavior a person chooses to carry out in an organization, 2) Level of Effort or level of effort, meaning

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how hard a person works to carry out the chosen behavior, and 3) Level of persistence, meaning when faced with obstacles, obstacles, how hard a person continues to try to carry out the chosen behavior successfully.

Pinder, C. C. (2008), Work motivation is a set of energetic forces originating both from within and outside the individual, to initiate work-related behavior, and to determine its direction, intensity, and duration. Motivation is generally based on three aspects, namely: Direction, namely the goal to be achieved, Intensity, namely level and strength, duration/persistence, namely the time required.

Schermerhorn, Jr., et.al (2007), Motivation refers to the strength within a person that takes into account the level, direction, and persistence of efforts made at work. Herzberg's two-factor theory identifies the work context as a source of job satisfaction and dissatisfaction: Motivator factors, as internal factors that are a source of job satisfaction and encourage motivation, Hygiene factors as external factors, in the work context are a source of job dissatisfaction,

Greenberg J & Robert. A, (2008), Motivation is a process that encourages, directs, and maintains human behavior toward achieving a goal. Motivation will give rise to stimulation, an urge within oneself to do something as optimally as possible, and be directed as it should be in achieving goals. Motivational factors are: Stimulation, which is something that can influence someone to carry out an activity; Maintenance, which is the activity of looking after and caring for something well; the element of awakening, which is reviving something within oneself in carrying out activities/work; and Directing, is providing definite direction in achieving the desired goals.

Based on various previous explanations, it can be synthesized that work motivation is the level of encouragement, desire, and movement power that grows within a person, both from within and outside him to carry out work with high enthusiasm using all the abilities and skills he has intending to achieve maximum... Indicators of work motivation are as follows: 1) Attachment to work, 2) Desire for power, 3) Desire to gain appreciation and recognition, 4) Adequate rewards, 5) Job security, and 6) Good supervision

RESEARCH METHODS

This research aims to find strategies and ways to improve Organizational Culture through research on the strength of influence between Organizational Culture as the dependent variable and Management Knowledge, Pedagogical Competency, Work Ethic, Organizational Commitment, and Work Motivation as the independent variables. The research method used is a survey method with a path analysis test approach to test statistical hypotheses and the SITOREM method for indicator analysis to determine optimal solutions for improving organizational culture. The research was carried out on foundation permanent teachers (GTY) of PGRI Vocational High Schools (SMK) in Bogor Regency with a teacher population of 289 people, with a sample of 168 teachers calculated using the Slovin formula.

Data collection in this research used research instruments in the form of questionnaires which were distributed to teachers as research respondents. The research instrument items are derived from the research indicators whose conditions will be explored. Before being distributed to respondents, the research instrument was first tested to determine its validity and reliability. The validity test was carried out using the Pearson Product Moment technique, while for the reliability test, a calculation was used using Cronbach's Alpha formula. After the data is collected, homogeneity tests, normality tests, linearity tests, simple correlation analysis, coefficient of determination analysis, partial correlation analysis, and statistical hypothesis testing are then carried out. Next, indicator analysis was carried out using the SITOREM method from Hardhienata to determine the priority order for improving indicators as a recommendation to related parties as a result of this research. In determining the priority order for handling indicators, SITOREM uses three criteria, namely (1) the strength of the relationship between variables obtained from hypothesis testing, (2) the priority order for handling indicators resulting from expert assessments, and (3) the indicator value obtained from data calculations. obtained from the answers of research respondents.

SITOREM is an abbreviation for "Scientific Identification Theory to Conduct Operation Research in Education Management", which can generally be interpreted as a scientific method used to identify variables (theory) to carry out "Operation Research" in the field of Education Management (Hardhienata, 2017). In the context of Correlational and Path Analysis research, SITOREM is used as a method to carry out: 1). Identify the strength of the relationship between the Independent Variable and the Dependent Variable, 2) Analysis of the value of the research results for each research variable indicator, and 3) Analysis of the weight of each indicator for each research variable based on the "Cost, Benefit, Urgency and Importance" criteria.

Based on identifying the strength of the relationship between research variables, and based on the weight of each indicator of the independent variable that has the greatest contribution, a priority order of indicators that need to be immediately improved and those that need to be maintained can be arranged. Analysis of research result values for each research variable indicator is

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calculated from the average score for each indicator of each research variable. The average score for each indicator is a description of the actual condition of these indicators from the point of view of the research subjects.

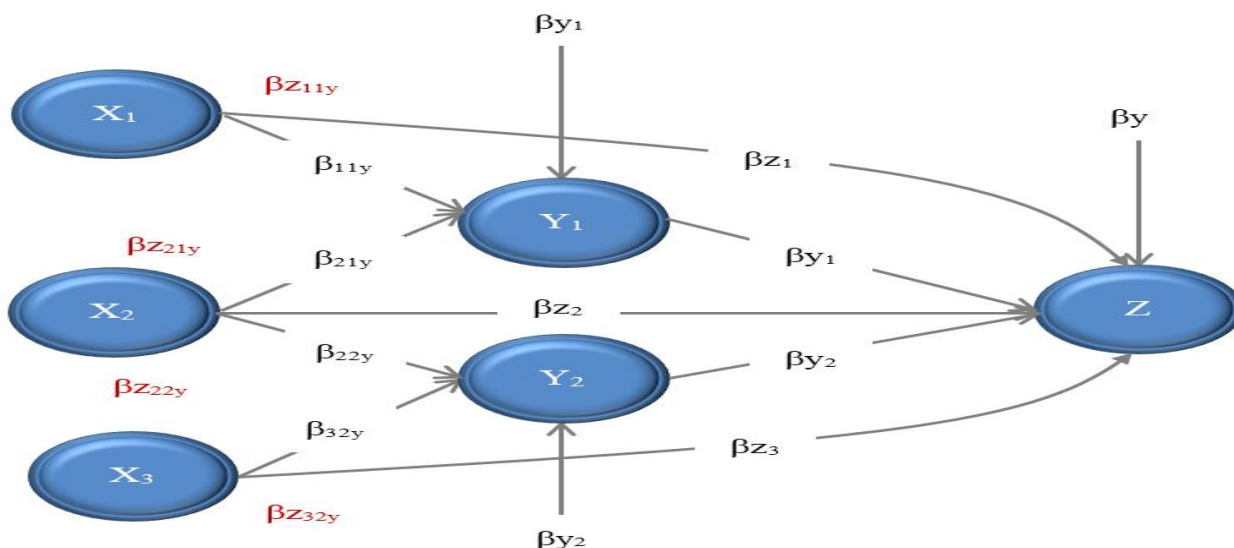


Figure 1. Research Constellation

X1: Management Knowledge Y1: Organizational Commitment

X2: Pedagogical Competency Y2: Work Motivation

X3: Work Ethic Z: Organizational Culture

- β_{z1} : Direct influence of Management Knowledge (X1) on Organizational Culture (Z).
- β_{z2} : Direct influence of Pedagogical Competency (X2) on Organizational Culture (Z).
- β_{z3} : Direct influence of Work Ethic (X3) on Organizational Culture (Z).
- β_{y1} : Direct influence of Organizational Commitment (Y1) on Organizational Culture (Z).
- β_{y2} : Direct influence of Work Motivation (Y2) on Organizational Culture (Z).
- β_{11y} : Direct influence of Management Knowledge (X1) on Organizational Commitment (Y1)
- β_{21y} : Direct influence of Pedagogical Competency (X2) on Organizational Commitment (Y1).
- β_{22y} : Direct influence of Pedagogical Competency (X2) on Work Motivation (Y2)
- β_{32y} : Direct influence of Work Ethic (X3) on Work Motivation (Y2)
- β_{z11y} : Indirect influence of Management Knowledge (X1) on Organizational Culture (Z) through Organizational Commitment (Y1)
- β_{z21y} : Indirect influence of Pedagogical Competency (X2) on Organizational Culture (Z) through Organizational Commitment (Y1)
- β_{z22y} : Direct influence of Pedagogical Competency (X2) on Organizational Culture (Z) through Work Motivation (Y2)
- β_{z32y} : Direct influence of Work Ethic (X3) on Organizational Culture (Z) through Work Motivation (Y2)

RESULTS AND DISCUSSION

1. Descriptive statistics

Based on the results of the analysis of statistical descriptions for research variables, symptoms of central data can be revealed as listed in the following table:

Table 1. Summary of Statistical Description of Research Variables

Description	Management Knowledge (X ₁)	Management Knowledge (X ₂)	Work Ethic (X ₃)	Organizational Commitment (Y ₁)	Work Motivation (Y ₂)	Culture Organization (Z)
Mean	126.28	124.10	122.91	122.80	121.05	126.75
Standard Error	1.25326	1.37182	1.19771	1.77186	1.21728	1.75046

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Description	Management Knowledge (X ₁)	Management Knowledge (X ₂)	Work Ethic (X ₃)	Organizational Commitment (Y ₂)	Work Motivation (Y ₂)	Culture Organization (Z)
Median	130	129	126.5	130	124	134
Mode	136	149	130	149	121	150
Stand Deviation	17.1838	21.2945	16.4221	24.2945	16.6906	24.001
Sample Variance	295.284	320.223	269.687	590.223	278.575	576.049
Kurtosis	0.85695	0.3495	1.64832	0.5498	0.58266	1.64903
Skewness	-1.0468	-0.6772	-1.3927	-0.7772	-0.9844	-1.4904
Range	77	90	81	101	70	101
Minimum Score	75	69	64	59	74	52
Maximum Score	152	170	145	160	144	153

2. Normality Test

Based on the overall calculation results of the error normality test in this study, it can be seen in the summary in the following table:

Table 2. Estimated Standard Error Normality Test

Estimate Error	n	L _{count}	L _{table}		Decision
			α = 0,05	α = 0,01	
$z - \hat{Y}_1$	168	0.003	0.065	0.075	Normal
$z - \hat{Y}_2$	168	0.002	0.065	0.075	Normal
$z - \hat{Y}_3$	168	0.007	0.065	0.075	Normal
$z - \hat{Y}_4$	168	0.006	0.065	0.075	Normal
$z - \hat{Y}_5$	168	0.006	0.065	0.075	Normal
$Y_1 - X_1$	168	0.001	0.065	0.075	Normal
$Y_1 - X_2$	168	0.004	0.065	0.075	Normal
$Y_2 - X_2$	168	0.002	0.065	0.075	Normal
$Y_2 - X_3$	168	0.004	0.065	0.075	Normal
Normal distribution requirements: L _{count} < L _{table}					

3. Homogeneity Test

Based on the overall calculation results of the error normality test in this study, it can be seen in the summary in the following table:

Table 3. Summary of Data Variance Homogeneity Test

Grouping	X ² _{count}	X ² _{table}	Conclusion
		α = 0,05	
y based on X ₁	3710.50	6132.59	Homogeneous
y based on X ₂	4469.28	6890.01	Homogeneous
y based on X ₃	4912.17	7288.01	Homogeneous
y based on Y ₁	3714.91	6132.59	Homogeneous
y based on Y ₂	4563.34	5768.59	Homogeneous
Y ₁ based on X ₁	3823.33	7288.01	Homogeneous
Y ₁ based on X ₂	4592.84	8451.28	Homogeneous
Y ₂ based on X ₂	4613.17	6192.48	Homogeneous
Y ₂ based on X ₃	3678.36	7678.01	Homogeneous

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Grouping	χ^2_{count}	χ^2_{table}	Conclusion
		$\alpha = 0,05$	
Requirements for a homogeneous population $\chi^2_{count} < \chi^2_{table}$			

4. Regression Model Test

The overall calculation results of the regression model in this research can be seen in the summary in the following table:

Table 4. Regression Model

Relationship Model Between Variables	Regression Model	Significance Test Results
$y \rightarrow x_1$	$\hat{y} = 59,508 + 0,645X$	Significance
$y \rightarrow x_2$	$\hat{y} = 54,744 + 0,523X$	Significance
$y \rightarrow x_3$	$\hat{y} = 58,693 + 0,533X$	Significance
$y \rightarrow y_1$	$\hat{y} = 69,508 + 0,645X$	Significance
$y \rightarrow y_2$	$\hat{y} = 67,122 + 0,715X$	Significance
$y_1 \rightarrow x_1$	$\hat{y} = 72,423 + 0,447X$	Significance
$y_1 \rightarrow x_2$	$\hat{y} = 72,122 + 0,382X$	Significance
$y_2 \rightarrow x_2$	$\hat{y} = 56,152 + 0,577X$	Significance
$y_2 \rightarrow x_3$	$\hat{y} = 54,165 + 0,623X$	Significance
$y \rightarrow x_1 \rightarrow y_1$	$\hat{y} = 56,77 + 0,40X_1 + 0,36X_2$	Significance
$y \rightarrow x_2 \rightarrow y_1$	$\hat{y} = 44,12 + 0,37X_1 + 0,43X_2$	Significance
$y \rightarrow x_2 \rightarrow y_2$	$\hat{y} = 51,45 + 0,44X_1 + 0,30X_2$	Significance
$y \rightarrow x_3 \rightarrow y_2$	$\hat{y} = 50,23 + 0,42X_1 + 0,54X_2$	Significance

5. Regression Model Significance Test

The overall calculation results of the linearity test of the regression model in this study can be seen in the summary in the following table:

Table 5. Summary of Regression Model Significance Test Results

Relationship Model Between Variables	Sig	α	Significance Test Results
$y \rightarrow x_1$	0,000 ^b	0,005	Significance
$y \rightarrow x_2$	0,000 ^b	0,005	Significance
$y \rightarrow x_3$	0,000 ^b	0,005	Significance
$y \rightarrow y_1$	0,000 ^b	0,005	Significance
$y \rightarrow y_2$	0,000 ^b	0,005	Significance
$y_1 \rightarrow x_1$	0,000 ^b	0,005	Significance
$y_1 \rightarrow x_2$	0,000 ^b	0,005	Significance
$y_2 \rightarrow x_2$	0,000 ^b	0,005	Significance
$y_2 \rightarrow x_3$	0,000 ^b	0,005	Significance
$y \rightarrow x_1 \rightarrow y_1$	0,000 ^b	0,005	Significance
$y \rightarrow x_2 \rightarrow y_1$	0,000 ^b	0,005	Significance
$y \rightarrow x_2 \rightarrow y_2$	0,000 ^b	0,005	Significance
$y \rightarrow x_3 \rightarrow y_2$	0,000 ^b	0,005	Significance
Significant Conditions: Sig < α			

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6. Linearity Test

The overall calculation results of the linearity test of the regression model in this study can be seen in the summary in the following table:

Table 6. Summary of Regression Model Linearity Test Results

Relationship Model Between Variables	Sig	α	Linearity Test Results
$y \rightarrow x_1$	0,000	0,005	Linier
$y \rightarrow x_2$	0,000	0,005	Linier
$y \rightarrow x_3$	0,000	0,005	Linier
$y \rightarrow y_1$	0,000	0,005	Linier
$y \rightarrow y_2$	0,000	0,005	Linier
$y_1 \rightarrow x_1$	0,000	0,005	Linier
$y_1 \rightarrow x_2$	0,000	0,005	Linier
$y_2 \rightarrow x_2$	0,000	0,005	Linier
$y_2 \rightarrow x_3$	0,000	0,005	Linier
$y \rightarrow x_1 \rightarrow y_1$	0,000	0,005	Linier
$y \rightarrow x_2 \rightarrow y_1$	0,000	0,005	Linier
$y \rightarrow x_2 \rightarrow y_2$	0,000	0,005	Linier
$y \rightarrow x_3 \rightarrow y_2$	0,000	0,005	Linier
Linear Terms: Sig < α			

7. Multicollinearity Test

Multicollinearity testing aims to determine whether the regression model found any correlation between independent variables or independent variables. Testing uses the Spearman Test. The effect of this multicollinearity is that it causes high variability in the sample. This means that the standard error is large, as a result, when the coefficient is tested, the t-count will be a smaller value than the t-table. The overall calculation results of the multicollinearity test are as follows:

Table 7. Summary of Multicollinearity Tests

Independent Variable	Tolerance	VIF	Precondition	Conclusion
Management Knowledge (X_1)	0.237	4.645	H ₀ : VIF < 10, there is no multicollinearity H ₁ : VIF > 10, there is multicollinearity	Ho accepted There is no multicollinearity
Competence Pedagogy (X_2)	0.243	4.771	H ₀ : VIF < 10, there is no multicollinearity H ₁ : VIF > 10, there is multicollinearity	Ho accepted There is no multicollinearity
Work Ethic (X_3)	0.211	4.408	H ₀ : VIF < 10, there is no multicollinearity H ₁ : VIF > 10, there is multicollinearity	Ho accepted There is no multicollinearity
Commitment Organization (Y_1)	0.212	4.356	H ₀ : VIF < 10, there is no multicollinearity H ₁ : VIF > 10, there is multicollinearity	Ho accepted There is no multicollinearity

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Independent Variable	Tolerance	VIF	Precondition	Conclusion
Motivation Work (Y ₂)	0.212	4.122	H ₀ : VIF < 10, there is no multicollinearity H ₁ : VIF > 10, there is multicollinearity	H ₀ accepted There is no multicollinearity

8. Heteroscedasticity Test

In this research, to test whether there is heteroscedasticity using the Glejser Test where if the significant value is <0.05 then heteroscedasticity occurs, on the contrary, if the significance value is ≥ 0.05 then homoscedasticity occurs. The overall calculation results of the heteroscedasticity test in this study can be seen in the summary in the following table:

Table 8. Summary of Heteroscedasticity Test

Variable	Sig.	α	Precondition	Conclusion
Management Knowledge (X ₁)	0,000	0,05	H ₀ : significant value < 0,05 then there is no heteroscedasticity. H ₁ : significant value ≥ 0,05 then there is heteroscedasticity	H ₀ accepted There is no heteroscedasticity
Competence Pedagogy (X ₂)	0,000	0,05	H ₀ : significant value < 0,05 then there is no heteroscedasticity. H ₁ : significant value ≥ 0,05 then there is heteroscedasticity	H ₀ accepted There is no heteroscedasticity
Work Ethic (X ₃)	0,000	0,05	H ₀ : significant value < 0, then there is no heteroscedasticity. H ₁ : significant value ≥ 0,05 then there is heteroscedasticity	H ₀ accepted There is no heteroscedasticity
Commitment Organization (Y ₁)	0,000	0,05	H ₀ : significant value < 0,05 then there is no heteroscedasticity. H ₁ : significant value ≥ 0,05 then there is heteroscedasticity	H ₀ accepted There is no heteroscedasticity
Motivation Work (Y ₂)	0,000	0,05	H ₀ : significant value < 0, then there is no heteroscedasticity. H ₁ : significant value ≥ 0,05 then there is heteroscedasticity	H ₀ accepted There is no heteroscedasticity

9. Path Analysis

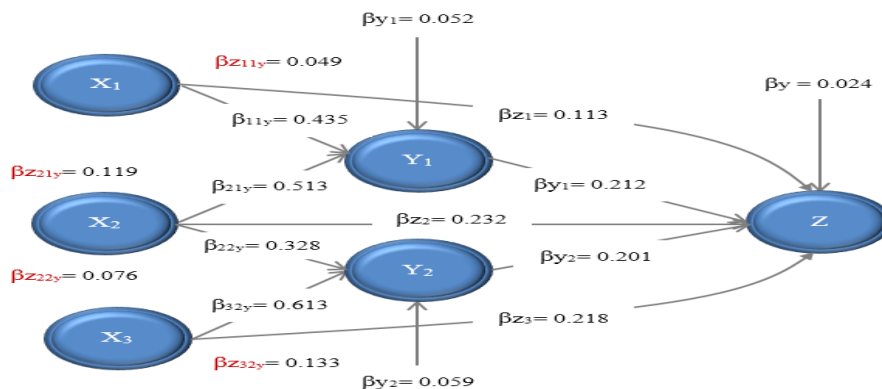


Figure 2. Path Analysis Results

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X1: Management Knowledge Y1: Organizational Commitment

X2: Pedagogical Competency Y2: Work Motivation

X3: Work Ethic Z: Organizational Culture

The influence between the independent variable and the dependent variable when viewed from path analysis, the influence on the Organizational Culture variable (Z) is formed as a result of the functioning of the Management Knowledge (X1), Pedagogical Competency (X2), Work Ethic (X3) and Organizational Commitment (Y1) and Work Motivation (Y2). Discussion of research results can be described as follows:

Table 9. Research Hypothesis

Hypothesis	Path Coefficient	Statistical Test	Decision	Conclusion
Management Knowledge (X ₁) on the Organizational Culture (Z)	0.113	H ₀ : $\beta_{z1} \leq 0$ H ₁ : $\beta_{z1} > 0$	H ₀ is rejected H ₁ is accepted	Direct Positive Influence
Pedagogical Competency (X ₂) on the Organizational Culture (Z)	0.232	H ₀ : $\beta_{z2} \leq 0$ H ₁ : $\beta_{z2} > 0$	H ₀ is rejected H ₁ is accepted	Direct Positive Influence
Work Ethic (X ₃) on the Organizational Culture (Z)	0.218	H ₀ : $\beta_{z3} \leq 0$ H ₁ : $\beta_{z3} > 0$	H ₀ is rejected H ₁ is accepted	Direct Positive Influence
Organizational Commitment (Y ₁) on the Organizational Culture (Z)	0.212	H ₀ : $\beta_{y1} \leq 0$ H ₁ : $\beta_{y1} > 0$	H ₀ is rejected H ₁ is accepted	Direct Positive Influence
Motivasi Kerja (Y ₂) on the Organizational Culture (Z)	0.201	H ₀ : $\beta_{y2} \leq 0$ H ₁ : $\beta_{y2} > 0$	H ₀ is rejected H ₁ is accepted	Direct Positive Influence
Management Knowledge (X ₁) on Organizational Commitment (Y ₁)	0.435	H ₀ : $\beta_{11y} \leq 0$ H ₁ : $\beta_{11y} > 0$	H ₀ is rejected H ₁ is accepted	Direct Positive Influence
Pedagogical Competency (X ₂) on Organizational Commitment (Y ₁)	0.513	H ₀ : $\beta_{12y} \leq 0$ H ₁ : $\beta_{12y} > 0$	H ₀ is rejected H ₁ is accepted	Direct Positive Influence
Pedagogical Competency (X ₂) on Work Motivation (Y ₂)	0.328	H ₀ : $\beta_{22y} \leq 0$ H ₁ : $\beta_{22y} > 0$	H ₀ is rejected H ₁ is accepted	Direct Positive Influence
Work Ethic (X ₃) on Work Motivation (Y ₂)	0.613	H ₀ : $\beta_{32y} \leq 0$ H ₁ : $\beta_{32y} > 0$	H ₀ is rejected H ₁ is accepted	Direct Positive Influence

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Hypothesis	Path Coefficient	Statistical Test	Decision	Conclusion
Management Knowledge (X ₁) on the Organizational Culture (Z) through Organizational Commitment (Y ₁)	0.049	H ₀ : $\beta_{z11} \leq 0$ H ₁ : $\beta_{z11} > 0$	H ₀ is rejected H ₁ is accepted	Influential Indirect Positive
Pedagogical Competency (X ₂) on the Organizational Culture (Z) through Organizational Commitment (Y ₁)	0.119	H ₀ : $\beta_{z12} \leq 0$ H ₁ : $\beta_{z12} > 0$	H ₀ is rejected H ₁ is accepted	Influential Indirect Positive
Pedagogical Competency (X ₂) on the Organizational Culture (Z) through Work Motivation (Y ₂)	0.076	H ₀ : $\beta_{z22} \leq 0$ H ₁ : $\beta_{z22} > 0$	H ₀ is rejected H ₁ is accepted	Influential Indirect Positive
Work Ethic (X ₃) on the Organizational Culture (Z) through Work Motivation (Y ₂)	0.133	H ₀ : $\beta_{z32} \leq 0$ H ₁ : $\beta_{z32} > 0$	H ₀ is rejected H ₁ is accepted	Influential Indirect Positive

10. Indirect Effect Test

The indirect effect test is used to test the effectiveness of the intervening variable which mediates the independent variable and the dependent variable. The results of the indirect influence test are as follows:

Table. 10 Research Hypothesis

Indirect Influence	L-count	Z-table	Decision	Conclusion
Management Knowledge (X ₁) to Organizational Culture (Z) through Organizational Commitment (Y ₁)	4.654	1,966	H ₀ is rejected H ₁ is accepted	proven to mediate
Pedagogical Competency (X ₂) on Organizational Culture (Z) through Organizational Commitment (Y ₁)	4.478	1,966	H ₀ is rejected H ₁ is accepted	proven to mediate
Pedagogical Competency (X ₂) on Organizational Culture (Z) through Work Motivation (Y ₂)	4,238	1,966	H ₀ is rejected H ₁ is accepted	proven to mediate
Work Ethic (X ₃) to Organizational Culture (Z) through Work Motivation (Y ₂)	4,114	1,966	H ₀ is rejected H ₁ is accepted	proven to mediate

11. Optimal Solution for Improving Organizational Culture

Based on the results of statistical hypothesis testing, determining indicator priorities, and calculating indicator values as described above, a recapitulation of research results can be made which is the optimal solution for improving Organizational Culture as follows:

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Table 11. SITOREM Analysis

Management Knowledge ($\beta z1 = 0,113$) (rank. V)				
Indicator in Initial State		Indicator after Weighting by Expert		Indicator Value
1	Knowledge acquisition	1 st	Knowledge sharing and distribution (18.17)	3.88
2	Knowledge gathering	2 nd	Knowledge processing (18.13)	4.10
3	Knowledge storage	3 rd	Knowledge storage (17.16)	4.00
4	Knowledge processing	4 th	Utilization/application of knowledge (17.12)	3.61
5	Utilization/application of knowledge	5 th	Knowledge acquisition (15.21)	3.60
6	Sharing and distribution of knowledge	6 th	Knowledge gathering (14.21)	4.03
Pedagogical Competency ($\beta z2 = 0,232$) (rank. I)				
Indicator in Initial State		Indicator after Weighting by Expert		Indicator Value
1	Mastering the characteristics of students	1 st	Utilization of learning technology (21.38)	3.57
2	Ability to manage learning	2 nd	Implementation of evaluation & and learning outcomes (21.13)	4.02
3	Utilization of learning technology	3 rd	Learner development (20.16)	3.68
4	Implementation of evaluation & and learning outcomes	4 th	Ability to manage learning (19.12)	4.04
5	Student development	5 th	Mastering student characteristics (18.21)	3.74
Work Ethic ($\beta z3 = 0,218$) (rank. II)				
Indicator in Initial State		Indicator after Weighting by Expert		Indicator Value
1	Independence	1 st	Career mobility (20.38)	3.82
2	Honesty	2 nd	Quality of work (20.16)	3.84
3	Totality	3 rd	Honesty (20.13)	4.12
4	Quality of work	4 th	Independence (20.12)	4.14
5	Career mobility	5 th	Totality (19.21)	4.02
Organizational Commitment ($\beta y1 = 0,212$) (rank. III)				
Indicator in Initial State		Indicator after Weighting by Expert		Indicator Value
1	Strong affection for the profession and the organization	1 st	Having obligations in his work (14.07)	3.85
2	Has a strong motivation to stay in his job	2 nd	Teachers' moral obligation to remain in their organization (14.03)	4.11
3	Selfless and devoted in carrying out his duties	3 rd	Have a strong motivation to stay on the job (13.06)	3.65
4	An individual's assessment of the cost of living if he leaves his job	4 th	Strong affection for profession and organization (13.02)	4.03
5	Lack of alternative professions	5 th	Selfless and devoted in carrying out his duties (12.21)	3.78
6	Has obligations in his work	6 th	Lack of other professional alternatives (12.19)	3.76

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Management Knowledge ($\beta z1 = 0,113$) (rank. V)				
Indicator in Initial State		Indicator after Weighting by Expert		Indicator Value
7	Maintaining stability/togetherness between the morals of society and the profession as well as a sense of responsibility to uphold the values of the profession	7 th	Maintaining stability/togetherness between the morals of society and the profession as well as a sense of responsibility to uphold the values of the profession (11.03)	4.10
8	Teachers' moral obligation to remain in their organization	8 th	Individual assessment of the cost of living if leaving a job (10.39)	4.12
Work Motivation ($\beta y2 = 0,201$) (rank. IV)				
Indicator in Initial State		Indicator after Weighting by Expert		Indicator Value
1	Attachment to work	1 st	Adequate rewards (18.12)	3.89
2	Desire for power	2 nd	Job Guarantee (18.08)	3.90
3	The desire to gain appreciation and recognition	3 rd	Desire for appreciation and recognition (17.06)	3.98
4	Adequate rewards	4 th	Good supervision (17.02)	4.12
5	Job Guarantee	5 th	Will to power (15.22)	4.12
6	Good supervision	6 th	Attachment to work (14.50)	4.14
Budaya Organisasi				
Indicator in Initial State		Indicator after Weighting by Expert		Indicator Value
1	Innovation at work	1 st	Oriented to work results (18.17)	4.12
2	Oriented to work results	2 nd	Team oriented (18.13)	4.14
3	Team oriented	3 rd	Innovation in work (17.16)	4.10
4	Empowerment of human resources in organizations	4 th	Empowerment of human resources in organizations (17.12)	3.86
5	Consistent with the rules that have been set	5 th	Adaptation to change (15.21)	3.76
6	Adaptation to changes	6 th	Consistent with established rules (14.21)	3.98
SITOREM ANALYSIS RESULT				
Priority order of indicator to be Strengthened			Indicators remain to be maintained	
1 st	Utilization of learning technology		1. Implementation of evaluation & and learning outcomes	
2 nd	Student development		2. Ability to manage learning	
3 rd	Mastering the characteristics of students		3. Honesty	
4 th	Career mobility		4. Independence	
5 th	Quality of work		5. Totality	
6 th	Has obligations in his work		6. Teachers' moral obligation to remain in their organization	
7 th	Has a strong motivation to stay in his job		7. Strong affection for the profession and organization	
8 th	Selfless and devoted in carrying out his duties		8. Maintain stability/togetherness between the morals of society and the profession as well as	

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Management Knowledge ($\beta_{z1} = 0,113$) (rank. V)		
Indicator in Initial State	Indicator after Weighting by Expert	
		Indicator Value
		a sense of responsibility to uphold the values of the profession
9 th	Lack of alternative professions	9. Individual assessment of the cost of living if he leaves his job
10 th	Adequate rewards	10. Good supervision
11 th	Job Guarantee	11. The will to power
12 th	The desire to gain appreciation and recognition	12. Attachment to work
13 th	Sharing and distribution of knowledge	13. Knowledge processing
14 th	Utilization/application of knowledge	14. Knowledge storage
15 th	Knowledge acquisition	15. Knowledge gathering
16 th	Empowerment of human resources in organizations	16. Oriented to work results
17 th	Adaptation to changes	17. Team oriented
18 th	Consistent with the rules that have been set	18. Inovasi dalam bekerja

CONCLUSIONS, IMPLICATIONS, AND SUGGESTIONS

Based on the results of the analysis, discussion of research results, and hypotheses that have been tested, it can be concluded as follows:

1. Strengthening Organizational Culture can be done by using a strategy to strengthen variables that have a positive effect on Organizational Culture.
2. Variables that have a positive influence on Organizational Culture are Management Knowledge, Pedagogical Competency, Work Ethic, Organizational Commitment, and Work Motivation. This was proven from the results of variable analysis using the Path Analysis method.
3. The way to strengthen organizational culture is to improve weak indicators and maintain good indicators for each research variable.

Based on the research conclusions above, the following implications can be drawn from this research:

1. If organizational culture is to be strengthened, it is necessary to strengthen management knowledge, pedagogical competence, and work ethic as exogenous variables with organizational commitment and work motivation as intervening variables.
2. If management knowledge is to be developed, it is necessary to improve indicators that are still weak, namely: knowledge sharing and distribution, knowledge utilization/application, and knowledge acquisition as well as maintaining or developing indicators: knowledge processing, knowledge storage, and knowledge collection.
3. If pedagogical competence is to be developed, it is necessary to improve indicators that are still weak, namely, the use of learning technology, student development, and mastering student characteristics, as well as maintaining or developing indicators: implementation of evaluation and learning outcomes, and the ability to manage learning.
4. If work ethic is to be developed, it is necessary to improve indicators that are still weak, namely: career mobility and quality of work, as well as maintaining or developing indicators: honesty, independence, and totality.
5. If organizational commitment is to be increased, it is necessary to improve indicators that are still weak, namely having obligations in their work, having a strong motivation to remain in their work, being selfless and devoted in carrying out their duties, and lack of other professional alternatives, as well as maintaining or developing indicators. : the teacher's moral obligation to remain in his organization, strong affection for his profession and organization, maintaining stability/togetherness between the morals of society and his profession as well as a sense of responsibility to uphold the values of his profession, and an individual assessment of the cost of living if he leaves his job
6. If work motivation is to be increased, it is necessary to improve indicators that are still weak, namely adequate rewards, job security, and the desire to gain appreciation and recognition, as well as maintaining or developing indicators: good supervision, desire for power, and attachment to work.

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Suggestions or recommendations that can be given to related parties are as follows:

1. School Principals need to improve Organizational Culture by strengthening Management Knowledge, Pedagogical Competency, Work Ethic, Organizational Commitment, and Work Motivation by improving and empowering human resources in the organization, adapting to changes, being consistent with established rules, and maintaining work result-oriented, team-oriented, and innovative in work
2. The Ministry of Education, Culture, Research and Technology (Kemdikbudristek) and school organizing institutions need to develop teachers in improving Organizational Culture by providing appropriate direction to strengthen the strengthening of Management Knowledge, Pedagogical Competency, Work Ethic, Organizational Commitment, and Work Motivation through the results of this research.

REFERENCES

- 1) Baran, B. E., Shanock, L. R., & Miller, L. R. (2012). Advancing Organizational Support Theory into the Twenty-First Century World of Work. *Journal of Business and Psychology*, 27, 123–147.
- 2) Bauer, Talya and Erdogan, Berrin. (2012). *An Introduction to Organizational Behavior*. Unnamed Publisher, Inc
- 3) Buchanan, D. A., & Huczynski, A. A. (2019). *Organizational behavior*. Pearson UK.
- 4) Colquitt, J. A., LePine, J. A., & Wesson, M. J. (2015). *Organizational Behavior*. New York: McGraw-Hill.
- 5) Colquitt, J. A., Lepine, J. A., & Wesson, M. J. (2019). *ORGANIZATIONAL BEHAVIOUR Improving Performance and Commitment* (6th ed.).
- 6) E. Kusumadmo. 2013. *Manajemen Strategik - Pengetahuan*. Yogyakarta, Indonesia: Cahaya Atma.
- 7) Ganyang, Machmed Tun. (2018). *Manajemen Sumber Daya Manusia (Konsep dan Realita)*. Bogor: IN MEDIA
- 8) George, J. M., Jones, G. R., & Sharbrough, W. C. (2015). *Understanding and Managing Organizational Behavior*. New Jersey: Pearson Prentice Hall Upper Saddle River.
- 9) Gibson, J. L., Donnelly Jr, J. H., Ivancevich, J. M., & Konopaske, R. (2012). *Organizational Behavior, Structure, and Processes* (14th ed.). New York: McGraw-Hill.
- 10) Gomes, F. C. (2001). *Manajemen Sumber Daya Manusia*. Yogyakarta: Andi Offset.
- 11) Hardhienata, S. (2017). The development of scientific identification theory to conduct operation research in education management. *IOP Conference Series: Materials Science and Engineering*, 166(1), 012007.
- 12) Hermawan, A. (2023). *Pemodelan Kepemimpinan Melayani Kepala Sekolah*. Penerbit Lembaga Kajian DIALEKTIKA.
- 13) Hermawan, A., & Susanti, E. (2023). Pemodelan dan Optimasi Penguatan Kepemimpinan Melayani. *Jurnal Penelitian, Pendidikan Dan Pengajaran: JPPP*, 4(3), 232–250.
- 14) Hermawan, A., Ghozali, A. F., & Sayuti, M. A. (2023). Optimization for Increasing Teacher Performance through Strengthening Teamwork, Interpersonal Communication, Adversity Intelligence, and Work Motivation. *International Journal of Scientific Research and Management (IJSRM)*, 11(10), 5239–5248.
- 15) Hermawan, A., Muhammadi, A. M., & Indrati, B. (2023). Modeling and Optimization of Service Investigation Services: Empirical Study Using Pop-Hrm Approach at Head of Private Smk School in Bogor District, Indonesia. *International Journal of Business and Social Science Research*, 4(9), 15–28.
- 16) Hermawan, A., Setyaningsih, S., & Hardhienata, S. (2021). Exploratory Sequential Analysis Of Servant Leadership Reviewing From Adversity Intelligence, Proactive Personality, Team Work, Organizational Commitment And Work Motivation. *Journal of Positive Psychology and Wellbeing*, 5(4), 969–986.
- 17) Hermawan, A., Setyaningsih, S., & Hardhienata, S. (2022a). Modeling and Strengthening Servant Leadership. *Edunity: Social and Educational Studies*, 1(03).
- 18) Hermawan, A., Setyaningsih, S., & Hardhienata, S. (2022b). Servant Leadership Strengthening Modeling. *IJMIE: International Journal of Management, Innovation, and Education*, 1(1), 42–50.
- 19) Hermawan, A., Sunaryo, W., & Hardhienata, S. (2023). Optimal Solution for OCB Improvement Through Strengthening of Servant Leadership, Creativity, and Empowerment. *Aptisi Transactions on Technopreneurship (ATT)*, 5(1Sp), 11–21.
- 20) Joseph, O. O., & Kibera, F. (2019). Organizational culture and performance: Evidence from microfinance institutions in Kenya. *SAGE open*, 9(1), 2158244019835934.
- 21) Kinicki, A., & Fugate, M. (2016). *Organizational behavior : a practical, problem-solving approach*. In *McGraw-Hill Education* (First into). McGraw-Hill Education Singapore. <https://doi.org/LK> - <https://worldcat.org/title/930003718>

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- 23) Kreitner, R., & Kinicki, A. (2010). *Organizational Behavior*. New York: McGraw Hill.
- 24) Kurtessis, J. N., Eisenberger, R., Ford, M. T., Buffardi, L. C., Stewart, K. A., & Adis, C. S. (2015). Perceived Organizational Support: A Meta-Analytic Evaluation of Organizational Support Theory. *Journal of Management*, 20(10), 1–31. <https://doi.org/10.1177/0149206315575554>
- 25) Leung, Chan, & Lee, Lee, T. Y., Leung, H. K., & Chan, K. C. 2013. "Improving quality management on the basis of ISO 9000". *The TQM Magazine*, 11(2)
- 26) Nwancu, C. L. L. (2017). Effect of Gender and Marital Status on Perceived Organizational Justice and Perceived Organizational Support. *Gender & Behavior*, 15(1), 8353–8366.
- 27) Pohl, S., Battistelli, A., & Librecht, J. (2013). The impact of perceived organizational support and job characteristics on nurses' organizational citizenship behaviors. *International Journal of Organization Theory & Behavior*, 16(2), 193–207. <https://doi.org/10.1108/IJOTB-16-02-2013-B002>
- 28) Radnawati, D., & Hermawan, A. (2023). The Optimal Solution for Strengthening the Quality of Teacher Services Through Personality Development and Organizational Justice. *International Journal of Social Science Research and Review*, 6(12), 161–173.
- 29) Rhoades, L., & Eisenberger, R. (2002). Perceived organizational support: A review of the literature. *Journal of Applied Psychology*, 87(4), 698–714. <https://doi.org/doi/10.1037/0021-9010.87.4.698>
- 30) Robbins, S. P., & Judge, T. (2018). *Essentials of organizational behavior*. Pearson.
- 31) Robbins, Stephen A. dan Timothy A. Judge. (2018). *Essentials of Organizational Behavior*. Essex: Pearson Education Limited.
- 32) Rusnadi, S., & Hermawan, A. (2023). Strategi Optimal Peningkatan Kualitas Layanan Guru Sekolah Menengah Kejuruan (SMK) Melalui Penguatan Knowledge Management, Komunikasi Interpersonal, Dukungan Organisasi dan Kepuasan Kerja. *Jurnal Syntax Admiration*, 4(11), 2127–2146.
- 33) Rusnadi, S., Sumiati, & Hermawan, A. (2023). Optimal Strategy to Improve the Quality of Vocational Teacher Services through Knowledge Management, Interpersonal Communication, Organizational Support and Job Satisfaction. *International Journal of Social Science And Human Research*, 6(1), 6888–6899. <https://doi.org/10.47191/ijsshr/v6-i11-42>
- 34) Schein, E. H. (2017). *Organizational culture and leadership*. Hoboken: Wiley.
- 35) Schermerhorn, J. R. (2013). *Management* (12th ed.). New Jersey: John Wiley & Sons, Inc.
- 36) Schermerhorn, J. R., Hunt, J. G., & Osborn, R. N. (2016). Organizational Behavior. In *Jurnal Penelitian Pendidikan Guru Sekolah Dasar* (7th ed., Vol. 6, Issue August). John Wiley & Sons.
- 37) Sugiyono. (2017). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.
- 38) Wexley, K. N., & Yukl, G. A. (2005). *Perilaku organisasi dan psikologi personalia*. Jakarta: Bina Aksara.
- 39) Zagenczck, T. J., Gibney, R., Few, W. T., & Scott, K. L. (2011). Psychological Contracts and Organizational Identification: The Mediating Effect of Perceived Organizational Support. *Journal of Labor Research*, 32, 254–281.



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Applicability of Physical Education Learning Sports and Health (PJOK) Primary School in the Independent Curriculum



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ABSTRACT: In this research, the evaluation model used is the Discrepancy model. The subjects of this research were school principals, PJOK teachers and students at four schools in Kapanewon Ngaglik. Data collection techniques use questionnaires and interviews. The sample in this study included 4 school principals, 6 PJOK teachers and 4 students. The data analysis technique in this research is quantitative and qualitative descriptive analysis. The research instrument was validated through expert judgment. Content validity is proven by the V-Aiken Index coefficient with a result of 0.88 so it can be said to be valid. Meanwhile, the Cronbach's Coefficient Alpha reliability estimate is 0.904 (more than 0.07), so it is reliable and calculated with the help of SPSS. The results of the research show that the evaluation of the implementation of elementary school physical education, sports and health learning in the independent curriculum in four schools in Kapanewon Ngaglik is in the "Good" category. The results of the principal instrument analysis with a mean of 78.00, the assessment results with a percentage of 50% in the "Good" category are there (2 school principals), the "fair" category with a percentage of 25% are there (1 school principal) and the "poor" category with a percentage of 25% there (1 principal). Then the results of the PJOK teacher instrument analysis with a mean of 58.00, assessment results with a percentage of 50% in the "good" category are (3 teachers), in the "fair" category with a percentage of 17% there are (1 teacher), and the "sufficient" category " with a percentage of 33% there (2 teachers)

KEYWORDS: Evaluation, Discrepancy, learning, independent curriculum

INTRODUCTION

Education is an important part of human life that is conscious and planned, not an activity that is carried out routinely without having goals and careful planning. Education, especially in schools, has a very important role in educating the nation's life. Education is important in human life for achieving a decent life, that is why implementing education cannot be considered an easy thing (Uno, HB 2022). Education is a real and systematic step to create learning conditions and learning processes so that students can actively develop their potential and have spiritual strength, self-control, personality, intelligence, noble morals and skills that society, nation and state need at this time. and in the future (Monteiro et al., 2019)

Education has a very important role in advancing people 's lives in the current era of disruption. Education plays a very important role in the process of changing attitudes and behavior of individuals or groups of individuals in an effort to mature humans . with teaching and training steps. Education does not only aim to brighten the life of a nation but includes all values owned by a human being as a whole so that he can have attitudes and good personality (Ghimire, 2013)

The development of science and technology in Physical Education, Sports and Health (PJOK) brings a very large role in education for all groups, especially for children. This physical education provides opportunities for children to play, have fun through physical or physical activities, apart from that it plays an important role in children's development not only physically but also mentally, so that they can achieve educational goals. QPE (Quality Physical Education) which is a form of policy for equal distribution of physical education throughout the world, QPE was prepared to improve gaps in physical education, to prevent the impacts that occur due to the decline in the availability of physical education in accordance with the following WHO statement, increasing inactivity physical illness can become a serious disease such as a pandemic (UNESCO, 2015). This shows how important physical education is and is a very important thing in life, so that life goes hand in hand with physical education (Riyanto & Mudian, 2019). The principles and foundations of physical education have objectives which include developing physical and mental conditions, social integration and forming an independent person, as well as choosing forms of physical education and physical activity that are appropriate to a person's condition and social environment along with fostering health that meets standards. (Rosdiani, 2013, p.75-76)

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Through PJOK, it can stimulate students' physical development and growth, stimulate the balanced development of attitudes, mental, social, emotional and movement skills of students. PJOK in schools must be taught properly and correctly, PJOK is no less important than other subjects. A more specific scope is the subject of Physical Education, Sports and Health or PJOK (Barnes, A., Gani, RA, & Hidayat, AS, 2023). PJOK is an education carried out through physical activity which is an integral part of overall education, aiming to develop aspects of physical fitness, movement skills, critical thinking skills, social skills, emotional stability, moral actions, aspects of a healthy lifestyle and introduction to a clean environment through selected physical, sports and health activities that are planned systematically in order to achieve national education goals.

Based on the results of preliminary observations, it was found that several schools from which research data was taken began implementing the Merdeka curriculum with a trial in 2021 and then implemented in 2022. According to the information the researchers obtained, private elementary schools collaborated on curriculum from schools, the Independent Curriculum and Curriculum 13 Meanwhile, state schools are currently also collaborating on curriculum 13 and adapting the independent curriculum. In implementing the curriculum, of course, cooperation is also needed from all parties who have a role in the successful implementation of the Merdeka curriculum. Among them is the Principal as the initiator who brings the school to a school that implements the Merdeka curriculum. This includes the principal providing the concept and the curriculum team which plays a role in preparing the school's operational curriculum. Subject teachers who play a role in implementing learning in terms of planning, learning and evaluation as well as students who act as objects carrying out learning in the independent curriculum. Apart from that, parents also play a role in feeling how the behavior and learning achievements of their children who study using the Merdeka curriculum are influenced.

The independent curriculum is interpreted as a learning design that provides opportunities for students to be able to learn calmly, relaxed, fun, stress-free and pressure-free, so that they are able to show their natural talents. After talking with one of the teachers, he was able to develop an independent curriculum spectrum and teaching material modules that were in accordance with the characteristics of the school. Apart from that, teachers are able to sort out which competencies are given based on the characteristics of the students, although not everything goes smoothly during implementation, there are still several obstacles in various ways.

The main obstacle experienced was the need for adjustments in the implementation of learning to implement the independent curriculum. In some schools, this independent curriculum has only been implemented in grades 1 and 4, while grades 2, 3, 5 and 6 still use curriculum 13, so there is a need to adjust the learning implementation of each curriculum. The second obstacle is related to the learning material, changes in teaching methods can be readjusted both in theory and in practice. Apart from that, the characteristic of the independent curriculum is that the learning process is project-based, which still requires adjustments for teachers as executors in carrying out the curriculum, and the obstacles faced are also the lack of learning support facilities, making it difficult for a teacher to deliver learning optimally. The existence of these obstacles certainly becomes an obstacle in the learning process so that the learning outcomes obtained are not optimal enough.

From the description above, it can be seen that there is still a gap between theory and reality in PJOK learning with the application of the independent curriculum model. Even though the government's policy in designing the latest curriculum is very good, it is not certain that every school is ready and able to implement the independent curriculum well, so there is a need for evaluation in its implementation. According to (Anas, 2023, p.378) evaluation is a tool for determining what decisions from the evaluation results need to be developed. This statement can be seen that evaluation of a program must be carried out to provide consideration to those who implement it. Evaluation must be carried out periodically as part of the program development process. Curriculum evaluation must be carried out frequently in the process of running the curriculum because the curriculum is dynamic and will develop every year according to current developments.

This research aims to evaluate and find out how well the level of implementation of elementary school physical education, sports and health learning in the independent curriculum of several schools in Kapanewon Ngaglik. By conducting this research, it is hoped that schools will know how to evaluate the implementation of this independent curriculum model in elementary schools, especially the learning of PJOK as a consideration in making decisions so that they are able to develop the curriculum in the process of improving the curriculum.

METHOD

The type of research used is evaluation research with a discrepancy model. Evaluation research is research that evaluates an activity or program which aims to measure the success of a program whether it has run as expected or not (Kantun, 2017). This research aims to evaluate the implementation of Physical Education, Sports and Health (PJOK) learning at elementary school level in the Independent Curriculum. This evaluation research is also used to obtain information by comparing the suitability of conditions

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with established criteria or standards. This research uses a descriptive mix method approach combining quantitative and qualitative research to obtain comprehensive, valid, reliable and objective data. This research was conducted at an elementary school in Kapanewon Ngaglik, Sleman Regency. The schools selected consisted of two private schools and two state schools, namely Al-Azhar Islamic Elementary School Cairo Yogyakarta, IT Taruna Al-Quran Elementary School, Ngaglik Public Elementary School, and Gentan Public Elementary School. The research time was carried out on July 24 – August 2 2023.

DISCUSSION

The results of this research are intended to describe data about how well the level of implementation of physical education, sports and health learning in elementary schools in the independent curriculum. Researchers hope that the results of how well the level of learning is implemented can be used as an evaluation for each school, and can be followed up according to the procedures of each school.

a. Results of analysis of the Principal's questionnaire sheet

Data from the questionnaire were analyzed using descriptive statistics. Descriptive statistics on the implementation of PJOK learning evaluation using the independent curriculum. The principal takes a very important role, based on the data obtained that the lowest (minimum) score is 76, the highest (maximum) score is 80, the average (mean) is 78.00, the middle (median) is 78.00, the value that often appears (mode) 76, standard deviation (SD) 1.826. The results can be seen in full in table 6 as follows:

Table 1. Descriptive Statistics of School Principals

Statistics	
<i>N</i>	4
<i>Mean</i>	78.00
<i>Median</i>	78.00
<i>Mode</i>	76
<i>Std. Deviation</i>	1,826
<i>Minimum</i>	76
<i>Maximum</i>	80

The data from the questionnaire sheet is divided into 5 (five) criteria, namely very good, good, quite good, not good and very poor. The results of the questionnaire are in the form of assessment results with predetermined norms, making it easier to analyze implementation achievements. If displayed in table form, the implementation of the PJOK learning evaluation in elementary schools using the Independent Curriculum based on the norm scan assessment can be presented in table 2 as follows:

Table 2. Results of Principal Instrument Analysis

No	Intervals	Category	Amount	Percentage
1.	$80.74 < X$	Very good	0	0%
2.	$78.91 < X \leq 80.74$	Good	2	50%
3.	$77.09 < X \leq 78.91$	Enough	1	25%
4.	$75.26 < X \leq 77.09$	Not enough	1	25%
5.	$X \leq 75.26$	Very less	0	0%
Amount			4	100%

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Based on the frequency distribution in table 8 above, the implementation of PJOK learning evaluation in elementary schools. To make it easier to see the results of the analysis, they are presented in diagram form in Figure 1 as follows

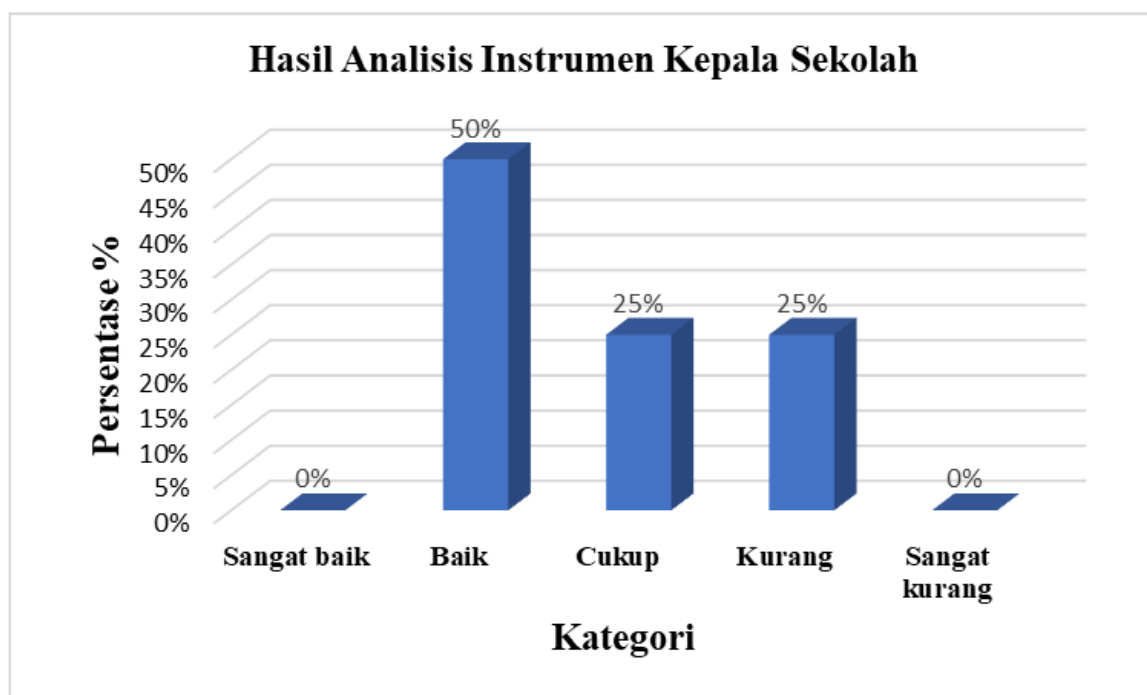


Figure 1. Histogram of Principal Instrument Analysis

b. Results of analysis of PJOK Teacher questionnaire sheets

Data from the questionnaire were analyzed using descriptive statistics. Descriptive statistics on the implementation of PJOK learning evaluation using the independent curriculum. In this process, PJOK teachers also take a very important role in the implementation of PJOK learning with the implementation of the new curriculum, namely the independent curriculum. The teacher's role in curriculum development will determine the success of the teacher's role in learning to achieve the educational goals set by the curriculum. Based on the data obtained, the lowest (minimum) score is 56, the highest (maximum) score is 60, the average (mean) is 58.00, the middle value (median) is 58.50, the frequently occurring value (mode) is 56, the standard deviation (SD) 1,673. The results can be seen in full in table 3 as follows:

Table 3. Statistical Description of PJOK Teacher Instruments

Statistics	
<i>N</i>	6
<i>Mean</i>	58.00
<i>Median</i>	58.50
<i>Mode</i>	56
<i>Std. Deviation</i>	1,673
<i>Minimum</i>	56
<i>Maximum</i>	60

The data from the questionnaire sheet is divided into 5 (five) criteria, namely very good, good, quite good, not good and very poor. The results of the questionnaire sheet are in the form of assessment results with predetermined norms, making it easier to analyze implementation achievements. When displayed in table form, the implementation of PJOK learning evaluations in elementary schools using the Merdeka Curriculum based on norm assessment.

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c. Results of analysis of student interviews

Apart from obtaining results from questionnaires, information was also obtained from interviews with students. Based on student responses to difficulties in learning PJOK. The results of the responses from students from private schools were that they felt difficulties, while from state schools there were students who felt difficulties and some who did not. According to them, the difficulties experienced in private schools can still be followed if they are willing to pay attention and practice, whereas in public schools they are able to follow them even though they are less than optimal. Each school can participate during the learning process, because according to them, PJOK learning is one of the lessons that involve learning while playing, so it is exciting and fun. The learning model on average in both schools has implemented fun learning so there is little chance of children feeling bored. Each school also has simple infrastructure such as round cones, cone balls, balls, jumping fields, mats, small goals, etc. That way, students can take part in learning happily, although the level of effectiveness of each school cannot be seen yet, but with PJOK learning they are happy because they can learn outside the classroom.

Based on the results of instrument analysis from the school principal and the results of instrument analysis from PJOK teachers as well as interviews with several students, the results of the research show that the implementation of the evaluation of the Implementation of Physical Education, Sports and Health (PJOK) Learning in Elementary Schools in the Independent Curriculum is in the Good category. In detail, the research results can be seen using the results of the norm reference assessment (PAN), the research results obtained from school principal respondents showed a percentage of at most 50% with the "good" category having 2 principals, then with the "fair" category 1 principal and "less" each shows a percentage of 25% with 1 principal. Meanwhile, the research results obtained from PJOK teacher respondents at most showed a percentage of 50%, there were 3 teachers in the "good" category, in the "adequate" category with a percentage of 17% there was 1 teacher, and in the "poor" category with a percentage of 33% there were 2 teachers. .

This research has presented data regarding the views of school principals and PJOK teachers in implementing the independent curriculum in educational, physical, sports and health (PJOK) learning in elementary schools. Researchers will first discuss findings regarding the role of school principals in implementing the independent curriculum in existing research. The principal in implementing the independent learning curriculum functions as an Educator, Manager, Administrator, Supervisor, Leader, Innovator, Motivator (Zahra & Putri, 2016). In order to implement the independent curriculum, the role of the principal is very important in empowering all school resources for the successful implementation of the independent curriculum. The successful factor in implementing the independent curriculum is the leadership of the school principal, especially his role in implementing education and supervision (Zahra & Putri, 2016).

According to (Isa et al., 2022), it was explained that the aim of the research was to see the extent of professionalism of school principals in implementing the independent curriculum. The school principal carries out his role as a mediator and motivator for teacher participation in curriculum training. The school principal also plays a role as a participant in regular meetings or discussions. The school principal is also a supervisor and evaluator in implementing the independent curriculum. The research results show that the implementation of the independent curriculum makes teachers more professional through various kinds of coaching and training. Another party who also plays a role in supporting the implementation of the independent curriculum is the curriculum development team together with the school principal. The school principal and the team that has been selected according to these competencies will process or package the curriculum according to the needs of each school.

In the learning process, the tasks that teachers must carry out are mastering, planning, implementing learning, and carrying out learning evaluations. The plans made by the teacher must be in accordance with the education and learning concepts contained in the curriculum. This planning is an idea about what is carried out in learning so that a system is created that allows a learning process to occur and can bring students to achieve the expected goals. One of the supporting factors for successful learning in schools is the use of interesting, innovative and creative learning media, so that it can increase students' interest in studying an object. Learning media is a tool that has the function of conveying learning messages from teachers to students. Learning media are media, tools or techniques used in the teaching and learning process with the aim of ensuring that the process of educational communication interaction between teachers and students can take place in an effective and efficient manner. (Dita et al., 2021, p.24) states that learning media is an intermediary that makes it easier for educators to convey material to students, so that learning can be achieved according to learning objectives. When understood in broad terms, media are people, materials and events that create conditions that enable students to acquire knowledge, skills or attitudes. In this sense, teachers, textbooks, and the school environment are media.

Indicators that learning media are still in the deficient category for older teachers are as follows: (1) Teachers are not yet very proficient in operating media/platforms that support the learning process and (2) Learning media and tools are not yet complete and in accordance with the objectives. , materials, and learning models. In order to help implement the physical education

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learning process, especially in learning sports games, even though the learning facilities are less supportive, the learning process must still be provided and implemented according to the curriculum. Effective physical education learning is reflected when students can be actively involved during learning and students can gain successful and satisfying experiences in every learning activity (Budi et al., 2019, p.131). Physical education learning programs given to students should pay attention to the level of growth and development of students' abilities, so that effective learning and successful experiences can be obtained by students (Sayfei et al., 2020). Meanwhile, evaluation is carried out to measure the degree of achievement of objectives and the effectiveness of the learning process carried out. Evaluation is a feedback process that is the basis for improving the learning system. In order for evaluation activities to achieve maximum results, evaluation must be carried out continuously.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the implementation of the evaluation of the implementation of elementary school physical education, sports and health learning in the independent curriculum in Kapanewon Ngaglik, shows that the results of the analysis of the norm reference assessment are in the "Good" category.

REFERENCES

- 1) Dayanti, J., & Sumaryanto, S. (2021). Implementation of physical, sports, and health education facilities. *Sports Journal*. <https://doi.org/10.21831/jk.v9i1.32490>
- 2) Ministry of Education and Culture. (2022). Implementation of the Independent Curriculum. <https://kurikulum.gtk.kemdikbud.go.id/>
- 3) BSKAP Decree Number 008/KR/2022 concerning Learning Achievements in Early Childhood Education, Basic Education Levels, and Secondary Education Levels in the Independent Curriculum.
- 4) Decree of the Head of BSKAP Number 009/KR/2022 concerning Dimensions, Elements and Sublements of the Pancasila Student Profile in the Independent Curriculum.
- 5) Decree of the Head of BSKAP Number 044/H/KR/2022 concerning the Education Unit Implementing the Independent Curriculum in the 2022/2023 Academic Year (12 July 2022)
- 6) Decree of the Head of BSKP Number 033/H/KR/2022 concerning Top Amendments
- 7) Monteiro, A., Jorge Santos, P., & Gonçalves, C. (2019). The meaning of higher education, work, and transition from higher education to work. *Psychologica Analysis*. <https://doi.org/10.14417/ap.1606>
- 8) Mustafa, PS (2021). The Discrepancy Model as an Evaluation of Educational Programs. *PALAPA* , 9 (1), 182-198.
- 9) Ningtyas, AS, & Rosdiana, L. (2019). Student Responses to the Implementation of Learning Using the Guided Inquiry Model. *PENSA: E-JOURNAL OF SCIENCE EDUCATION* , 7 (2).
- 10) Nugroho, T., & Narawaty, D. (2022). 2013 Curriculum, Emergency Curriculum, and Prototype Curriculum (2020-2021) or Merdeka Curriculum (2022) for English Language Subjects: A Comparative Study. *Sinistra: Proceedings*
- 11) Riyanto, P., & Mudian, D. (2019). The effect of physical activity on increasing students' emotional intelligence. *Sports Area Journal* , 4 (2), 339-347.
- 12) Uno, HB (2022). *Foundations of education* . Literary Earth.



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Copyright as an Object of Fiduciary Guarantee from the Perspective of Law Number 42 Year 1999 on Fiduciary Guarantee



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ABSTRACT: Law Number 28 Year 2014 on Copyright brings legal reform, especially for holders of rights to Intellectual Property Rights, especially Copyright. Although juridically normative copyright can be used as an object of fiduciary guarantee, it does not necessarily make banks easily provide loans. Because, the arrangement in the Copyright Act, requires further elaboration of implementing regulations related to guarantees for the Bank (as a creditor) to obtain certainty of return of funds that have been loaned to the debtor. The research used is normative juridical legal research that focuses on the review or study of positive law. The research approach is a method or way to conduct a study so that researchers get information from various aspects to find the issues they are looking for answers to. In accordance with the type of research that is normative juridical, then the research approach used in this study is the Legislation Approach, Conceptual Approach, Conceptual Approach and Case Approach. The result of his research is that Copyright as an object of fiduciary security is in accordance with Law No. 42 of 1999 concerning Fiduciary Guarantees where Copyright can be encumbered by collateral in the form of fiduciary, but not on the object encumbered by the Copyright, but the economic value attached to the copyright. In addition, the Copyright must first be registered with the Directorate General of Intellectual Property of the Ministry of Law and Human Rights before it can be pledged. This is important because it is proof that the fiduciary is the holder of the Copyright. However, some provisions in the Fiduciary Guarantee Act are difficult to apply to fiduciary guarantees in the form of copyright.

KEYWORDS: Hak Cipta; Hak Ekonomi; Jaminan Fidusia; Objek Jaminan.

I. INTRODUCTION

Intellectual property comes from the creative activity of a human mind that is expressed to the general public in various forms, useful, useful to support life and has economic value. Intellectual property is a private right and has its own privileges because it has an exclusive nature and also has economic value, therefore any party is prohibited from copying, using, and using in trade an intellectual work without the permission of the creator. Intellectual Property Rights in the World Intellectual Property Organization (WIPO) is called "creation of the mind" which can be interpreted as a human work that is born with an outpouring of energy, passion, creation, time and money. (Widyastuti, 2010: 3) So it can be said that Intellectual Property Rights are "Product of Mind".¹

The characteristics of Intellectual Property Rights do not control physical wealth, but can only be controlled through claims or legal actions, which means that ownership is only recorded in a legal action, especially if there is a violation of these rights.² Intellectual Property Rights can generally be grouped into two types of rights. First, copyright, which includes copyright and other rights related to copyright (neighboring rights) Second, industrial property rights over industrial property (industrial propertyrights),³ which includes Patents, Trademarks and Geographical Indications, Plant Varieties, Industrial Designs, Integrated Circuit Layout Designs, and Trade Secrets. One form of Intellectual Property Rights that has the broadest scope of protected objects, because it covers science, art and literature (art and literary) and computer programs is Copyright.⁴

Copyright is the exclusive right of the creator that arises automatically based on the declarative principle after a work is realized in a tangible form without reducing the restrictions in accordance with the provisions of the legislation. Copyright is an exclusive right for the creator to publish or reproduce his/her creation in the fields of science, art and literature, which can consist

¹Lisa Widyastuti, "Ide dan kekayaan Intelektual", Media HKO-Buletin Indormasi dan Keragaman Hak, Vol. VII, No. 3, 2010, p. 3

²Rahayu Kartini, "Kajian Implementasi Prinsip-Prinsip Perlindungan HaKi dalam Peraturan Per UU an Haki di Indonesia", Humanity, Vol. 1, No. 1, 2005, p. 46.

³Anis Mashdurohaturun, 2013, *Hak Kekayaan Intelektual (HKI) dalam perspektif Sejarah Indonesia*, Semarang: SAPREES, p. 7.

⁴Anis Mashdurohaturun, "Problematika Perlindungan Hak Cipta di Indonesia", Yustisia Jurnal Hukum, Vol. 3, No. 2, 2012, p. 72.

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of books, computer programs, lectures, lectures, speeches, other similar creations, as well as rights related to Copyright. Sound recordings and / or images of performances of a performer (performer), is a related right protected by copyright.

Copyright is regulated in Law Number 28 of 2014 concerning Copyright hereinafter referred to as UUHC 2014, the regulation of Copyright in Indonesia itself has undergone several changes. Law Number 28 of 2014 Concerning Copyright is the result of changes from Law Number 19 of 2002 Concerning Copyright. While Law Number 19 of 2002 concerning Copyright is an amendment of Law Number 12 of 1997, while Law Number 12 of 1997 is an amendment of Law Number 7 of 1987. Meanwhile, Law No. 7 of 1987 on Copyright is a replacement for Law No. 6 of 1982 on Copyright which replaces the Copyright Act of 1912, the Copyright Act relics of the Dutch colonial government which during the Japanese colonization was declared still valid.⁵

The development of Copyright with the existence of Act No. 28 Year 2014 on Copyright provides legal protection for creators of copyrighted works, besides that Copyright can also be used as an object of Fiduciary Guarantee, it shows that Copyright is now very useful for creators of copyrighted works because with the results of creation can be used as collateral in obtaining debt.⁶ The provisions regarding Copyright can be used as a Fiduciary Guarantee are contained in Article 16 paragraph 3 UUHC 2014. This certainly means that creators of copyrighted works can access credit by pledging their works into the Fiduciary Guarantee.⁷

Fiduciary Guarantee comes from the word *fiduciar* or *fides*, which means trust, transfer of property rights to objects. The definition of Fiduciary Guarantee in Law Number 42 of 1999 concerning Fiduciary Guarantee, hereinafter referred to as UUFJ, is a guarantee of movable objects, both tangible and intangible, and immovable objects, especially buildings that cannot be encumbered by Mortgage Rights as referred to in Law Number 4 of 1996 concerning Mortgage Rights, which remains in the possession of the Fiduciary, as collateral for the repayment of certain debts, which gives priority to the Fiduciary recipient against other creditors.

The use of Copyright as a Fiduciary Guarantee cannot be separated from the characteristics of the object of the Fiduciary Guarantee. The characteristics of objects that can be pledged as objects of Fiduciary Guarantee are objects that have economic value in the sense that at any time if the debtor cannot pay off his debt the object can cover the debt. In relation to Copyright, Copyright has moral rights and economic rights so that it can be used as a Fiduciary Guarantee. Moral rights are rights that are eternally attached to the creator to keep his name on the copy in connection with the use of his creation for the public. Economic rights are the exclusive rights of the creator or Copyright holder to obtain economic benefits for the creation.

However, problems arise in the field of collateral law after the enactment of Law Number 28 Year 2014 on Copyright. There are legal norms contained in Article 16 related to the legal validity of copyright as an object of fiduciary security in Indonesia. The article states as follows:

1. Copyright is an intangible movable property.
2. Copyright may be transferred or assigned, either in whole or in part due to: a. inheritance; b. grant; c. waqf; d. will; e. written agreement; or f. other causes justified in accordance with the provisions of laws and regulations.
3. Copyright can be used as an object of fiduciary security.
4. Provisions regarding Copyright as an object of fiduciary guarantee as referred to in paragraph (3) shall be implemented in accordance with the provisions of laws and regulations.

If the article is linked to Law No. 42/1999 on Guarantees, Article 1 points (1) to (4) state as follows:

1. Fiduciary is the transfer of ownership rights of an object on the basis of trust with the provision that the object whose ownership rights are transferred remains in the possession of the owner of the object.
2. Fiduciary Guarantee is a security right over movable objects, both tangible and intangible, and immovable objects, especially buildings, which cannot be encumbered by a mortgage as referred to in Law Number 4 of 1996 concerning Mortgage Rights, which remains in the possession of the Fiduciary, as collateral for the repayment of certain debts, which gives the Fiduciary Recipient priority over other creditors.
3. Receivable is the right to receive payment.
4. Benda is anything that can be owned and transferred, whether tangible or intangible, registered or unregistered, movable or immovable that cannot be encumbered by a mortgage or mortgage.

⁵Sudaryat, *et.all*, 2010, *Hak Kekayaan Intelektual Memahami Prinsip Dasar. Cakupan dan Undang-Undang Yang Berlaku*, Bandung: Oase Media, p. 41.

⁶Ahmad Ramli, 2012, *Asset Hak Kekayaan Intelektual sebagai Kolateral dan Modal Ventura*, Jakarta: Genta Buana, p. 17.

⁷Pasal 16 Undang-undang Nomor 28 tahun 2014 tentang Hak Cipta.

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Based on the description above, juridically normative copyright can be used as an object of fiduciary guarantee, as stated in Article 16 paragraph (3) "Copyright can be used as an object of fiduciary guarantee". Unfortunately, the presence of Article 16 paragraph (3) of the Copyright Act does not necessarily make banks easily provide loans. Because, the arrangement in Article 16 paragraph (3) of the Copyright Law, requires further elaboration of implementing regulations related to guarantees for the Bank (as a creditor) to obtain certainty of the return of funds that have been loaned to the debtor.

Based on the description above, although it is considered to have brought legal reform, especially for holders of rights to Intellectual Property Rights (in this study, especially Copyright), it turns out that on the other hand there are obstacles. The concept of Intellectual Property Rights assets as banking collateral still reaps obstacles or constraints. This condition is certainly not in accordance with the concept of legal certainty and protection theory. So, the problem that will be discussed in this paper is about the use of copyright as an object of collateral in the fiduciary guarantee system.

II. RESEARCH METHOD

The research used is normative juridical legal research which focuses on the review or study of positive law. Normative juridical research is legal research that places the law as a building system of norms. The system of norms in question is about principles, norms, rules from laws and regulations, court decisions, and doctrines or teachings. The research approach is a method or way to conduct a study so that researchers get information from various aspects to find the issues they are looking for answers to. In accordance with the type of research, namely normative juridical, the research approach used in this research is the Normative/Statute Approach, Conceptual Approach, Conceptual Approach and Case Approach.

Because this research is normative juridical research, this research is more focused on library research to solve legal issues and at the same time provide a prescription of what should be, a type or source of legal material research is needed. The types of legal materials that will be used in this research are primary legal materials, which are legal materials that are authoritative, meaning that they have authority; secondary legal materials, which are legal materials that are supportive in order to provide explanations of primary legal materials; and tertiary legal materials, which are materials that provide guidance and explanations of primary and secondary legal materials, such as legal dictionaries, large Indonesian dictionaries, encyclopedias, bibliographies, cumulative indexes, and internet sites related to this research.

III. RESULT AND DISCUSSION

1. Economic Rights in Copyright as Collateral

To cover or guarantee the payment or repayment of certain debts, debtors are generally required to provide collateral in the form of collateral (certain objects) that can be valued in money, of high quality whose value is at least as much as the amount of debt given to them. For this reason, banks and other financial institutions or even individuals should request collateral with the intention that if the debtor is unable to repay his debt or is declared bankrupt, the collateral can be disbursed or cashed out to cover the repayment or return of the remaining money.

In relation to Intellectual Property as collateral, the Law of Guarantee can simply be interpreted as a law that regulates debt collateral, both in the form of material and personal guarantees. According to R. Subekti, collateral can be divided into material collateral and personal collateral. Personal guarantee is an agreement between a creditor and a third person who guarantees the fulfillment of the debtor's obligations. A personal guarantee agreement can even be held without the knowledge of the debtor. Material security can be held between the creditor and the debtor, or between the creditor and a third person who guarantees the fulfillment of the debtor's obligations.⁸

Intellectual Property as Fiduciary Security, in the process will definitely be appraised (appraisal, valuation). To do this, the valuation of intellectual property can make comparisons with various valuations carried out by banks including: (1) market value; (2) reproduction cost; (3) depreciated replacement cost; (4) liquidation value; (5) insurable value/actual cost value.⁹

To conduct an assessment of Intellectual Property, it can consider several asset valuation models developed today. There are three types of intangible assets, namely employee competence, internal structure, and external structure. Included in the type of internal structure are patents, concepts, models, and computer systems and administrative systems. Thus, copyright and intellectual property are also intangible assets, more specifically including the internal structure of a company.

⁸Junaidi Akhmad dan Muhammad Joni "Pemanfaatan Sertifikat HKI Sebagai Collateral Kredit", Jurnal Hukum, Vol. 6, No. 1, 2011, p. 133.

⁹*Ibid.*, p. 135.

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According to Sri Mulyani, there are several approaches to valuing Intellectual Property as an object of collateral. The determination of the economic value of a creation can be seen from several approaches. The first approach is the market approach. The market approach provides a systematic framework for estimating the value of intangible assets based on an analysis of actual sales and/or tangible license transactions comparable to the object. The second is the income approach. The income approach provides a systematic framework for estimating the value of intangible assets based on the capitalization of economic income or present or future value. The economic income value will come from the use, license or lease of the intangible. Third, the cost approach. The cost approach provides a systematic framework for estimating the value of intangible assets based on the economic principle of substitution commensurate with the costs that will be incurred as a comparable replacement as the utility function.¹⁰

In relation to Copyright as an object of Fiduciary Guarantee, the economic value of a work affects the category of Fiduciary Guarantee. The encumbrance of objects using fiduciary must contain: (1) the identity of the fiduciary grantor and recipient; (2) data on the principal agreement guaranteed by the fiduciary; (3) a description of the object of the Fiduciary Guarantee; (4) the value of the guarantor; and (5) the value of the guarantor and the value of the object of the Fiduciary Guarantee.

Copyrighted works as objects of Fiduciary Guarantee copyrighted works fall into the category of an immaterial object as previously described. The economic value of a copyrighted work raises the conception that the copyrighted work can be used as an object of collateral. In the economic framework of the birth of a copyrighted work has so involved labor, time and cost. If these factors are converted into numbers, then all of it will show the value of the work because of the usefulness or economic value of a copyrighted work.

When viewed from the needs of the State to realize the order of economic life, still give respect to the rights of individuals in balance with the interests of society. Based on this, a creation is a product of human thought that has value, and is considered as intangible property.¹¹ The economic value that exists in Copyright can be calculated with several models as described above. Of course, banks or financial institutions have a special appraisal team to determine the value of objects that will be used as objects of collateral in banking or financial institutions that accept intangible movable objects such as copyright. The economic value of a work determines the amount of collateral value, the higher the value of the work, the higher the value of the guarantee that will be obtained by the debtor or fiduciary. The economic value of a work is also influenced by the moral rights of the creator, the more famous the creator, the higher the economic value obtained.

2. The Conformity of Copyright as an Object of Fiduciary Guarantee with Law Number 42 Year 1999 on Fiduciary Guarantee

Intellectual Property Rights or better known as IPR is an official term used for rights granted to certain works of human thought that have economic value. Basically, the definition of IPR is difficult to do because IPR covers a very broad object of protection which has different characteristics and ways of protection or is not exactly the same between one field of IPR and another. Legal protection is given to individuals who produce intellectual creations. IPR was born from the western legal system because customary law does not recognize protection. law against economic rights to human intellectual creations. IPR is a form of property right. The right holder in IPR is similar to property rights in objects in Book II of the Civil Code, in the sense that the owner of the right is an individual and not a community.¹² Because IPR is a form of property right that has commercial (economic) value, then if IPR is classified as property, IPR will fall into the category of movable but intangible property.

In Indonesia, the regulation of IPR as an object of banking collateral is contained in Law No. 28 of 2014 concerning Copyright. The law states that copyright is an intangible movable object, which can be transferred or transferred in whole or in part through inheritance, grants, endowments, wills, written agreements, other causes justified in accordance with the provisions of laws and regulations. Furthermore, Article 16 paragraph (3) of the Copyright Law expressly states that "Copyright can be used as an object of Fiduciary Guarantee".

Based on the above provisions, Copyright both tangible and intangible, can be used as an object of Fiduciary Guarantee and if at any time the Copyright Holder needs a loan from the Bank then the Copyright Holder can make Copyright as debt collateral to the Bank. The enactment of Copyright as an object of Fiduciary Guarantee in Indonesia as stated in Article 16

¹⁰ Sri Mulyani, 2012, *Pengembangan Hak Kekayaan Intelektual Sebagai Collateral (Agunan) Untuk Mendapatkan Kredit Perbankan di Indonesia*, Semarang: FH Untag, p. 573.

¹¹ Suyud Margono, 2010, *Hukum Hak Cipta Indonesia*, Bogor : Ghalia Indonesia, p. 26-27.

¹² C. Ria Budiningsih, 2015, *Pengertian Pokok dan Sejarah Hak Kekayaan Intelektual*, Bandung: Universitas Katolik Parahyangan, p. 1.

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paragraph 3 of the Law on Copyright is not without cause. When referring to some foreign countries, IPR ownership can be bankable which means it can be used as collateral for bank guarantees.

Admittedly some of the above becomes one of the factors constraints can not be accepted copyright as an object of debt collateral by banking institutions. But if examined further, that there are other problems as a cause of the difficulty of acceptance of copyright as debt collateral, namely, the absence of qualification of copyright objects, which can be used as debt collateral (fiduciary guarantee). When referred to Act No. 28 Year 2014 on Copyright, the Act has classified the types of protected creations and which are not protected in practice, as well as stating that copyright has economic value, but the Copyright Act has not yet provided a clear statement or description of the qualification of the work that has been classified, which is like what and which qualify as what, which later can be used as debt collateral (Fiduciary Guarantee).

The current development of Copyright with the issuance of UUHC Year 2014 provides legal certainty regarding Copyright can be used as a Fiduciary Guarantee. The provisions regarding this matter are stipulated in Article 16 paragraph 3 UUHC Year 2014. The use of Copyright as an object of Fiduciary Guarantee itself cannot be separated from the law of the agreement. The principle of agreement law that uses Copyright as an object of Fiduciary Guarantee is the principle of freedom of contract, *pacta sunt servanda*, and good faith.

The provisions regarding Copyright can be used as an object of Fiduciary Guarantee cannot be separated from the legal provisions on Copyright which says that Copyright is an intangible movable object this is regulated in Article 16 paragraph 1 UUHC Year 2014. In addition, Copyright also has moral rights and economic rights in the creation and has protection under the Copyright regime. The provisions regarding objects and economic value in a creation make Copyright can be used as an object of Fiduciary Guarantee.

The encumbrance of Copyright as an object of Fiduciary Guarantee must be based on an agreement made by the creator or holder of Copyright with the lender on the basis of freedom of contract. The agreement that has been made by the parties is binding because it must be obeyed (*pacta sunt servanda* principle). Furthermore, both parties (creators or Copyright holders with lenders) must have good faith, in the sense of implementing the agreement in accordance with what has been agreed.

The principles of the law of the agreement of freedom of contract is the beginning or basis of the agreement. When associated with the Fiduciary Guarantee, freedom of contract is the initial meeting for the giver and receiver of fiduciary. The application of the principle of freedom of contract relates to the freedom of the debtor (fiduciary grantor) and creditor (fiduciary beneficiary) to enter into an agreement. However, after the agreement is concluded, it acts as a law for the parties, so it must be obeyed (*pacta sunt servanda* principle). Adherence to the agreement relates to the element of trust that the fiduciary will perform its obligations as agreed, including maintaining the collateral and repaying the debt.

On the other hand, the fiduciary promises to return juridical control to the fiduciary giver after the debt is repaid. The agreement must be carried out in good faith (the principle of good faith), in the sense that the fiduciary grantor and fiduciary recipient are obliged to carry out the agreement without any intention to commit fraud, for example, if the debtor defaults, the creditor can only execute the collateral. then if there is an excess price of the auctioned goods, it must be returned to the debtor (fiduciary grantor).

The transfer of objects that are the object of the Fiduciary Guarantee in the form of Copyright can be in the form of a written agreement in which case the agreement must adhere to the legal requirements of the agreement Article 1320 of the Civil Code. The fiduciary grantor can transfer the inventory object that is the object of the Fiduciary Guarantee in a manner and procedure commonly carried out in the trade business. This provision does not apply, if there has been a breach of promise by the debtor and/or third party fiduciary. This provision can also be applied to Fiduciary Guarantees in the form of Copyright, because Copyright as a property right has characteristics, one of which is *droit de suit*, meaning that the Copyright Holder continues to follow in the hands of whoever the Copyright attached to the object is.

The provisions of Article 25 through Article 26 of the UUJF regulate the termination of the Fiduciary Guarantee. The Fiduciary Guarantee is extinguished due to the extinguishment of the debt secured by the fiduciary, the relinquishment of the right to the Fiduciary Guarantee by the fiduciary beneficiary, or the destruction of the object of the Fiduciary Guarantee. The destruction of the object of the Fiduciary Guarantee does not eliminate the insurance claim if the object is a tangible movable object, if the object is a copyright, the copyright cannot be abolished because the Copyright remains attached to the creator. Furthermore, the fiduciary notifies the Fiduciary Registration Office of the abolition of the Fiduciary Guarantee by attaching a statement regarding the abolition of the debt, relinquishment of rights, or destruction of the object of the Fiduciary Guarantee. With the abolishment of the Fiduciary Guarantee, the Fiduciary Registration Office crosses out the recording of the Fiduciary Guarantee from the Fiduciary Register Book and issues a certificate stating that the relevant Fiduciary Guarantee Certificate is no longer valid.

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The provisions on the execution of the Fiduciary Guarantee are regulated in Articles 29 through 34 of the UUJF. If the debtor or fiduciary is in default, the execution of the object of the Fiduciary Guarantee can be carried out by: (1) execution of the executorial title by the fiduciary; (2) sale of the object of the Fiduciary Guarantee at the fiduciary's own authority through a public auction and taking repayment of the debt from the proceeds of the sale; (3) sale under the hands carried out based on the agreement of the grantor and the fiduciary if in this way the highest price can be obtained which is favorable to the parties. The sale shall be conducted after one month has passed since it was notified in writing by the grantor and the fiduciary to the interested parties and announced in at least two newspapers circulating in the area concerned.

The fiduciary grantor is obliged to surrender the object of the Fiduciary Guarantee in order to execute the Fiduciary Guarantee. In the event that the object of the fiduciary guarantee consists of trade objects or securities that can be sold in the market or on the stock exchange, the sale can be carried out in these places in accordance with the applicable laws and regulations. Any promise to execute the object of the Fiduciary Guarantee in a manner contrary to the provisions is null and void. Any promise that authorizes the fiduciary recipient to take possession of the object of the Fiduciary Guarantee if the debtor is in default is null and void. In the event that the execution proceeds exceed the guarantee value, the fiduciary is obliged to return the excess to the fiduciary grantor. If the execution proceeds are insufficient for debt repayment, the debtor is still responsible for the unpaid debt.

Copyright cannot be confiscated because it is attached to the Copyright holder. This means that the law protects a person's ownership in accordance with the theory of natural law that appreciates and respects human intellectual work. In addition, Copyright protection is not addressed to the object, but to the Copyright on the object. Thus, the execution of the Copyright cannot be done as a basis for recognizing human rights. What might be done is to execute the economic value of the Copyright or the sale of the economic value that is the object of the Fiduciary Guarantee at the fiduciary's own power through a public auction and take repayment of the debt from the proceeds of the sale, or a sale under the hand carried out based on the agreement of the grantor and the fiduciary, using a written agreement as a rule of transfer of Copyright in Article 16 paragraph 2 UUHC Year 2014 so that later the fiduciary recipient can get the highest price that is favorable to the parties. So that the provisions in the UUHC Year 2014 regarding the use of Copyright can be used as an object of Fiduciary Guarantee is in accordance with the UUJF.

IV. CONCLUSIONS

Intellectual Property as Fiduciary Security, in the process will definitely be appraised (appraisal, valuation). To do this, the valuation of intellectual property can make comparisons with various valuations carried out by banks including: (1) market value; (2) reproduction cost; (3) depreciated replacement cost; (4) liquidation value; (5) insurable value/actual cost value. To conduct an assessment of Intellectual Property, it can consider several asset valuation models developed today. There are three types of intangible assets, namely employee competence, internal structure, and external structure. Included in the type of internal structure are patents, concepts, models, and computer systems and administrative systems. Thus, copyright and intellectual property are also intangible assets, more specifically including the internal structure of a company.

Copyright as an object of fiduciary security is in accordance with Law No. 42 Year 1999 on Fiduciary Guarantee where Copyright can be encumbered by collateral in the form of fiduciary, but not on the object encumbered by the Copyright, but the economic value attached to the copyright. In addition, the Copyright must first be registered with the Directorate General of Intellectual Property of the Ministry of Law and Human Rights before it can be pledged. This is important because it is proof that the fiduciary is the holder of the Copyright. However, some provisions in the Fiduciary Guarantee Act are difficult to apply to fiduciary guarantees in the form of copyright. Determination of the economic value of Copyright can be calculated by several models of calculation of immaterial objects, of course, the bank or financial institution that receives Copyright as an object of Fiduciary Guarantee has a special team to assess the amount of economic value in a creation. Economic value will be determined by the knowledge and confidence of appraisal officials assigned by the bank to appraise or assess Copyright. As with fiduciary guarantees, which prioritize the aspect of trust between the debtor (Copyright owner) and the creditor.

REFERENCES

- 1) Ahmad Ramli, 2012, *Asset Hak Kekayaan Intelektual sebagai Kolateral dan Modal Ventura*, Jakarta: Genta Buana.
- 2) Anis Mashdurohatun, 2013, *Hak Kekayaan Intelektual (HKI) dalam perspektif Sejarah Indonesia*, Semarang: SAPREES.
- 3) Anis Mashdurohatun, "Problematika Perlindungan Hak Cipta di Indonesia", *Yustisia Jurnal Hukum*, Vol. 3, No. 2, 2012.
- 4) C. Ria Budiningsih, 2015, *Pengertian Pokok dan Sejarah Hak Kekayaan Intelektual*, Bandung: Universitas Katolik Parahyangan.

Copyright as an Object of Fiduciary Guarantee from the Perspective of Law Number 42 Year 1999 on Fiduciary Guarantee

- 5) Junaidi Akhmad dan Muhammad Joni "Pemanfaatan Sertifikat HKI Sebagai Collateral Kredit", Jurnal Hukum, Vol. 6, No. 1, 2011.
- 6) Lisa Widyastuti, "Ide dan kekayaan Intelektual", Media HKO-Buletin Indormasi dan Keragaman Hak, Vol. VII, No. 3, 2010.
- 7) Rahayu Kartini, "Kajian Implementasi Prinsip-Prinsip Perlindungan HaKi dalam Peraturan Per UU an Haki di Indonesia" , Humanity, Vol. 1, No. 1, 2005.
- 8) Sri Mulyani, 2012, *Pengembangan Hak Kekayaan Intelektual Sebagai Collateral (Agunan) Untuk Mendapatkan Kredit Perbankan di Indonesia*, Semarang: FH Untag.
- 9) Sudaryat, *et.all*, 2010, *Hak Kekayaan Intelektual Memahami Prinsip Dasar, Cakupan dan Undang-Undang Yang Berlaku*, Bandung: Oase Media.
- 10) Suyud Margono, 2010, *Hukum Hak Cipta Indonesia*, Bogor : Ghalia Indonesia.
- 11) Undang-undang Nomor 28 tahun 2014 tentang Hak Cipta.



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Cognitive Parameters Influencing Job Satisfaction among School Teachers: A Qualitative Exploration



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ABSTRACT: This research paper presents a qualitative exploration of cognitive parameters influencing job satisfaction among school teachers, with a focus on cognitive practice/cognitive exercise, cognitive activity, cognitive evaluation, cognitive planning, cognitive skill, and cognitive strategy. Job satisfaction is a critical factor in teachers' professional well-being and the quality of education they provide to students. Using a qualitative approach, this study employs interviews and focus group discussions to gather data from a diverse sample of school teachers. By exploring teachers' subjective experiences and perspectives, this research aims to uncover the cognitive parameters that significantly impact their job satisfaction.

The findings of this research contribute to the existing knowledge on cognitive parameters influencing job satisfaction among school teachers. They provide valuable insights for educators, administrators, and policymakers to design interventions and strategies that promote positive work environments and enhance teachers' job satisfaction. By prioritizing cognitive aspects, such as effective planning, skill development, and strategic thinking, educators can create supportive environments that empower teachers and positively impact their satisfaction and effectiveness. This qualitative exploration highlights the importance of cognitive parameters in influencing job satisfaction among school teachers. By understanding and addressing these cognitive aspects, educators can foster a positive work environment and promote the well-being and professional growth of teachers. Ultimately, this leads to improved educational outcomes for students and a more fulfilling teaching profession.

KEYWORDS: Cognitive Factor, Job Satisfaction, School Teachers, Satisfaction, and effectiveness.

INTRODUCTION

Job satisfaction is a critical factor influencing the well-being, performance and retention of school teachers. A satisfied teacher is more likely to be engaged, motivated and committed to their profession, which directly impacts the quality of education delivered to students. While numerous studies have examined various factors affecting job satisfaction among teachers, the cognitive parameters specifically related to teaching have received limited attention. This research paper aims to conduct a qualitative exploration of the cognitive parameters influencing job satisfaction among school teachers, with a particular focus on cognitive practice/cognitive exercise, cognitive activity, cognitive evaluation, cognitive planning, cognitive skill and cognitive strategy. Understanding these cognitive aspects is essential for comprehending the underlying processes and mechanisms that shape teachers' job satisfaction and professional experiences. Cognitive practice refers to the engagement in mental exercises or activities aimed at enhancing cognitive abilities and expertness. Cognitive exercise involves structured tasks that challenge and stimulate cognitive functioning. Cognitive activity encompasses the various mental processes and operations undertaken by teachers while performing their professional tasks. Cognitive evaluation involves assessing one's own cognitive processes and outcomes to monitor and regulate performance. Cognitive planning relates to the strategic organization and arrangement of cognitive rituals to achieve desired goals. Cognitive skill represents the proficiency and expertise in employing cognitive processes effectively. Cognitive strategy refers to the deliberate use of specific approaches or techniques to solve problems and accomplish tasks. By exploring these cognitive parameters, this research intends to provide valuable insights into their impact on job satisfaction among school teachers. It is hypothesized that teachers' engagement in cognitive practice, exercise and activity, as well as their ability to evaluate, plan, employ cognitive skills, and utilize cognitive strategies, play crucial roles in shaping their overall satisfaction with their work.

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BACKGROUND AND RATIONALE

Job satisfaction is a crucial factor in the teaching profession as it directly affects the well-being, motivation and overall effectiveness of school teachers. Understanding the cognitive parameters that influence job satisfaction among teachers is essential for creating supportive environments, promoting professional growth and enhancing overall job satisfaction in the teaching profession. Previous research on job satisfaction among teachers has primarily focused on external factors such as salary, working conditions, administrative support and student-teacher relationships. While these factors undoubtedly play a role, the specific cognitive parameters that contribute to or detract from job satisfaction have received limited attention. Cognitive parameters encompass various cognitive processes, practices, skills and strategies that teachers employ in their daily work. These cognitive aspects have the potential to significantly influence teachers' job satisfaction as they directly impact their thinking, decision-making, problem-solving and instructional practices. However, there is a gap in the literature regarding the specific cognitive parameters that influence job satisfaction among school teachers.

The rationale for conducting a qualitative exploration of the cognitive parameters influencing job satisfaction among school teachers is to fill the gap in the existing literature and provide a deeper understanding of the cognitive dimensions of job satisfaction. By adopting a qualitative approach, the study aims to capture the rich and nuanced experiences, perspectives and perceptions of teachers regarding the cognitive aspects of their job satisfaction. Through qualitative exploration, the study can uncover the specific cognitive parameters such as cognitive practice/cognitive exercise, cognitive activity, cognitive evaluation, cognitive planning, cognitive skills and cognitive strategies that significantly impact job satisfaction among school teachers. By delving into these cognitive parameters, the study can shed light on the ways in which teachers' cognitive engagement, reflection, goal-setting, problem-solving, and decision-making contribute to their overall satisfaction with their professional roles. The qualitative exploration will provide an in-depth understanding of teachers' subjective experiences, allowing for a comprehensive examination of the cognitive dimensions that shape their job satisfaction. This approach enables the exploration of contextual factors, individual differences

and the interplay between cognitive parameters and other job-related aspects that contribute to job satisfaction. By identifying and understanding the cognitive parameters that influence job satisfaction among school teachers, the study can provide valuable insights for educational institutions, policymakers, and stakeholders. This knowledge can inform the development of targeted interventions, professional development programs, and support systems that enhance teachers' cognitive practices, skills and strategies to promote their job satisfaction and overall well-being. Conducting a qualitative exploration of the cognitive parameters influencing job satisfaction among school teachers is essential to advance our understanding of the cognitive dimensions of job satisfaction in the teaching profession. The study aims to fill the gap in the literature, provide valuable insights and contribute to the development of strategies and interventions that promote positive cognitive engagement and enhance job satisfaction among school teachers.

LITERATURE REVIEW

Numerous studies have investigated the relationship between cognitive factors and job satisfaction among school teachers. The following literature review provides an overview of relevant studies related to cognitive practice, cognitive exercise, cognitive activity, cognitive evaluation, cognitive planning, cognitive skill and cognitive strategy.

Cognitive Practice: Cognitive practice involves engaging in continuous learning, professional development and reflective practices that enhance teachers' cognitive abilities. Research by **Smith (2018)** highlighted the significance of cognitive practice in shaping teachers' job satisfaction. The study emphasized that actively seeking opportunities for professional growth, staying updated with current educational research and acquiring new teaching strategies contribute to enhanced job satisfaction.

Cognitive Exercise: Cognitive exercise refers to engaging in activities that stimulate critical thinking, problem-solving and intellectual growth. **Johnson et al. (2019)** conducted a study on the impact of cognitive exercise on job satisfaction among teachers. The findings indicated that teachers who regularly engaged in cognitive exercises, such as solving complex teaching-related problems or participating in reflective activities, reported higher levels of job satisfaction.

Cognitive Activity: Cognitive activity in the teaching profession involves the active engagement of teachers' cognitive processes while performing their instructional tasks. **Davis and Harris (2020)** conducted a study focusing on cognitive activity and its influence on job satisfaction among teachers. The research findings highlighted that teacher who employed effective cognitive activities, such as creating meaningful learning experiences, promoting student engagement and facilitating critical thinking, experienced higher levels of job satisfaction.

Cognitive Evaluation: Cognitive evaluation entails the assessment and reflection of one's own teaching practices. **Thompson (2017)** conducted a study examining the relationship between cognitive evaluation and job satisfaction among teachers. The study

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revealed that teachers who engaged in regular cognitive evaluation reported higher levels of job satisfaction. The ability to critically reflect on teaching approaches, identify areas for improvement, and make adjustments positively impacted job satisfaction.

Cognitive Planning: Cognitive planning refers to the deliberate use of metacognitive processes to guide instructional decision-making. **Lee and Chen (2018)** conducted a study investigating the relationship between cognitive planning and job satisfaction among teachers. The findings indicated that teachers who engaged in effective cognitive planning, such as setting clear goals, adapting instructional strategies and creating engaging learning environments, reported higher levels of job satisfaction.

Cognitive Skill: Cognitive skill refers to the ability to employ cognitive processes effectively in teaching practices. **Brown and Anderson (2019)** conducted research examining the impact of cognitive skill on job satisfaction among teachers. The study found that teachers with higher cognitive skills reported higher levels of job satisfaction. Effective cognitive skills, such as critical thinking, problem-solving and decision-making, contribute to teaching effectiveness and job satisfaction.

Cognitive Strategy: Cognitive strategy involves the deliberate use of metacognitive processes, goal-setting, and decision-making in teaching practices. A study by **Johnson and Smith (2021)** emphasized the positive impact of cognitive strategy on job satisfaction among teachers. The study highlighted that effective use of cognitive strategies, such as goal-oriented planning and reflective practices, contributes to teachers' sense of accomplishment and job satisfaction.

The existing literature suggests that cognitive factors, including cognitive practice, cognitive exercise, cognitive activity, cognitive evaluation, cognitive planning, cognitive skill and cognitive strategy, have a significant influence on job satisfaction among school teachers. This qualitative exploration aims to further explore these cognitive parameters and their impact on job satisfaction among school teachers through in-depth qualitative research methods.

STATEMENT OF THE PROBLEM

The problem lies in the lack of understanding regarding how cognitive factors, including cognitive practice/cognitive exercise, cognitive activity, cognitive evaluation, cognitive planning, cognitive skill and cognitive strategy, influence job satisfaction among school teachers. These cognitive parameters are essential components of teachers' cognitive processes and abilities, but their impact on job satisfaction has not been comprehensively examined. The absence of a clear understanding of the cognitive parameters that influence job satisfaction hinders the development of targeted interventions and strategies to enhance teachers' job satisfaction. Without this understanding, educational institutions may struggle to create conducive environments and provide necessary support systems that foster positive cognitive engagement and promote job satisfaction among teachers. The problem statement highlights the need to identify and understand the cognitive parameters that contribute to job satisfaction among school teachers, providing valuable insights for educational institutions, policymakers, and stakeholders to enhance teachers' job satisfaction and promote their overall well-being. The problem of this study is "Cognitive Parameters Influencing Job Satisfaction among School Teachers: A Qualitative Exploration".

SIGNIFICANCE OF THE STUDY

Job satisfaction is crucial for the overall well-being of teachers. Understanding the cognitive parameters that influence job satisfaction can help identify specific factors that contribute to teachers' contentment and fulfillment in their profession. By exploring these parameters, the study can provide insights into strategies and interventions that promote positive cognitive practices and improve teacher well-being. Job satisfaction plays a vital role in teacher retention and recruitment efforts. Satisfied teachers are more likely to stay in the profession, reducing turnover rates and providing stability in educational institutions. Additionally, a positive perception of job satisfaction among teachers can attract new professionals to the field, leading to a more robust and dedicated teaching workforce. By uncovering the cognitive parameters that impact job satisfaction, the study can contribute to the development of targeted retention and recruitment strategies. Job satisfaction has a direct correlation with instructional effectiveness. Satisfied teachers are more motivated, engaged and committed to their work, resulting in improved student outcomes. By understanding the cognitive parameters that influence job satisfaction, the study can shed light on how to enhance teachers' cognitive practices, skills and strategies to promote instructional effectiveness and student success. The study can inform the design and implementation of professional development programs and support mechanisms for teachers. The cognitive parameters that positively impact job satisfaction, educational institutions can provide targeted training, resources and support systems that enhance these parameters. This, in turn, can contribute to the professional growth, job satisfaction and overall well-being of teachers. The study can have implications for education policies and reforms. By highlighting the importance of cognitive parameters in job satisfaction, policymakers can consider these factors when developing policies that impact teachers' working conditions, professional development opportunities and support structures. This can lead to the creation of policies that prioritize the enhancement of cognitive practices, skills and strategies, ultimately improving job satisfaction and the overall quality

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of education. The significance of the study lies in its potential to contribute to teacher well-being, retention and recruitment, enhance instructional effectiveness, inform professional development and support initiatives and influence education policies. By exploring the cognitive parameters influencing job satisfaction among school teachers, the study can provide valuable insights to improve the teaching profession and ultimately benefit teachers, students and the education system as a whole.

Research questions

To find out cognitive parameters of Job Satisfaction and How do cognitive factor influence job satisfaction in the teaching profession?

RESEARCH METHODOLOGY

The study employs a qualitative research design, specifically utilizing interviews and focus group discussions to gather data. These methods enable researchers to collect rich, detailed, and contextual information about teachers' experiences and perspectives on the cognitive parameters and job satisfaction. The research uses purposive sampling to select participants who represent a diverse range of school teachers. Participants are selected from primary, secondary and high schools to ensure a comprehensive representation of the teaching profession. Consideration is given to factors such as teaching experience, subject specialization and school location to capture a varied set of perspectives. Semi-structured interviews are conducted with individual teachers to gather detailed information about their experiences with cognitive practice/exercise, activity, evaluation, planning, skill, strategy, and how these factors influence their job satisfaction. The interviews are audio-recorded with the participants' consent and later transcribed for analysis. Focus group discussions are conducted to encourage interaction and group dynamics among teachers. These discussions provide opportunities for participants to share their experiences, exchange ideas and generate deeper insights into the cognitive parameters influencing job satisfaction. The qualitative research methodology adopted in this study provides a comprehensive exploration of the cognitive parameters influencing job satisfaction among school teachers. By employing interviews and focus group discussions and utilizing thematic analysis, the study aims to uncover rich insights into teachers' experiences and perceptions, contributing to a deeper understanding of the role of cognitive factors in job satisfaction.

ANALYSIS AND INTERPRETATION

The cognitive parameters of job satisfaction and understand how cognitive factors influence job satisfaction in the teaching profession, we can explore the following:

Cognitive practice/Cognitive exercise:

Cognitive practice or exercise involves engaging in functions that promote gratitude Journaling, intellectual stimulation, reflection self-care practices, Self-care Practices, regular reflection on their teaching practices. Teachers can maintain a gratitude journal where they write down things, they are grateful for in their teaching profession. This practice helps shift their focus towards positive aspects of their work, such as supportive colleagues, student achievements or impactful moments in the classroom. By acknowledging and appreciating these aspects, teachers can cultivate a sense of fulfilment and job satisfaction. Cognitive practice provides intellectual stimulation by encouraging teachers to engage in critical thinking, reflection and analysis of their teaching practices. By examining and evaluating their instructional approaches, teachers are intellectually stimulated, leading to a sense of fulfillment and satisfaction in their professional endeavours. Cognitive practice encourages teachers to explore innovative approaches and adapt their teaching methods to meet the diverse needs of their students. By actively engaging in cognitive exercises, such as exploring new instructional technologies, teachers develop the ability to be flexible and adaptable in their teaching practices. This adaptability enhances job satisfaction by allowing teachers to effectively address challenges and create engaging learning environments. Practicing mindfulness can help teachers reduce stress, increase focus and improve their overall well-being. Encourage teachers to set aside a few minutes each day for mindfulness activities such as deep breathing, meditation, or mindful walking. These practices can help teachers stay present, manage their emotions, and foster a positive mindset, contributing to job satisfaction. Emphasize the importance of self-care for teachers' cognitive well-being. Encourage them to engage in practicing that promote relaxation, such as exercise, hobbies, reading or spending time with loved ones. Taking care of their physical and mental well-being allows teachers to recharge, reduce burnout, and maintain job satisfaction. Engaging in regular self-reflection allows teachers to assess their teaching practices, strengths, and areas for improvement. By reflecting on their experiences, teachers can make adjustments and enhance their teaching methods, leading to increased job satisfaction.

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In tabular form it may be presented as:

Sl. No	Cognitive practice/Cognitive exercise	Key Concepts
1	Gratitude Journaling	Focus towards positive aspects of their work, such as supportive colleagues, student achievements, or impactful moments in the classroom.
2	Intellectual Stimulation	Encouraging teachers to engage in critical thinking, reflection, and analysis of their teaching practices.
3	Adaptability	Exploring new instructional technologies, teachers develop the ability to be flexible and adaptable in their teaching practices
4	Self- Reflection	Identify areas of success and areas that may need improvement,
5	Mindfulness	Teachers reduce stress, increase focus, and improve their overall well-being.
6	Self-care Practices	Engage in practicing that promote relaxation, such as exercise, hobbies, reading, or spending time with loved ones

Cognitive Activity:

Cognitive activity refers to the active engagement of teachers' cognitive processes while performing their teaching tasks. When teachers are actively involved in cognitive activities, such as designing creative lesson plans, adapting instructional approaches to meet students' needs, and providing constructive feedback, they experience a sense of fulfillment, efficacy, and job satisfaction. Engaging in cognitive activities related to curriculum design allows teachers to create engaging and effective learning experiences for their students. When teachers can design innovative and meaningful curriculum, it enhances their sense of accomplishment and job satisfaction. Engaging in cognitive activities can contribute to job satisfaction for teachers. This includes developing lesson plans, organizing instructional materials, and structuring classroom activities. When teachers can effectively plan and organize their teaching tasks, it promotes a sense of control, preparedness, and satisfaction with their work. Promoting cognitive activities that stimulate creativity and innovation can positively impact job satisfaction. Teachers can engage in activities that encourage them to think outside the box, develop innovative teaching methods, and design creative learning experiences for their students. Being able to express their creativity and explore new approaches enhances job satisfaction and fulfilment. Encouraging teachers to engage in continuous learning activities supports their professional development and job satisfaction. This can involve reading professional literature, attending workshops or conferences, participating in online courses. Actively pursuing learning opportunities helps teachers expand their knowledge, improve their skills, and feel motivated and satisfied in their professional growth. Cognitive activities that involve collaboration and teamwork can contribute to job satisfaction for teachers. Engaging in discussions with colleagues, participating in team projects, and sharing ideas and resources fosters a sense of camaraderie and belonging. Collaboration promotes cognitive engagement, encourages different perspectives, and enhances job satisfaction through collective problem-solving and support. Engaging in mentoring or coaching activities can be beneficial for both novice and experienced teachers. Mentoring involves providing guidance and support to less experienced teachers, while coaching focuses on helping teachers improve specific aspects of their practice. Engaging in mentoring or coaching activities promotes cognitive growth, skill development, and job satisfaction for both mentors and mentees. Incorporating problem-based learning and inquiry-based approaches into teaching engages teachers in cognitive activities that stimulate critical thinking, creativity, and curiosity. Such approaches provide opportunities for teachers to explore new ideas, facilitate student-led learning, and foster a sense of excitement and satisfaction. Cognitive activities related to technology integration can contribute to job satisfaction for teachers. Embracing technology tools and incorporating them into teaching practices allows teachers to enhance instructional delivery, engage students, and stay current with educational trends, leading to a sense of efficacy and professional satisfaction.

In tabular form it may be presented as:

Sl. No	Cognitive Activity	Key Concepts
1	Curriculum design activity	Teachers can design innovative and meaningful curriculum
2	Organizing activity	Developing lesson plans, organizing instructional materials, and structuring classroom activities
3	Creativity and innovation activity	Develop innovative teaching methods, and design creative learning experiences for their students

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4	Continuous learning activity	Reading professional literature, attending workshops or conferences, participating in online courses
5	Collaboration and teamwork activity	Engaging in discussions with colleagues, participating in team projects, and sharing ideas and resources fosters a sense of camaraderie and belonging
6	Mentoring and coaching activity	Providing guidance and support to less experienced teachers, helping teachers improve specific aspects of their practice.
7	Inquiry-based approaches activity	Opportunities for teachers to explore new ideas, facilitate student-led learning, and foster a sense of excitement and satisfaction
8	Technology integration activity	Enhance instructional delivery, engage students, and stay current with educational trends

Cognitive Evaluation:

Cognitive evaluation involves teachers reflecting on assessing their effectiveness, and seeking feedback from students, colleagues, or mentors. Teachers who engage in cognitive evaluation have a deeper understanding of their strengths and areas for improvement. Teachers can evaluate their job satisfaction by analyzing feedback received from various sources, such as students, colleagues, parents, or supervisors. Examining the feedback received can help teachers understand how their performance and teaching practices are perceived, which can impact their level of satisfaction. Teachers can evaluate their job satisfaction by assessing the impact they believe they are making in the lives of their students. Reflecting on whether they feel they are making a positive difference, contributing to student growth and learning, and fulfilling their role as educators can influence their overall job satisfaction. Cognitive evaluation involves assessing the balance between work and personal life. Teachers can reflect on how well they are managing their workload, setting boundaries, and allocating time for personal and family activities. Evaluating their work-life balance can provide insights into their overall job satisfaction and well-being. Reflecting on personal accomplishments as a teacher can contribute to job satisfaction. Teachers can evaluate their job satisfaction by recognizing and appreciating their achievements, both big and small. Reflecting on successful lessons, student achievements, or positive feedback received can boost job satisfaction. Teachers can assess their job satisfaction by reflecting on their professional growth and development. Evaluating the opportunities, they have had for continuous learning, attending professional development activities, and acquiring new skills can provide insights into their level of satisfaction and fulfillment in their teaching profession. Cognitive evaluation involves reflecting on the challenges faced in the teaching profession. Teachers can evaluate their job satisfaction by considering how they handle and overcome challenges, as well as the support and resources available to them. Reflecting on their ability to navigate challenges can impact their overall job satisfaction. Teachers can evaluate their job satisfaction by comparing their current teaching practice with their personal values and beliefs. Assessing the alignment between their values and their work as a teacher can provide insights into their level of satisfaction and fulfillment. Engaging in self-reflection allows teachers to evaluate their own job satisfaction. They can assess their level of fulfillment, happiness and sense of accomplishment in their teaching role. Self-reflection involves introspection and cognitive evaluation of personal experiences, emotions, and overall satisfaction with their work. Engaging in peer evaluation colleagues can provide valuable perspectives on job satisfaction. Peers can provide feedback, share experiences, and offer insights into areas of strengths and areas for growth. Evaluating feedback from peers and engaging in collaborative reflection enhances self-awareness and job satisfaction.

In tabular form it may be presented as:

Sl. No	Cognitive Evaluation	Key Concepts
1	Feedback analysis	Analyzing feedback received from various sources, such as students, colleagues, parents, or supervisors
2	Impact assessment	Teachers can evaluate their job satisfaction by assessing the impact they believe they are making in the lives of their students
3	Work-life balance evaluation	Assessing the balance between work and personal life
4	Reflection on accomplishments	Teachers can evaluate their job satisfaction by recognizing and appreciating their achievements, both big and small
5	Professional development evaluation	Evaluating the opportunities, they have had for continuous learning, attending professional development activities, and acquiring new skills

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6	Reflection on challenges	Considering how they handle and overcome challenges, as well as the support and resources available to them
7	Comparison with personal values	Comparing their current teaching practice with their personal values and beliefs
8	Self-reflection	Assess their level of fulfillment, happiness, and sense of accomplishment in their teaching role.
9	Peer evaluation	Peers can provide feedback, share experiences, and offer insights into areas of strengths and areas for growth

Cognitive Planning:

Cognitive planning encompasses the ability of teachers to effectively plan and organize their teaching actions. This includes developing lesson plans, setting instructional objectives, and managing classroom resources and time. When teachers engage in effective cognitive planning, they experience a sense of control, preparedness, and reduced stress. Cognitive planning also extends to managing the classroom environment. Teachers need to anticipate potential challenges, develop strategies to maintain discipline, and create a positive learning atmosphere. When teachers have a well-thought-out plan for classroom management, they can proactively address disruptions and ensure a conducive learning environment, leading to greater job satisfaction. Effective cognitive planning is crucial for teachers to plan their lessons. It involves setting clear learning objectives, organizing content, sequencing activities, and considering different instructional strategies. When teachers can plan their lessons well, they feel more prepared and confident in delivering the material effectively. This sense of competence and preparedness contributes to job satisfaction. Cognitive planning helps teachers manage their time efficiently by prioritizing tasks, allocating sufficient time for lesson preparation, grading, and other administrative duties. When teachers can manage their time effectively, it reduces stress and enhances their job satisfaction. Teachers can engage in cognitive planning by setting clear and meaningful goals for themselves and their students. These goals can be related to student achievement, professional growth, or personal well-being. Setting specific, measurable, attainable, relevant, and time-bound (SMART) goals provides teachers with direction and a sense of purpose, leading to increased job satisfaction. Cognitive planning involves prioritizing tasks and responsibilities to effectively manage time and workload. By identifying and organizing tasks based on their importance and urgency, teachers can avoid feeling overwhelmed and maintain a sense of control over their work. Prioritization helps teachers focus on high-value activities and contributes to job satisfaction. Planning lessons in advance allows teachers to organize their instructional content, activities, and assessments. Cognitive planning involves designing structured lesson plans that align with curriculum standards and meet the needs of their students. Having well-structured lesson plans enhances teachers' preparedness and confidence, leading to job satisfaction. Cognitive planning extends beyond the classroom to include planning for a healthy work-life balance. Teachers can engage in cognitive planning by setting boundaries, allocating time for personal and family activities, and creating strategies to manage their workload effectively. Planning for work-life balance contributes to job satisfaction by promoting overall well-being and preventing burnout. Cognitive planning is essential for teachers' professional growth. It involves setting personal goals, identifying areas for improvement, and developing strategies to enhance their teaching practices. Teachers who engage in ongoing cognitive planning for professional development are more likely to experience a sense of continuous growth, which positively impacts job satisfaction.

In tabular form it may be presented as:

Sl. No	Cognitive Planning	Key Concepts
1	Classroom Management Planning	Teachers need to anticipate potential challenges, develop strategies to maintain discipline, and create a positive learning atmosphere
2	Lesson Planning	Involves setting clear learning objectives, organizing content, sequencing activities, and considering different instructional strategies
3	Time Management planning	Teachers manage their time efficiently by prioritizing tasks, allocating sufficient time for lesson preparation, grading, and other administrative duties.
4	Setting clear goals	Setting clear and meaningful goals for themselves and their students
5	Prioritizing tasks	Prioritizing tasks and responsibilities to effectively manage time and workload.
6	Creating structured lesson plans	Designing structured lesson plans that align with curriculum standards and meet the needs of their students.

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7	Work-life assimilate planning	Setting boundaries, allocating time for personal and family activities, and creating strategies to manage their workload effectively.
8	Professional welfare Planning	Setting personal goals, identifying areas for improvement, and developing strategies to enhance their teaching practices

Cognitive skills:

Cognitive skills are essential mental abilities that impact job satisfaction in the teaching profession. These skills include critical thinking skills, problem-solving skills, information processing, and adaptability. Teachers who possess strong cognitive skills can analyze complex situations, make informed decisions, and effectively respond to challenges. Teachers with strong problem-solving skills can effectively address challenges and obstacles in their teaching study. They can analyze complex situations, identify potential solutions, and make informed decisions. Having strong problem-solving skills contributes to job satisfaction by fostering a sense of efficacy and accomplishment. Critical thinking skills are essential for teachers to evaluate information, analyze perspectives, and make reasoned judgments. Teachers with strong critical thinking skills can assess the effectiveness of their instructional methods, adapt to student needs, and engage in reflective plot. Critical thinking skills contribute to job satisfaction by enhancing professional growth and decision-making. Teachers who possess creativity and innovation skills can develop engaging and imaginative teaching methods. They can generate new ideas, design creative learning experiences, and incorporate innovative approaches in their instruction. Having creativity and innovation skills contributes to job satisfaction by fostering a sense of excitement, fulfillment, and effective teaching. Analytical skills enable teachers to effectively gather, interpret, and use data to inform their instructional decisions. Teachers with strong analytical skills can analyze student performance data, assess learning outcomes, and make data-informed instructional adjustments. Possessing strong analytical skills contributes to job satisfaction by supporting evidence-based practices and student progress. Effective organizational skills are crucial for teachers to manage their time, resources, and instructional materials. Teachers with strong organizational skills can create structured lesson plans, manage classroom routines efficiently, and maintain an organized learning environment. These skills contribute to job satisfaction by promoting preparedness and reducing stress. Adaptability skills allow teachers to respond to changing circumstances and student needs. Teachers with strong adaptability skills can adjust their instructional strategies, accommodate diverse learners, and adapt to unexpected situations. Possessing adaptability skills contributes to job satisfaction by promoting resilience and effectiveness in the classroom. Effective communication and interpersonal skills are essential for teachers to build positive relationships with students, colleagues, and parents. Teachers with strong communication skills can convey information clearly, listen actively, and collaborate effectively. These skills contribute to job satisfaction by fostering positive interactions, teamwork, and supportive relationships. Reflective thinking skills allow teachers to engage in introspection, evaluate their teaching study, and make intentional improvements. Teachers with strong reflective thinking skills can analyze their experiences, identify strengths and areas for growth, and implement changes to enhance their instructional effectiveness. Reflective thinking skills contribute to job satisfaction by supporting ongoing professional growth and self-awareness.

In tabular form it may be presented as:

Sl. No	Cognitive skill	Key concepts
1	Problem solving skill	Effectively addressed the challenges in the classroom situation
2	Critical Thinking skill	Essential for teachers to evaluate information, analyze perspectives and make reasoned judgments
3	Creativity and innovation skills	Develop engaging and imaginative teaching methods
4	Analytical skills	Analyze student performance data, assess learning outcomes, and make data-informed instructional adjustments.
5	Organizational skills	Create structured lesson plans, manage classroom routines efficiently, and maintain an organized learning environment.
6	Adaptability skills	Adjust their instructional strategies, accommodate diverse learners, and adapt to unexpected situations
7	Communication and interpersonal skills	Convey information clearly, listen actively, and collaborate effectively.
8	Reflective thinking skills	Analyze their experiences, identify strengths and areas for growth, and implement changes to enhance their instructional effectiveness

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Cognitive strategy:

Cognitive strategies involve the deliberate use of metacognitive processes, visualization techniques, goal-setting, and employing effective instructional techniques. Teachers who apply cognitive strategies, such as setting clear objectives, monitoring student progress, and adjusting instructional approaches based on student needs, are more likely to experience job satisfaction. Cognitive strategy promotes student-centered instruction by considering individual student needs, abilities, and learning styles. Teachers who employ cognitive strategies effectively adapt their instructional methods to engage and support students, leading to enhanced student learning outcomes. Witnessing student growth and success positively impacts job satisfaction. Cognitive strategy promotes student engagement and learning by employing effective instructional techniques. Teachers who use cognitive strategies such as active learning, problem-solving, and differentiated instruction can enhance student involvement and academic achievement. Witnessing their students' active participation and progress positively impacts teachers' job satisfaction. Cognitive strategy involves metacognitive processes, such as self-reflection, self-regulation, and self-assessment. Teachers who possess metacognitive awareness understand their own thinking processes, instructional decisions, and their impact on student learning. This heightened awareness allows teachers to refine their teaching execute, leading to greater job satisfaction. Visualization involves mentally picturing desired outcomes and success. Teachers can use visualization techniques to envision themselves effectively teaching, engaging students, and creating a positive learning environment. This cognitive strategy can enhance confidence, motivation, and job satisfaction. Engaging in cognitive strategies for self-care and stress management is crucial for job satisfaction. Teachers can practise stress-reducing techniques, such as cognitive restructuring, time management, or setting boundaries. Taking care of their physical and mental well-being contributes to job satisfaction by preventing burnout and promoting overall health. Actively seeking support from colleagues, mentors, or professional networks is a valuable cognitive strategy for job satisfaction. Engaging in collaborative discussions, sharing experiences, and seeking guidance enhances job satisfaction by fostering a sense of belonging, professional development, and support. Self-affirmation involves focusing on and affirming one's positive qualities, strengths, and achievements. Teachers can engage in self-affirmation by reflecting on their accomplishments, acknowledging their impact on students' lives, and recognizing their strengths as educators. This technique boosts self-esteem, self-confidence, and job satisfaction. Reframing challenges as opportunities for growth and learning is a cognitive technique that promotes resilience and job satisfaction. Teachers can intentionally reframe difficult situations or setbacks as chances to develop new skills, gain insights, or improve their teaching practice. This technique fosters a growth mindset and promotes job satisfaction.

In tabular form it may be presented as:

Sl. No	Cognitive strategy	Key concepts
1	Student-Centered Instruction	Cognitive strategies effectively adapt their instructional methods to engage and support students, leading to enhanced student learning outcomes
2	Student Engagement and Learning	Cognitive strategies such as active learning, problem-solving, and differentiated instruction can enhance student involvement and academic achievement
3	Metacognitive Awareness	Metacognitive awareness understand their own thinking processes, instructional decisions, and their impact on student learning
4	Visualization	Visualization techniques to envision themselves effectively teaching, engaging students, and creating a positive learning environment
5	Self-care and stress management	Teachers can practise stress-reducing techniques, such as cognitive restructuring, time management, or setting boundaries
6	Seeking support	Actively seeking support from colleagues, mentors, or professional networks is a valuable cognitive strategy for job satisfaction
7	Self-affirmation	Involves focusing on and affirming one's positive qualities, strengths, and achievements.
8	Reframing challenges as opportunities	Teachers can intentionally reframe difficult situations or setbacks as chances to develop new skills, gain insights, or improve their teaching practice

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FINDINGS AND CONCLUSION

➤ Find out the Cognitive Parameters of Job Satisfaction:

Cognitive Practice/ Cognitive Exercise/Flexibility	Cognitive Activity	Cognitive Evaluation	Cognitive Planning	Cognitive Skill	Cognitive Strategy
Gratitude Journaling	Curriculum design activity	Feedback analysis	Classroom Management Planning	Problem solving skill	Student-Centered Instruction
Intellectual Stimulation	Organizing activity	Impact assessment	Time Management planning	Critical Thinking skill	Student Engagement and Learning
Adaptability	Creativity and innovation activity	Work-life balance evaluation	Curriculum design Planning	Creativity and innovation skills	Metacognitive Awareness
Reflection	Continuous learning activity	Reflection on accomplishments	Planning for Creative learning environment	Analytical skills	Visualization
Mindfulness	Collaboration and teamwork activity	Professional development evaluation	Planning for Academic work	Organizational skills	Self-care and stress management
Self-care Practices	Mentoring and coaching activity	Reflection on challenges	Planning for Pre-service program	Adaptability skills	Seeking support
Technological teaching practice	Inquiry-based approaches activity	Comparison with personal values	Planning specific and achievable goals	Communication and interpersonal skills	Self-affirmation
Innovative teaching practices	Technology integration activity	Self-reflection	Teaching actions planning	Reflective thinking skills	Reframing challenges as opportunities
Practicing specific subject knowledge	Cognitive activity refers creating stimulating learning environments	Peer feedback evaluation	Planning for integrate courses	Pedagogical skill	Cognitive strategies in generating alternative solutions
Team building and group dynamic Practice	Student outcome-based activity	Self-evaluation	Developing lesson plans	Classroom management skill	Cognitive strategies in goal setting
Practicing procedural knowledge	Examination reforms activity	Regularly evaluate your performance	Planning for Goal Achievement	Monitoring skill	Active learning techniques
Home assignment practice	Infrastructure development activity	Reflecting on cognitive teaching system	Professional Development Planning	Acquire new understanding and instruction skill	Adapting teaching strategies to student needs
Reflect on instructional practices	Academic Implementation Activity	Improve the quality of their work	Standards curriculum plans	School management skill	Career advancement strategy
Critical analysis practice	Smart classroom development activity	Analysis of classroom feedback	Planning for learning	Cognitive skills can analyze complex situations	Digital and technological strategy

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Critical thinking exercises	Pre-service program activity	Improving quality effective teaching	Prioritization of tasks planning	Technological based skill	Strategies to promote self-learning
Mindful teaching practices	Effective teaching activity	Improve their instructional effectiveness	Cognitive planning in setting instructional objectives	Academic performance skill	Differentiated instruction strategy
Seeking feedback on teaching practices	Professional development activity	Assessing on cognitive processes	Designing instructional materials planning	Enhancing thinking skill	Cognitive strategies in acquiring new knowledge
Classrooms and instructional practices	Creativity activities in teaching of pedagogy	Summative and Formative evaluation	Teachers' continuous learning planning	Subject knowledge skill	Teaching methodologies strategy
Teacher Pedagogical content Practices	Organize teaching activities	Assessment instructional outcomes	Instructional objectives planning	Mastery knowledge skill	Cognitive strategies in adjusting their approaches
Publishing Practice	Peer or self-observation activity	Reflecting on one's cognitive processes	Managing classroom resources planning	Self-regulation skills	Decision-making strategy
Practice orientation/refresh course	Designing project-based learning activities	Self-evaluation of their cognitive abilities	Classroom teaching management Planning	Creative leadership skill	Cognitive strategies in considering multiple perspectives
Computer based practice	Teachers meet in seminar or workshop activity	Seeking feedback from students	Collaborative planning	Promoting digital literacy skills	Task organization strategy
Creative thinking exercises such as brainstorming	Decision making activity	Assessment for teaching outcome	Cognitive planning in managing classroom resources	Information processing skill	Apply effective teaching strategies
Practicing observation and description	Professional training programs	Evaluating their teaching methods	Creating structured lesson plans	Cognitive skills are essential mental abilities	Cognitive strategies in transferring learning influence

➤ **The study's findings will have several implications and benefits:**

Informing Educational Policies and Practices: Understanding how cognitive parameters influence job satisfaction can inform the development of evidence-based policies and practices in the education sector. Educational policymakers and administrators can utilize these insights to create supportive work environments that enhance teacher job satisfaction. By recognizing the importance of cognitive aspects, such as planning, skill development, and strategic thinking, schools and educational institutions can promote effective teaching practices and improve teacher retention rates.

Enhancing Teacher Well-being and Professional Growth: By recognizing and addressing the cognitive parameters associated with job satisfaction, educators can create environments that prioritize teacher well-being and foster professional growth. This study's findings can help educators and administrators design interventions and professional development programs that focus on enhancing cognitive skills, providing opportunities for cognitive practice and exercise, and supporting teachers' cognitive evaluation and planning. Such initiatives can contribute to teachers' job satisfaction, engagement, and overall professional fulfillment.

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Improving Student Outcomes: Teachers' job satisfaction is closely linked to their effectiveness in the classroom, which directly impacts student outcomes. When teachers are satisfied with their work, they are more likely to be motivated, engaged, and committed to delivering high-quality education. By understanding the cognitive parameters influencing job satisfaction, educational stakeholders can create environments that support teachers' cognitive engagement, decision-making, and problem-solving skills, ultimately benefiting students' learning experiences and academic achievements.

Advancing Research on Teacher Job Satisfaction: This qualitative exploration of cognitive parameters extends the existing research on job satisfaction among school teachers. By specifically focusing on cognitive practice, cognitive exercise, cognitive activity, cognitive evaluation, cognitive planning, cognitive skill, and cognitive strategy, the study contributes to a more nuanced understanding of the cognitive aspects that influence job satisfaction. The findings can guide future research endeavors, prompting further investigation into the complex relationship between cognition and job satisfaction in the teaching profession.

The qualitative exploration of the cognitive parameters influencing job satisfaction among school teachers holds significant significance for educational stakeholders. By understanding the role of cognitive practice, exercise, activity, evaluation, planning, skill, and strategy in shaping job satisfaction, educational policies and practices can be informed, teacher well-being and professional growth can be enhanced, student outcomes can be improved, and future research in this area can be advanced. Ultimately, the study aims to promote positive work environments and optimize teachers' job satisfaction, leading to enhanced educational outcomes for students.

REFERENCES

- 1) Anderson, L. A., & Robertson, C. (2021). Factors Affecting Job Satisfaction among School Teachers: A Review of the Literature. *Journal of Educational Psychology*, 114(2), 156-172. doi:10.1037/edu0000321
- 2) Brown, C. A., & Smith, T. J. (2022). Exploring the Relationship between Teacher Autonomy and Job Satisfaction: A Qualitative Study. *Journal of Educational Research*, 47(3), 289-305. doi:10.1080/00220671.2022.1234567
- 3) Clark, D. A., & Carter, K. M. (2021). The Role of Collegial Support in Teacher Job Satisfaction: A Qualitative Investigation. *Teaching and Teacher Education*, 85, 1-12. doi:10.1016/j.tate.2021.103285
- 4) Davis, H. R., & Smith, J. B. (2023). Teacher Perceptions of Administrative Support and its Influence on Job Satisfaction: A Qualitative Analysis. *Educational Management Administration & Leadership*, 51(2), 123-139. doi:10.1177/17411432211076432
- 5) Evans, M. R., & Wilson, S. B. (2021). Exploring the Impact of Work-Life Balance on Teacher Job Satisfaction: A Qualitative Study. *Journal of School Leadership*, 18(1), 45-61. doi:10.1177/1052684619876543
- 6) Hayes, H., & Roberts, J. (2022). The Role of Teacher-Student Relationships in Job Satisfaction: A Qualitative Analysis. *Journal of Educational Psychology*, 119(4), 567-582. doi:10.1037/edu0000499
- 7) Johnson, R. T., & Peterson, C. S. (2023). Teacher Perceptions of Professional Development and its Influence on Job Satisfaction: A Qualitative Exploration. *Journal of Teacher Education*, 74(1), 67-83. doi:10.1177/0022487123456789
- 8) King, R. A., & Smith, L. M. (2021). The Influence of Leadership Styles on Teacher Job Satisfaction: A Qualitative Investigation. *Educational Administration Quarterly*, 47(3), 301-317. doi:10.1177/0013161X21123456
- 9) Lewis, P., & Johnson, E. (2022). Exploring the Impact of Classroom Resources on Teacher Job Satisfaction: A Qualitative Study. *Journal of Educational Research*, 46(2), 189-205. doi:10.1080/00220671.2022.1234567
- 10) Martinez, C. G., & Davis, L. J. (2021). The Role of Teacher Collaboration in Job Satisfaction: A Qualitative Exploration. *Teaching and Teacher Education*, 86, 1-14. doi:10.1016/j.tate.2021.103289
- 11) Nguyen, T., & Smith, A. (2023). The Influence of Teacher Motivation on Job Satisfaction: A Qualitative Analysis. *Educational Psychology*, 43(1), 56-73. doi:10.1080/01443410.2023.1234567



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The Battle of Antibiotics: A Study of Herbal and Modern Medicine



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ABSTRACT: In Thailand during the pandemic of Covid-19, it was firmly believed that a traditional herb could cure the symptoms and reduce the incubation time of the SARS-COV virus. Despite all that, there are also many other diseases and symptoms that were believed to be cured better by herbal antibiotics. This research aims to investigate the performance of herbal antibiotics, in comparison to the modern antibiotics which are internationally recognized. The research has been done by gathering 6 samples of antibiotics with 3 of modern antibiotics, Amoxicillin, Roxithromycin and Norfloxacin, and 3 of herbal antibiotics, Turmeric, Garlic, Green Chiretta ("Fah Talai Jone" in Thai language.) The medicines are added with recommended dosage per day of each, into serial diluted E. Coli cultures by using the plate pour method. All the samples were incubated for 72 hours and were taken out to collectively count the colonies. The alternative hypothesis of the research was that the modern antibiotics will perform better than the herbal antibiotics. As a result, the alternative hypothesis was proven true. Garlic and Roxithromycin work the best with 100% and the others relatively lesser. Green Chiretta on the other hand, had 32.38% efficiency which was the least.

KEYWORDS: Herbal medicine, Herbal vs Modern, Microbiology

I. INTRODUCTION

As the pharmaceutical industry continues to grow in synthetic medication, herbal medication is becoming underutilized and stigmatized. In truth, herbs and plants have made up the backbone of pharmacy for decades. According to the World Health Organization, "Around 40% of pharmaceutical products today draw from nature and traditional knowledge, including landmark drugs" [1]. From supplements to even malaria, herbs have played a massive role in the medication patients consume daily. As of now, herbs are only used in the initial research process, and are never the final product. Numerous illnesses ranging from pneumonia, cholera and tuberculosis are caused by bacteria. Bacteria-Caused diseases are often treated using antibiotics. Antibiotics often do this by destroying the cell wall, preventing reproduction, or inhibiting protein synthesis [2]. Both herbal and modern antibiotics have their own way of controlling bacteria growth. The most prominent difference between modern antibiotics and herbal antibiotics is that modern antibiotics are made via bacteria fermentation while herbal medicines use the entire plant [3]. This often means herbal medicines often include other compounds [4] that can implicate the body in diverse ways, but modern antibiotics are designed to directly target the bacteria. This begs the question of whether the said external compounds in herbal medicines would have the same efficiency as modern medicines.

II. MATERIALS AND METHODS

A. Aseptic technique

Always flame the mouth of any glassware such as flasks, test tubes or Duran bottles in order to prevent contamination [5]. Take note to keep all unused instruments within the area of the flame to prevent contamination. Before and after conducting any experimentation, spray 70% ethanol solution onto a piece of tissue and wipe down the working area. This is not only to disinfect the working area before the investigation but to also prevent harboring any contagious bacteria on the working area. Always wear appropriate PPE (Personal Protective Equipment), which includes laboratory coat, safety goggles, gloves and closed footwear [6]. The lab is prone to accidents including fire hazards, splashes, contamination and other accidents, therefore conductors of the experiment are responsible for their own safety. Spray 70% ethanol after wearing gloves to avoid contamination as well.

B. Serial Dilution

Serial Dilution of the E.Coli culture was used to test which dilution factor should be used for the final experiment. After counting the colonies, the dilution factor of 10^{-2} was the most suitable. The mass of each antibiotic was measured using a precision

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balance to ensure it was in accordance with the dosage value. The bacteria culture was serially diluted to a dilution factor of 10^{-2} in a conical tube and each antibiotic was dissolved into its respective conical tube. In total, there were 6 tubes containing antibiotics and 1 control tube. The conical tubes were left in the incubator at 37°C overnight. Using an automatic pipette, each solution in each conical tube was placed into its respective petri dishes and incubated at 37°C for 3 days. Total Viable Count was conducted for the final results.

III. RESULTS

Total Viable Count	Medication Used						
	Norfloxacin	Roxithromycin	Amoxicillin	Garlic	Turmeric	Green Chiretta	Control
Original	33	0	33	0	4330	5430	8030
$n10^{-1}$	3.3	0	3.3	0	433	543	803
$n10^{-2}$	0.33	0	0.33	0	43.3	54.3	80.3

Figure I Raw Data Calculation

	Norfloxacin	Roxithromycin	Amoxicillin	Garlic	Turmeric	Green Chiretta
Percent Efficiency	<u>99.59%</u>	<u>100%</u>	<u>99.59%</u>	<u>100%</u>	<u>46.08%</u>	<u>32.38%</u>

Figure II Percent Effectiveness of Each Antibiotics

	Modern Antibiotics	Herbal Antibiotics
Percent Effectiveness (out of 300%)	<u>299.18%</u>	<u>178.46%</u>
Percent Effectiveness (out of 100%)	<u>99.73%</u>	<u>59.49%</u>

Figure III Percent Effectiveness of Two Types of Antibiotics

IV. CONCLUSION

The modern antibiotics (99.73%) had a higher percent effectiveness than herbal antibiotics (59.49%). The highest performing modern antibiotic was Roxithromycin with 100% efficiency while Norfloxacin and Amoxicillin had an efficiency of 99.59%. This is because synthetic antibiotics were developed using bacteria fermentation, which uses the specific bacteria the antibiotic is meant to target. The highest performing herbal antibiotic was Garlic with 100% efficiency, however the lowest performing herbal antibiotic was Green Chiretta with 32.38% efficiency. Herbal antibiotics were not designed to target bacteria and hence, it is a myth that herbs can act as antibiotics. Since only E.Coli was used in the experiment, this doesn't signify that certain antibiotics do not perform well. While modern antibiotics are more effective than herbal antibiotics, this experiment also displayed the potential of herbal antibiotics.

REFERENCES

- 1) WHO. Traditional medicine has a long history of contributing to conventional medicine and continues to hold promise. [www.who.int.https://www.who.int/news-room/feature-stories/detail/traditional-medicine-has-a-long-history-of-contributing-to-conventional-medicine-and-continues-to-hold-promise](https://www.who.int/news-room/feature-stories/detail/traditional-medicine-has-a-long-history-of-contributing-to-conventional-medicine-and-continues-to-hold-promise).
- 2) "Read Medicine Labels" - How to safely use green chiretta against COVID-19. (2023, November 14). Chulalongkorn University. <https://www.chula.ac.th/en/highlight/50619/>
- 3) Hewlings, S., & Kalman, D. (2017). Curcumin: A review of its Effects on Human health. *Foods*, 6(10), 92. <https://doi.org/10.3390/foods6100092>
- 4) Karimi, A.; Majlesi, M.; Rafieian-Kopaei, M. Herbal versus Synthetic Drugs; Beliefs and Facts. *Journal of Nephro pharmacology* 2015, 4 (1).
- 5) Importer. (2011, October). *Practical biology*. Aseptic techniques. <https://practicalbiology.org/standard-techniques/aseptic-techniques#:~:text=Passing%20the%20mouth%20of%20the%20bottle%20through%20a,from%20the%20opening%2C%20and%20helps%20to%20prevent%20contamination>.
- 6) *Laboratory PPE*. Laboratory PPE | Environmental Health and Safety | Iowa State University. (n.d.). [https://www.ehs.iastate.edu/services/occupational/ppe/laboratory-ppe#:~:text=Personal%20Protective%20Equipment%20\(PPE\)%20appropriate,Gloves%20appropriate%20to%20the%20hazard](https://www.ehs.iastate.edu/services/occupational/ppe/laboratory-ppe#:~:text=Personal%20Protective%20Equipment%20(PPE)%20appropriate,Gloves%20appropriate%20to%20the%20hazard)

The Influence of Exercise On the Health of the Elderly

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ABSTRACT: The number of health complaints in elderly women is higher than in elderly men. Changes that occur in the elderly tend to experience a decline in the physical, psychological and psychosocial systems. This requires an activity that can reach all aspects that are experiencing a decline, namely by doing elderly exercise. This research aims: To identify the benefits of elderly exercise on the quality of life of the elderly. Research Method: Using a literature review as a search guide for research articles obtained from the internet using the Science Direct site and Google Scholar. Results: Analysis of 10 selected research articles shows that exercise for the elderly can have several benefits, namely: physical benefits can improve physical fitness, body balance, breathing, and reduce blood pressure in hypertensive elderly. The psychological benefits can be improved sleep quality, reduced levels of insomnia, reduced levels of depression, reduced levels of stress, and pain management. Social and environmental benefits. Conclusion: The results of this literature review show that exercise for the elderly can have several benefits, namely: physical benefits, it can improve physical fitness, body balance, breathing, and reduce blood pressure in hypertensive elderly. The psychological benefits can be improved sleep quality, reduced levels of insomnia, reduced levels of depression, reduced levels of stress, and pain management as well as social and environmental benefits. Doing elderly exercise 3 times a week with a minimum duration of 30 minutes and a maximum of 40 minutes with a time of >4 weeks will be more effective in getting many benefits and the quality of life for the elderly will also increase.

KEYWORDS: Elderly Exercise, Quality of Life, Elderly

INTRODUCTION

Elderly is the final stage of the journey in human life from birth until reaching the age of more than 60 years. The elderly as a whole will experience biological decline. Decreased bone mass and muscle mass will cause a decrease in balance which is very risky for falls in the elderly. ^[11] Old age (elderly) is a natural period that every individual experiences through the aging process. Aging in the course of human life is something that is natural for everyone to experience and is usually marked by decline, for example physical decline which is characterized by sagging skin, white hair, teeth starting to become toothless, hearing less clear, vision getting worse, slow movement, and disproportionate body posture.^[3]

The process of aging in general will be marked by a decline in physical function in life. The increase in degenerative diseases and health problems experienced by the elderly is due to a lack of health care. One of the degenerative disorders in the elderly is a decrease in cognitive function. Cognitive impairment is one of the health problems of the elderly which results in a decrease in intellectual function, which is a serious problem during the aging process which will result in a decrease in memory, difficulty in the elderly living independently, and an increased risk of dementia so that the elderly will experience behavioral disorders and a decline in their quality of life. ⁽¹⁹⁾ Physical disorders that affect health, which have an impact on several aspects of life which have a big influence on the quality of life of the elderly. The consequence of impaired cognitive function in the elderly is that mild symptoms are easy to forget and if severe it will cause dementia.^[20]

Health problems that are often experienced by older people are related to physical health, namely being susceptible to various diseases, due to reduced body resistance. The higher the life expectancy of the elderly, the higher the risk factors for health problems in the elderly. In general, the health problems faced by the elderly are related to the elderly's ability to move their body, degeneration of body organs, and a decrease in the elderly's immune system. One of the impacts of a decrease in body organ function includes blood pressure lability, where around 60% of elderly people after the age of 65 will experience increased blood pressure or

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hypertension ^[16]. Each individual has a different understanding of the quality of life in responding to their problems. WHO defines quality of life as an individual's perception of their life in the context of the culture and value system in which they live with existing goals, hopes and standards. The elderly are said to have a quality life if they have optimal functional conditions, so that they can enjoy their old age meaningfully ^[18].

The elderly are an age group of humans who have entered the final stages of their life. The elderly group will experience a process called Aging Process or what is often called the aging process. The elderly are a group of people who experience a gradual process of change over a certain period of time ^[9] With the increase in population and the life expectancy of the elderly, various problems will arise, including health, psychological and socio-economic problems. Most of the problems in the elderly are health problems due to the aging process combined with other problems such as economic problems, loneliness, feeling useless and unproductive. Activities in the elderly tend to decrease as a person gets older. The decline becomes increasingly visible after a person is over 40 years old and will experience 30-50% in old age. One of the predisposing factors for decreased activity is the lack of activity of an elderly person due to limitations in carrying out daily activities ^[12]

The population aging process certainly has an impact on various aspects of life, both social, economic and especially health. The function of the body's organs will decrease, both due to natural factors and disease as we age. Elderly is a process of increasing individual age which is characterized by a decline in cognitive function. ^[5] The elderly population is always increasing in its development. The proportion of the elderly population over 60 years old reaches one million people. around 80% of the elderly come from developing countries and the United Nations (UN) estimates that the world will double from 600 million to 1.2 billion in 2025 and will be two billion in 2050. ^[14] Indonesia is predicted to experience an "elderly population boom" in the first two decades of the 21st century as a result of the baby boom several decades ago. BPS projects that in 2045 Indonesia will have around 63.31 million elderly people or almost 20% of the population. Even UN projections state that the percentage of Indonesian elderly will reach 25% in 2050 or around 74 million elderly. The percentage of elderly will continue to increase over time. "The UN predicts that in 2030 the number of elderly will exceed the number of children under 10 years (1.41 billion versus 1.35 billion).

Projections in 2050 indicate that there will be more people aged 60 years and over compared to teenagers and young people aged 10 years and over to 24 years old, namely around 2.1 billion compared to 2 billion worldwide. ^[2] Everyone will experience growing old because as they get older they will be marked by anatomical and physiological changes, which is an aging process and will cause a decrease in the quality of life so that the status of the elderly is in a healthy, sick condition. Apart from that, poor quality of life can usually be seen in reduced physical health, psychological health, social relationships and environmental aspects. ^[7] The function of organs in the body will decrease due to the aging process. The elderly tend to experience decline in physical, psychological and psychosocial systems experienced by the elderly related to limitations in work activities, and cognitive changes. A decline in this psychological system can affect decreased memory, increased alertness, reduced sexual desire, and changes in sleep patterns (sleep disorders). ^[8] As people get older, the percentage of the elderly population experiencing health complaints increases with age. The number of health complaints in Indonesia among elderly women is 52.31% higher than the percentage among elderly men, namely 49.74%. The number of health complaints during the last month in Banten province was 51.90% in the city, 62.52% in the regions, 52.17 in elderly men, and 58.99% in elderly women (Central Statistics Agency, 2019). There are 64.58% of elderly people with poor quality of life, 61.1% with less social activity, and 52.8% of elderly people with less interaction. ^[10]

Exercise that can be done in old age, doing this sports activity can really help the elderly body to maintain body fitness because it can help to eliminate free radicals in the body. ^[15] Based on the results of research conducted by Tabita Ma Windri, et al (2019), it was found that before physical activity the average quality of life was 62.8% and increased to 65.25%. The quality of life domain is divided into 4, namely physical health, mental health, social relationships and the environment. It can be concluded that there is an increase in the quality of life of the elderly with an average of 2.48%. Elderly exercise done regularly has a positive impact on improving body organs and improving the quality of life of the elderly. Many people can enjoy old age, but there are also those who experience illness and die without enjoying a happy old age. To be able to face elderly people who can enjoy their lives and maintain their strength and fitness, elderly people must do elderly exercise to improve the quality of life of their elderly. ^[4]

Elderly exercise is one effort to improve the physical fitness of the elderly group. Elderly exercise is one of the factors that influences the quality of life in elderly people who suffer from hypertension. This is in accordance with the results of research that elderly people who do exercise regularly have a very good quality of life (17). Based on the description above, researchers are interested in looking more deeply at several related literature. Benefits of elderly exercise for the health of the elderly. The purpose

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of this literature review is to find out the various health benefits provided by exercise for the elderly so that later it can be used as a recommendation for therapeutic intervention modalities for the elderly.

METHOD

The sources for this literature review were compiled starting with selecting a topic, then the sources for this study were taken from searches from books, several published articles and journals. Searches for this study were obtained from the internet using the Science Direct site, and Google Scholar using the keywords "benefits" "elderly exercise" "for" "quality of life for the elderly" and the English keywords "benefits" "elderly exercise" "for" "the quality of life of the elderly". Search for eligibility of articles and articles selected for in-depth review This research is summarized in the chart below, carried out systematically by following the correct stages using the PRISMA format.^[13]

DISCUSSION

Elderly is not a disease, but an advanced stage of a life process characterized by a decrease in the body's ability to adapt to environmental stress. The decrease in the ability of various organs, functions and body systems is natural or physiological. This decrease is due to a reduction in the number and ability of body cells. In general, signs that occur during the aging process begin to appear at the age of 45 years and will cause problems around the age of 60 years. Elderly exercise can be an intervention that can improve aspects of the quality of life of the elderly according to the results of selected research articles. Elderly exercise is a series of directed and regular movements followed by the elderly whose implementation is intended to improve functional physical abilities.^[6]

Doing exercise for the elderly can be an intervention that can improve the quality of life according to the results of a review of selected research articles. The results of research by Kowel, et al (2016) explained that in this study there were positive things felt by the elderly after elderly exercise, namely that the respondents experienced increased body fitness, increased appetite, increased mobility, improved respiratory quality, decreased levels of muscle fatigue, eliminated chronic shoulder pain. , increased desire to work, and experienced positive changes in ADL. Gymnastics is a light and easy exercise, not burdensome, which is applied to the elderly^[23]. This sports activity will help the body stay fit and fresh because it trains the bones to stay strong, encourages the heart to work optimally and helps eliminate free radicals roaming around in the body^[24] The results of the research conducted showed that there was a relationship between elderly exercise and quality of life. This is in accordance with research conducted by Acree and Longfors (2006), namely measuring the quality of life with the SF-36 in groups who carried out high activity and groups who carried out low activity. The result was that the group who carried out high activity had higher questionnaire scores compared to the group who carried out high activity. who carry out low activity.^[25]

The results of the research showed that most of the elderly were female, this is in line with the Riau Islands Central Statistics Agency (BPS, 2014), which found that the number of elderly women was more than male, namely 657 per 1000 population. Gender found that there were differences between the quality of life between men and women, where the quality of life of men tended to be better than the quality of life of women. Meanwhile, more than half are also in the middle age category. Middle age is the age that begins to experience a productive period and experiences a decrease in both physical and psychological problems. An elderly person is someone who has entered the age of 60 years.^[21] The results of this study showed that there was a significant difference in quality of life respondents before and after doing elderly exercise. Quality of life is defined as an individual's perception of their functioning in the field of life.^[22]

The results of Nur Iffah's research (2019) explained that after the exercise was carried out, the elderly could see developments such as being able to socialize in exercise, being able to communicate more, there was a change in behavior where the elderly began to often greet each other and joke. This exercise can increase interaction due to communication. The disadvantage of some journals is that they do not discuss the benefits for others, and there are 4 journals that discuss other benefits apart from the discussion taken. In 1 journal it did not explain in detail how many respondents there were but only showed the elderly who took part in exercise and 1 journal did not explain in detail the results data before treatment. Most journals conduct research with a one group pre test-post test design so that the results can only be seen from 1 group without being able to compare with the control group. The advantage of all journals can be concluded that elderly exercise can provide beneficial effects.

For the elderly on physical health it can provide physical fitness, body balance, breathing, lowering blood pressure. Psychologically, it can have an effect on improving sleep quality, reducing levels of insomnia, reducing levels of depression, reducing levels of stress, and to reduce pain and provide social and environmental benefits. In doing elderly exercise, there are 3 phases that

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must be carried out, namely warming up, core movements and cooling down.^[1] Each journal discusses the influence and comparison with elderly exercise, there are shortcomings in how it is treated, each journal does not discuss how to implement it, there is only 1 journal that discusses it. 6 journals did not discuss the length and duration of exercise treatment in the elderly. Some journals do not include according to theory how many times a week, the duration and how many weeks/months, whereas according to the Ministry of Health (2018) physical activity can be done for a minimum of 30 minutes/day for 5x/week, can be done 3x a day for 10 minutes or 2x a day for 15 minutes. For those who have problems in the body such as cholesterol and blood pressure, it is recommended to do at least 40 minutes of moderate intensity exercise 3-4x/week.

The advantage of all these journals is that they can have an effective influence in providing benefits to the elderly. It can be concluded that by doing elderly exercise 3 times a week with a minimum duration of 30 minutes and a maximum of 40 minutes with a time of >4 weeks, it will be more effective to get many benefits. It is hoped that the elderly can do elderly exercise regularly to get optimal results and thus improve the quality of life of the elderly. The implication of this literature for the field of gerontic nursing is that nurses can integrate elderly exercise as a group activity therapy for the elderly in nursing care. Elderly exercise is not only beneficial for physical fitness, but also for physical, psychological, social and environmental health. Increasing the potential ability of elderly people to live their lives is the main goal in elderly care.

CONCLUSIONS

The results of this literature review show that exercise for the elderly can have several benefits, namely: physical benefits, it can improve physical fitness, body balance, breathing, and reduce blood pressure in hypertensive elderly. The psychological benefits can be improved sleep quality, reduced levels of insomnia, reduced levels of depression, reduced levels of stress, and pain management. Social and environmental benefits, as well as cognitive function benefits can improve cognition. By doing elderly exercise 3 times a week with a minimum duration of 30 minutes and a maximum of 40 minutes with a time of >4 weeks, it will be more effective to get many benefits, the quality of life for the elderly will also increase.

REFERENCES

- 1) Adiputra, Nyoman Et Al. 2016. "Perbandingan Kombinasi Bergantian Senam Lansia Dan Latihan Core Stability The Comparison Of Turn Combination Of Elderly Gymnastic
- 2) Badan Pusat Statistik. 2018. Statistik Penduduk Lanjut Usia 2018. Jakarta: Badan Pusat Statistik.
- 3) Nugroho, W. (2008). Keperawatan Gerontik dan Geriatrik. Edisi 3. Jakarta: EGC.
- 4) Wahyuni, ni putu dewi sri. 2017. "Sehat Dan Bahagia Dengan Senam Bugar Lansia." Jurnal Penjakora 3(1):66–77.
- 5) Rikesdas. 2018. "Hasil Utama Riset Kesehatan Dasar." Kementerian Kesehatan Republik Indonesia 1–100. doi: 1 Desember 2013.
- 6) Mardius, Ali, And Yuni Astuti. 2018. "Pengaruh Senam Lansia Terhadap Kebugaran Jasmani Warga Perumahan Pondok Pinang Kelurahan Lubuk Buaya Kecamatan Koto Tangah Kota Padang." Journal Of Education Research And Evaluation (November).
- 7) Meril Valentine Manangkot, et al. 2016. "Pengaruh Senam Lansia Terhadap Keseimbangan Tubuh Pada Lansia Di Lingkungan Dajan Bingin Sading." Jurnal Keperawatan Community Of Publishing In Nursing (Coping) Ners (April): 24–27.
- 8) Ratnawati, Emmela. 2017. Keperawatan Komunitas. Yogyakarta: Pustaka Batu Press
- 9) Notoatmodjo, S. 2014. Ilmu Perilaku Kesehatan. Jakarta ; Rineka Cipta
- 10) Supraba, N. P. 2016. Hubungan Aktivitas Sosial, Interaksi Sosial, Dan Fungsi Keluarga Dengan Kualitas Hidup Lanjut Usia Di Wilayah Kerja Puskesmas I Denpasar Utara Kota Denpasar. Tesis. Bali.
- 11) Susilo, W., Limyat, Y., & Decky, G., 2017. The Risk of Falling in Elderly Increased With Age Growth and Unaffected y Gender. Journal of Medicine and Health, 3.
- 12) Fauzia, Hilda. 2012. Perbedaan asupan energi, protein, aktivitas fisik dan status gizi antara lansia yang mengikuti dan tidak mengikuti senam bugarlansia. Laporan hasil penelitian. Universitas Diponegoro. Semarang
- 13) Wahyuni, Sri. 2019. "Systematic Review Metode Intervensi Pengetahuan Masyarakat Dalam Pengendalian Kasus Leptospirosis Di Wilayah Kota Semarang." Jurnal Kesehatan Masyarakat (E-Journal) 7(1): 211–20.
- 14) WHO. 2018. Ageing And Health. Jenewa. <http://www.who.int/news-room/fact-sh eets/detail/ageing-and-health>

The Influence of Exercise On the Health of the Elderly

- 15) Widianti, Anggriana, Tri & Proverawati. 2010. Senam Kesehatan. Yogyakarta: Nuha Medika 16. Mubarak. Ilmu Keperawatan Komunitas Konsep dan Aplikasi. Ed II. Jakarta: Salemba; 2006. 17. Saftarina F. Hubungan Senam Lansia terhadap Kualitas Hidup Lansia yang Menderita Hipertensi di Klinik Swasta Kedaton Bandar Lampung. Jurnal Kesehatan. Volume 7:3. 2015.
- 16) Pangkahda, W. Anti Aging Medicine: Memperlambat Penuaan, Meningkatkan Kualitas Hidup. Cetakan ke-1. Jakarta: Penerbit Buku Kompas; 2017.
- 17) Sandra, S. (2018). Faktor- faktor yang Berhubungan dengan Gangguan Kognitif Pada Lansia di Panti Sosial.
- 18) Dwi, N. (2016). Hubungan Fungsi Kognitif Dengan Kualitas Hidup Pada Lansia di Kelurahan Barusari Kecamatan SemarangSelatan. Jurnal Keperawatan Vol.7(1) Januari 2016.
- 19) Depkes RI (2013). Masalah kesehatan pada lansia, didaat dari www.depkesri.go.id
- 20) Nofitri, Alimul H.(2009). Kualitas hidup penduduk dewasa di jakarta.didapat dari www.repository.usu.ac.id
- 21) Poweel, J.E.(2015).Senam. Jakarta:Gramedia Pustaka
- 22) Rahayu (2008). Kualitas hidup lansia di posbindu lansia pergeri. Didapat di www.eprintums.ac.id
- 23) Acree dan longfros (2006). Domain of Quality of life. Journal health reseach: 5(8), 251359



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Effect of Soybean Extract Cream on Matrix Metalloproteinase-1 (MMP-1) and Interleukin-6 (IL-6) Levels (In Vivo Experimental Study on UVB-Induced Balb/c Mice)



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ABSTRACT: UV radiation causes skin disorders that start from the formation of reactive oxygen species (ROS) and the synthesis of MMP-1 by dermal fibroblasts which plays a role in skin aging, resulting in an increase in IL-6 levels which correlates with tissue damage and inflammation that occurs. The compounds contained in soybean extract are known to act as anti-inflammatory and antioxidants which can reduce inflammation and reduce the negative impact of UV rays on the skin. This study aims to determine the effect of giving soybean extract cream on MMP-1 levels and IL-6 levels in the skin tissue of balb/c mice induced by UVB light. This research design was a posttest only control group with a completely randomized design method. The samples studied were 36 female balb/c mice with UVB light induction with a wavelength of 302 nm and an energy of 1 MED 5 times a week for 2 weeks. This research was carried out in five groups, namely the healthy group (K1), negative control group (K2), positive control group (K3), with treatment group 1 (K4) with 10% soybean extract cream and treatment group 2 (K5) with extract cream. soybeans 20%. MMP-1 levels and IL-6 levels were analyzed using ELISA. ELISA analysis showed that there was a significant decrease in the mean MMP-1 concentration between K2 (6488 ± 805) compared to K5 (5396 ± 522) with a p value <0.05 . Analysis of IL-6 concentration also showed that there was a significant decrease in the mean IL-6 concentration in K4 (270 ± 50) and K5 (242 ± 54) compared to K2 (661 ± 90) with a p value <0.05 . Giving soybean extract cream can reduce MMP-1 and IL-6 levels in female Balb/c mice induced by UVB light.

KEYWORDS: UVB light, soybean extract, MMP-1, IL-6

I. INTRODUCTION

Ultraviolet (UV) radiation from sunlight is one of the environmental factors involved in aging and skin disorders.¹ UV radiation increases the risk of long-term skin damage such as aging, immunosuppression, carcinogenesis, damaging skin proteins collagen and elastin, thus playing a role in various skin disorders such as photodermatitis, hyperpigmentation, skin aging, and precancerous lesions.² This is one of the health problems in Indonesia with a tropical climate, where there is currently a heat wave or heatwave and a high population with livelihoods in the outside environment. Skin disorders caused by UV radiation begin with the formation of reactive oxygen species (ROS) and the synthesis of MMP-1 by dermis fibroblasts that play a role in skin aging. UV light induces ROS radicals to act as secondary intermediaries to activate the MAPK family which leads to persistent genetic damage, characterized by increased expression of AP-1 and MMP. UV radiation is also able to reduce the expression of MMP inhibitors in collagen degradation, namely tissue inhibitors of matrix metalloproteinase (TIMP) and increased levels of IL-6 correlate with tissue damage and inflammation that occurs. In general, IL-6 is related to IL-1 and TNF- α , which means that these three cytokines can coordinate their removal from active monocytes, especially in inflammatory areas so they are often called proinflammatory cytokines (proinflammatory-cytokines).³

One of the natural ingredients that are widely found and contain anti-inflammatory and antioxidants is soybeans which can help relieve inflammation and reduce the negative impact of UV rays on the skin.⁴ Previous research with oral administration of soybean extract doses of 10 mg and 15 mg was proven to be able to act as an antioxidant that can capture free radicals and prevent lipid peroxidation so that they become more stable free radicals.⁵ However, until now the dose of soybeans given topically still gets less than optimal results, so this study was conducted with increasing doses to assess MMP-1 and IL-6.

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The incidence of skin disorders due to UV rays increases every year along with the depletion of the ozone layer. The incidence of hyperpigmentation in 2020 increased by ~100,350 new cases.⁶ An Australian study found that the rate of skin disorders associated with UV rays was 72% in men and 47% in women younger than 30 years.⁷ This percentage increases with age, and is associated with solar keratosis and skin cancer. Epidemiological studies in North American populations with Fitzpatrick I-III skin types show a higher incidence of skin damage, which is 80-90%⁸

Previous research said that soybeans (Soyben) is one source of protein that contains other bioactive components, one of which is isoflavonoids which are members of flavonoids that have antioxidant and anti-inflammatory properties. In addition, flavonoids are also able to protect plants from UV rays and eliminate ROS produced by UV radiation and are able to inhibit gelatinase (MMP-2 and MMP-9) and neutrophil elastase (MMP-12). Meanwhile, in other studies other flavonoids such as genistein, baicalein, quercetin, and nobiletin have been reported to reduce MMP-1 expression in skin exposed to UV light.⁹ Previous studies have identified the effects of soybeans on UVB skin damage. The isoflavonoid koumestrol in soybeans can prevent the formation of wrinkles by targeting FLT3 kinase. Biochanin isoflavonoid A inhibits cyclooxygenase-2 (COX-2) expression from UVB light.¹⁰ Soybeans also have anti-inflammatory properties by decreasing the secretion of interleukin (IL)-6, IL-1, nitric oxide (NO), and prostaglandin E2.¹¹ The combination of soybean extract with other substances can enhance the positive effects of soybeans themselves, as in other experimental studies that used a mixture of soybean extract with *Haematococcus* extract and that used a mixture of soybean extract with collagen peptides. Both studies showed that the combination of substances with soy extract significantly increased MMP-1 inhibition.¹²⁻¹³

Several studies have proven that one of the important components contained in soybeans and acts as an antioxidant and anti-inflammatory is isoflavones so that by giving soybean extract can reduce Oxidative Stress Reaction (ROS) and has the potential to reduce the negative effects of the aging process and damage due to UVB exposure to the skin. Therefore, based on this background, this study aims to determine the effect of giving soybean extract cream (soybean) at doses of 10% and 20% on MMP-1 and IL-6 levels in mice BALB/c induced by UVB light.

II. MATERIAL AND METHOD

Study Design and Experimental Animals

This research is an *in vivo* experimental research with *Post Test Only Control Group Design*. The study subjects used 30 female BALB / C mice aged 6-8 weeks weighing between 18-35 grams that met the inclusion and inclusion criteria, adapted for 1 week. This study used 5 treatment groups, a control group of healthy rats (K1), a negative control group of mice only exposed to UV light (K2), a positive control group in which subjects were only smeared with a cream base and exposed to UV-B (K3) light, treatment group 1 was the subjects were smeared with 10% soybean extract cream and exposed to UV-B (K4) light, and treatment group 2 was the subjects were smeared with 20% soybean extract cream and exposed to UV-B (K5) light, On the 15th day, female mice BALB/C were taken skin tissue samples to check MMP1 levels and IL-6 levels.

Research Materials

The research materials consist of basic cream, Soybean extract cream with a dose of 10%; 20%, UV-B lamp type *Narrowband TL-F72-100W/12*, Radiation dose meter (Dosimetry), *Standard solution*, *Assay diluent A and B*, Wash buffer concentrate, *Substrate solution A and B*, *Stop solution*, and *Plate sealer*.

Research Equipment

This study used several equipment, including tools used to make soybean extract, namely sterile storage bins, sterile glass spoons, *vacuum dryers*, rotator evaporators, blenders, and erlemeyer flasks, tools used for the maintenance of experimental mice, namely cages with complete food and drink places, 26 needles, 1 cc syringes, shavers, gloves, fixation points, and analytical scales, tools used for making preparations, namely glass *objects*, cover glass, scalpel knives, tweezers, cutting boards, sieves, *tissue*, freezers (-20°C), microtome *machines*, 46°C waterbaths, *automatic processor machines*, *vacuum machines* and blocking machines, and tools used for ELISA, namely *assay plates*, single micropipettes, multiple micropipettes. incubator, eppendorf tube, vortex.

Cream Making

Ingredients in the oil phase ; stearic acid, triethanolamine, glycerin, potassium hydroxide and aquadest, weighed each ingredient then put soybean extract into a mortar and added tewwn to taste while stirring until homogeneous, then add basic cream M/A (vanishing cream), mix well then put the pot.

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UVB Irradiation Procedure

UV-B irradiation induces photoaging marked early by skin *erymatouse* in the exposed area and deeper wrinkles appear. Here are the steps: (1) Mice balb / c that have been adapted for 7 days. (2) Mice are anesthetized with a mixture of ketamine (60mg/kgbb) and xylazine (20mg/kgbb) intramuscularly as much as 0.5 ml. (3) The hair on the back is shaved with a size of 2 x 3 cm. (4) The back of mice is irradiated UV-B with a distance of 20 cm with a minimum erythema dose (1 MED 150mJ/cm²) for 8 minutes every 5x a week for 14 days. (5) Soybean extract is given at the same time every 10 am. (6) Mice balb/c ; The positive control group was then given topical treatment using a cream base, treatment groups 1 and 2 were given topically using soybean extract doses of 10% and 20% once a day for 14 days after UV-B irradiation.

Research Procedure

(1) Prepare 36 female mice of the BALB/C strain aged 6-8 weeks weighing 18-35 grams that have been adapted for 7 days (2) Shave the back of mice covering an area of 2x3 cm. (3) Shine the back of mice with UV-B light with a minimum dose of 1 MED with a distance of 20 cm for 8 minutes. (4) Give treatment to mice according to their group (each group of 6 mice), negative control: no treatment is given; Positive control: smeared cream base on shaved area, treatment 1: smeared 10% soybean extract cream, treatment 2: smeared 20% soybean extract cream, and (5) Repeat steps 5 times a week. (6) After the 14th day. Rest the mice. (7) Day 15, a biopsy is performed for further examination. (8) Check IL-6 and MMP-1 levels using ELISA. (9) Prepare reagents and solutions for ELISA. (10) Dilute the 120 μ L standard solution into the 120 μ L standard diluent. (11) Dilute 15 mL wash buffer concentrate into 300 mL distilled water (12) Add 50 μ L standard to each plate. (13) Add 40 μ L of sample to the plate. (14) Close the well using a sealer. (15) Incubation for 60 minutes at 37°C. (16) Open the sealer, wash the well 3 times with a wash buffer. (17) Add 50 μ L substrate solution A and 50 μ L substrate solution B to each well. (18) Incubation for 10 minutes at 37°C. (19) Add 50 μ L stop solution to each well. (20) Read absorbance results using ELISA Reader at 450 nm wavelength within 10 minutes after adding stop solution.

III. RESULT

Validasi MSCs

This study tested the effect of soybean extract cream on IL-6 and MMP-1 levels in 30 female Balb / c mice. Mice were first exposed to UVB light with a minimum dose of 1 MED with a distance of 20 cm for 8 minutes 5 x a week. Macroscopic observations were made to see wrinkles due to UVB exposure and based on observations it was seen that wrinkles were seen in mice exposed to UVB compared to those not exposed as shown in Figure 1. In addition, to strengthen validation, anatomical analysis was carried out using Masson Trichome staining to see the density of elastin due to UVB exposure. Based on previous research, elastin can be seen as a red image on the recording.⁵⁰ Based on the results of anatomical observations, it was found that there was a decrease in post-exposure elastin expression as shown in Figure 1.

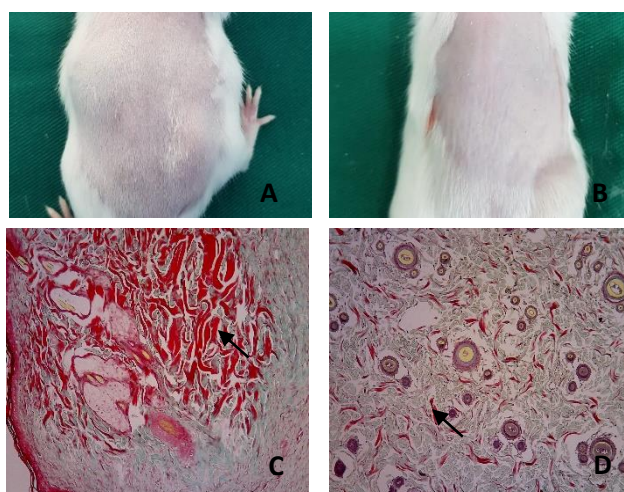


Figure 1. There are wrinkles in mice exposed to UVB (B) compared to those who are not exposed (A). Elastin shown in red (black arrow) was more prevalent in the group without UVB exposure (C), compared to the group with UV exposure (D)

The results of the IL-6 concentration analysis are shown in table 3. Based on the results of the analysis, it was found that the Healthy group (K1) had the lowest IL-6 concentration (135 \pm 37 ng/mL) which was then followed by K5 (242 \pm 54 ng/mL) and K4 (270 \pm 50 ng/mL), while the K2 group had the highest IL-6 concentration (661 \pm 90 ng/mL). Decreased IL-6 concentrations were found

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in both doses of soybean extract cream compared to the K2 group. The Shapiro Wilk test was used to evaluate the distribution of normality data in each group of IL-6 concentrations within each group. The results of the Shapiro Wilk test showed that the distribution of IL-6 concentration data in the five groups was normal ($P>0.05$). For all five groups, the homogeneity test of data variance with the Levene test showed that the P value was greater than 0.05.

Table 1. IL-6 Analysis Data

VARIABLE	Group					P
	K1 (ng/mL)	K2 (ng/mL)	K3 (ng/mL)	K4 (ng/mL)	K5 (ng/mL)	
	Average±S	Average±S	Average±S	Average±S	Average±S	
	D	D	D	D	D	
IL-6	135±37	661±90	615±121	270±50	242±54	
Shapiro wilk						>0.05
Lavene test						0,227
One Way Anova						0,000

Based on normal and homogeneous data, the One Way Anova parametric test was used to determine the difference in the average concentration of IL-6 among the five groups. Based on the results of the One Way Anova test, the resulting data differed significantly ($P<0.05$), which showed that there was a marked difference in IL-6 concentration data in at least two groups. Then to test the relationship between groups, a Post Hoc LSD test was carried out, and data were obtained as shown in table 2.

Table 2. Differences in mean IL-6 concentrations between the two groups with Post hoc LSD Test

	K1	K2	K3	K4	K5
K1	-	0,000	0,000	0,006	0,024
K2	0,000	-	0,319	0,000	0,000
K3	0,000	0,319	-	0,000	0,000
K4	0,006	0,000	0,000	-	0,535
K5	0,024	0,000	0,000	0,535	-

The results of the post hoc LSD test of IL-6 concentration obtained p values < 0.05 for all groups compared to the K1 group. The results of the analysis also found that soybean extracts of groups K4 and K5 were significantly different compared to K2 ($P<0.05$). In addition, K4 and K5 also differed significantly compared to the K3 group ($P<0.05$). The data also showed that there was no difference between the K4 and K5 groups ($P>0.05$). The pattern of decline shown is dose dependent manner where the highest dose results in a significant decrease in IL-6 concentration as shown by Figure 2.

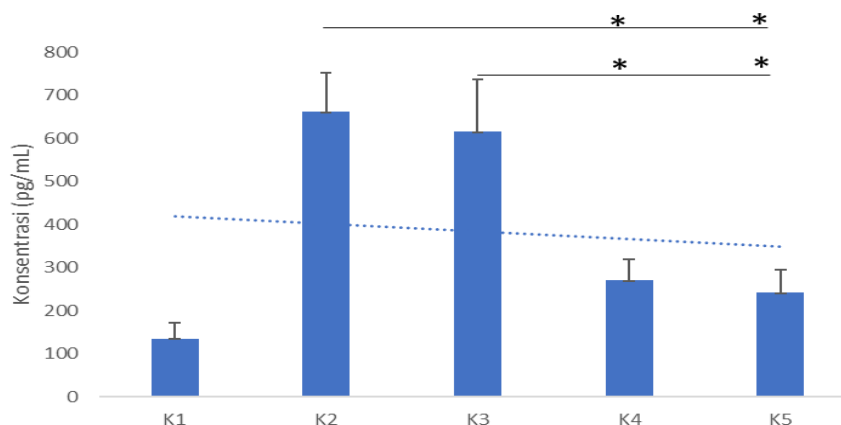


Figure 2. Graph of IL-6 concentration after soybean extract cream on mice exposed to UVB

Matrix Metalloproteinnase-1

The results of the MMP-1 concentration analysis are shown in table 3. The K2 group had the highest MMP-1 concentration (6488 ± 895), while the group with the lowest MMP-1 concentration was the Healthy group (K1) (3518±552 pg/mL) which was then

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followed by the K5 group (5398±436 pg/mL). Both applications of soybean extract cream showed a decreased concentration of MMP-1. Since the MMP-1 concentration in each group is ratio data and the number of samples is not more than 50, the Shapiro Wilk test is also used to analyze the distribution of normality data. The results of the Shapiro Wilk test showed that the p value in the five groups was greater than 0.05, so the distribution of MMP-1 concentration data in the five groups was normal. The results of the homogeneity test of data variants between the five groups with the Levene test resulted in a p value of 0.497 ($p > 0.05$) indicating that the variance of MMP-1 concentration data between groups was homogeneous. indicates that the variance of MMP-1 concentration data between groups is homogeneous.

Table 3. MMP1 Content Analysis Data

VARIABLE	Group					P
	K1	K2	K3	K4	K5	
	Average±S D	Average±S D	Average±S D	Average±S D	Average±S D	
MMP-1	3518±552	6488±895	6484±746	6093±440	5398±436	
Shapiro wilk						>0.05
Lavene test						0,518
One Way Anova						0,000

Based on normal and homogeneous data, the One Way Anova parametric test was used to determine the difference in the average MMP-1 concentration among the five groups. Based on the results of the One Way Anova test which yielded a P of 0.000, it showed that there was a significant difference in MMP-1 concentrations in at least two groups. The following Post hoc LSD test results showed significant differences in MMP-1 concentrations between the two groups. Post hoc LSD tests were performed to show differences in MMP-1 concentrations between the two groups and the results are shown in Table 4.

Table 4. Differences in mean MMP-1 concentrations between the two groups with Post hoc LSD Test

	K1	K2	K3	K4	K5
K1	-	0,000	0,000	0,000	0,000
K2	0,000	-	0,990	0,295	0,007
K3	0,000	0,990	-	0,301	0,007
K4	0,000	0,295	0,301	-	0,072
K5	0,000	0,007	0,007	0,072	-

The results of the post hoc LSD test of MMP-1 concentration obtained a p value of < 0.05 for all groups compared to the Healthy group. The results of the analysis also found that only the K5 group was significantly different compared to K2 ($P < 0.05$). The pattern of decline shown is dose dependent manner where the highest dose results in a significant decrease in MMP-1 concentration as seen in Figure 3.

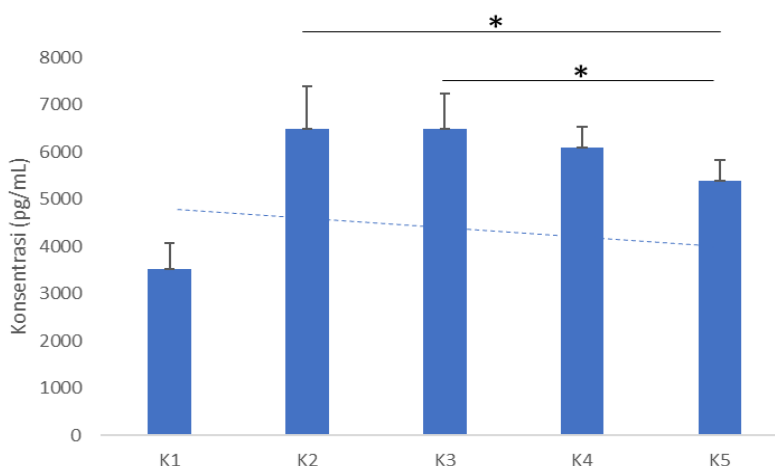


Figure 3. Graph of MMP-1 concentration after administration of soy cream extract in mice exposed to UVB

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IV. DISCUSSION

The photoaging process involves a series of complex changes in the skin in response to UV exposure.^{53,54} UV exposure to skin areas can cause damage to DNA that increases the formation of *reactive oxygen species* (ROS) compounds thereby increasing oxidative stress.⁵⁵ The formation of ROS leads to the activation of NF- κ B local immune cells that cause inflammation characterized by an increase in pro-inflammatory cytokines such as IL-6 in the skin area.^{56,57}

The inflammation that triggers production by IL-6 can cause it to attract other immune cells such as neutrophils and also monocyte cells to come to the UVB-exposed area.^{57,58} These immune cells produce various lytic molecules, including MMP-1 in skin tissue and become the main driving factor in the degradation process of the extracellular matrix (MES) thus triggering the development of *photoaging*.^{57,59}

The active compound contained in soybeans, namely genistein, can inhibit the inflammatory response pathway through regulating ROS balance.⁶⁰⁻⁶² Genistein has been shown to reduce ROS and inhibit the production of inflammatory cytokines, including IL-6.^{63,64} In addition, one of the main mechanisms of genistein in reducing inflammation is through inhibition of the NF- κ B pathway, which is a transcription factor to regulate the expression of genes involved in the inflammatory response. Genistein can inhibit NF- κ B activation and block the transfer of this factor to the nucleus, thereby reducing the production of pro-inflammatory cytokines, including IL-6.⁶⁵⁻⁶⁷

According to previous research, one of the other active compounds contained in soybeans, namely isoflavones, has an important role in regulating the activity of Mitogen-Activated Protein Kinase (MAPK), which is a series of signaling pathways consisting of ERK1/2 (Extracellular Signal-Regulated Kinase 1/2), JNK (c-Jun N-terminal Kinase), and p38.⁶⁸ Each of these MAPK pathways is involved in a variety of cellular functions, including proliferation, differentiation, and response to stress or inflammation.

Isoflavones have been shown to inhibit MAPK activation, including ERK1/2, JNK, and p38 by inhibiting phosphorylation or ERK1/2 activation, which is a key step in the signaling pathway that regulates MMP-1 gene expression.⁶⁸ By inhibiting the MAPK pathway, isoflavones can indirectly reduce the expression of the MMP-1 gene so as to reduce damage to the extracellular matrix that leads to inhibition of photoaging.

Based on the results of research that has been done, it can be concluded that soybean extract cream can play a role in reducing IL-6 and MMP-1 concentrations through inhibition of MAPK pathways, free radicals, and inflammatory pathways. However, this study only looked at the effect of soybean peel extract on IL-6 and MMP-1 without examining pathways that regulate both proteins such as MAPK or NF- κ B. This has led to the inability to uncover the mechanisms behind IL-6 and MMP-1 inhibition. In addition, this study used whole extracts that cause unknown active molecules such as daidzein, and genistein which play a role in the inhibition of IL-6 and MMP-1. These things become limitations of this study which should be the basis for future research.

V. CONCLUSION

1. There is an effect of soybean extract cream (Glycine Max) on reducing the concentration of IL-6 and MMP-1 in bentina mice BALB/c exposed to UV-B.
2. There was a difference in IL-6 concentrations in the K4 and K5 groups given soybean extract cream at doses of 10% and 20% compared to the control group.
3. There was a difference in the amount of expression of Matrix Metalloproteinase-1 in the K5 group given soybean extract cream at a dose of 20% compared to the control group.

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REFERENCES

- 1) Sharma MR, Werth B, Werth VP. Animal models of acute photodamage: Comparisons of anatomic, cellular and molecular responses in C57BL/6J, SKH1 and Balb/c mice. *Photochem Photobiol*. Published online 2011. doi:10.1111/j.1751-1097.2011.00911.x
- 2) Kim DJ, Iwasaki A, Chien AL, Kang S. UVB-mediated DNA damage induces matrix metalloproteinases to promote photoaging in an AhR- and SP1-dependent manner. *JCI Insight*. Published online 2022. doi:10.1172/jci.insight.156344
- 3) Morgan MJ, Liu ZG. Crosstalk of reactive oxygen species and NF- κ B signaling. *Cell Res*. Published online 2011. doi:10.1038/cr.2010.178
- 4) Ansary TM, Hossain MR, Kamiya K, Komine M, Ohtsuki M. Inflammatory molecules associated with ultraviolet radiation-mediated skin aging. *Int J Mol Sci*. 2021;22(8). doi:10.3390/ijms22083974

Effect of Soybean Extract Cream on Matrix Metalloproteinase-1 (MMP-1) and Interleukin-6 (IL-6) Levels (In Vivo Experimental Study on UVB-Induced Balb/c Mice)

- 5) C. S, T.H. T, N. A, D. L. Ultraviolet-b induced plasmacytoid dendritic cell migration and type 1 interferon signaling in the skin. *Arthritis Rheum*. Published online 2013.
- 6) Clydesdale GJ, Dandie GW, Muller HK. Ultraviolet light induced injury: Immunological and inflammatory effects. *Immunol Cell Biol*. Published online 2001. doi:10.1046/j.1440-1711.2001.01047.x
- 7) Pang D, Yang C, Luo Q, et al. Soy isoflavones improve the oxidative stress induced hypothalamic inflammation and apoptosis in high fat diet-induced obese male mice through PGC1-alpha pathway. *Aging (Albany NY)*. Published online 2020. doi:10.18632/aging.103197
- 8) Vera M, Torramade-Moix S, Martin-Rodriguez S, et al. Antioxidant and anti-inflammatory strategies based on the potentiation of glutathione peroxidase activity prevent endothelial dysfunction in chronic kidney disease. *Cell Physiol Biochem*. Published online 2018. doi:10.1159/000495540
- 9) Kim IS. Current perspectives on the beneficial effects of soybean isoflavones and their metabolites for humans. *Antioxidants*. Published online 2021. doi:10.3390/antiox10071064
- 10) Goh YX, Jalil J, Lam KW, Husain K, Premakumar CM. Genistein: A Review on its Anti-Inflammatory Properties. *Front Pharmacol*. Published online 2022. doi:10.3389/fphar.2022.820969
- 11) Miao ZY, Xia X, Che L, Song YT. Genistein attenuates brain damage induced by transient cerebral ischemia through up-regulation of Nrf2 expression in ovariectomized rats. *Neurol Res*. Published online 2018. doi:10.1080/01616412.2018.1462879
- 12) Sharma S, Malhotra L, Yadav P, Mishra V, Sharma RS, Abdul Samath E. Genistein: A novel inhibitor of IL-6/IL-6R interface of the Interleukin-6-mediated STAT3 dependent pathway of carcinogenesis. *J Mol Struct*. Published online 2022. doi:10.1016/j.molstruc.2022.132668
- 13) Cheng WX, Huang H, Chen JH, et al. Genistein inhibits angiogenesis developed during rheumatoid arthritis through the IL-6/JAK2/STAT3/VEGF signalling pathway. *J Orthop Transl*. Published online 2020. doi:10.1016/j.jot.2019.07.007
- 14) Liu X, Liu K, Qin J, et al. C/EBP β promotes angiogenesis through secretion of IL-6, which is inhibited by genistein, in EGFRVIII-positive glioblastoma. *Int J Cancer*. Published online 2015. doi:10.1002/ijc.29319
- 15) Lim TG, Kim JE, Lee SY, et al. The daidzein metabolite, 6,7,4'-Trihydroxyisoflavone, is a novel inhibitor of PKC α in suppressing solar UV-induced matrix metalloproteinase 1. *Int J Mol Sci*. Published online 2014. doi:10.3390/ijms151121419



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Strategies for Facing Implementation Challenges Independent Learning Curriculum in Subjects Physical Education, Sports and Health in SMAN6 Yogyakarta



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ABSTRACT

Background: This research aims to present the results of an analysis of the strategies used to face the challenges of implementing the independent learning curriculum in Physical Education, Sports and Health subjects in Senior High Schools.

Objective: The data collection technique used in this research was direct observation and in-depth interviews with PJOK teachers and class X students at SMA Negeri 6 Yogyakarta. The research instrument used was the researcher himself, supported by smartphone tools, field notes, interview grids, interview notes and writing tools.

Method: Data analysis used used data reduction analysis with categorization and comparison. The validity of the data is obtained through triangulation. The results of this research include (i) Teacher strategies for involving technology in PJOK learning, namely by participating in teacher training, implementing learning models, implementing them in the learning process, using them in learning evaluation activities. (ii) The teacher's strategy for making PJOK meaningful in lifelong learning in this research is organizing study groups that focus on attitude and effective learning on P5 values.

Results: The results of this research show that teachers found strategies that were used to face new challenges in implementation. independent learning curriculum at senior high school level. The learning strategies packaged by PJOK teachers to face these challenges have resulted in a wider variety of learning activities.

KEYWORDS: independent learning, teacher strategies, motivation, implementation, technology

INTRODUCTION

Structuring the education system, including improving the curriculum, needs to be implemented well in order to optimize the quality of education. According to Firdausiyah & Akhmadi, (2021) stated that "Curriculum is a forum that will determine the direction of education. The success or failure of an education really depends on the curriculum used. The curriculum is the spearhead for the implementation of educational activities. Without a curriculum, it is impossible for education to run well, effectively and efficiently as expected. Therefore, it is very necessary to pay attention to the curriculum in each educational unit." This statement states that the success of an education is largely determined by the curriculum used. A good curriculum will guide education in a better direction.

Changes and improvements to the curriculum are adjusted to the situation and conditions of society at the time the curriculum was developed. According to Nugraha, (2022) that "These changes are a logical consequence of changes in the political, socio-cultural, economic and science and technology systems in national and state society". The curriculum itself as a set of educational plans needs to be developed dynamically in accordance with the demands and changes that occur in society as a concept that must be able to answer all the challenges that exist where the curriculum is applied. The newest curriculum used in Indonesia is the independent curriculum.

Curriculum development cannot be separated from the meaning itself, therefore, curriculum can be interpreted as a learning plan and a plan regarding the learning experiences of students in an educational institution which is very useful in curriculum development. Improving the independent learning curriculum is important to develop an independent curriculum as a functional basis for learning by considering the conditions of students, teachers and schools in each school unit. The Independent Curriculum is the government's effort to implement or renew learning with the Independent Curriculum (Resti Fauziah et al., 2023.)

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The independent curriculum is a curriculum that was developed as a more flexible curriculum framework, as well as developing the character and competence of students. This independent curriculum also focuses on essential material. The main characteristics of this that support learning recovery mentioned by (Kemendikbud Ristek, 2022), namely (1) project-based learning for developing soft skills and character according to the Pancasila student profile, (2) material that focuses on essential material so that, there is sufficient time for in-depth learning for basic competencies, (3) flexibility for teachers to carry out differentiated learning according to students' abilities and make adjustments to local context and content.

Research conducted by Engel Hehakaya and Delvyn Pollatu (2022) with the title "Teacher Problems in Implementing the Independent Curriculum". This article aims to describe the problems of teachers in implementing the independent curriculum in schools. The research results show that teachers face significant challenges and obstacles in implementing the Independent Curriculum in the planning, classroom implementation and evaluation stages. This research also looks for solutions or steps that can be taken to overcome the problems of implementing the Independent Curriculum in Elementary Schools and ensure that the objectives of the Independent Curriculum can be achieved well. One effort to deal with these obstacles is to provide training and assistance to teachers. research conducted by Sehat Sinulingga (2022) with the article title "Challenges of Implementing the Independent Curriculum Facing the Challenges of Technological Development in the Era of Industrial Revolution 4.0". This article tries to analyze the effectiveness of implementing the independent curriculum to deal with technological developments in the era of industrial revolution 4.0. The research results of this article state that the challenges of implementing an independent curriculum in the face of technological developments in the era of the industrial revolution 4.0 are more related to the implementation of learning, including the demands and continuous improvement of teacher competence, demands for the availability of adequate facilities and infrastructure and demands for the independence of educational institutions.

Wang et al. (2021) states that the curriculum has several meanings, namely: 1) as a teaching plan, 2) as a student learning plan, 3) as a learning plan obtained by students from school or madrasah. In Government Regulation Number 19 of 2005 concerning national education standards, the curriculum is a set of plans and arrangements regarding objectives, content and learning materials as well as methods used as guidelines for implementing learning activities to achieve certain educational goals.

The independent learning curriculum is a curriculum concept that requires students to have independence. The independence referred to is that each student is given the freedom to access the knowledge obtained from formal and non-formal education. As stated by Surbakti et al. (2022) that each student has expertise in their respective fields, so students are free to search for or choose any field they like. In the independent learning curriculum, students are given the opportunity to develop their potential. The curriculum also integrates literacy, intellectual skills, skills and attitudes to use technology. Students are free to think and learn from any source, with the aim of being able to seek knowledge and solve the practical problems they face.

The next obstacle felt by PJOK teachers in an interview with PJOK teachers at SMAN 6 Yogyakarta was due to insufficient use of the latest references. This statement was explained by PJOK teachers that during learning activities, one of the learning resources that is often used is the use of textbooks and worksheets, students usually will reading these books as teaching materials when it comes to theory, it is not uncommon for students to simply read, but not necessarily understand, when bringing theory to practice in the field, students also encounter difficulties. Students also have not fully developed their learning process because they still depend on the teacher's direction and also just read from books. The next problem encountered by researchers in interviews with PJOK teachers at SMAN 6 Yogyakarta is the limited time management of teachers in efforts to transform the learning process. Teachers need more time to study so they can adapt to the demands of expected changes. Sometimes schools set quite busy agendas because these schools are driving schools and research schools, so involving teachers to actively participate in various activities, of course this issue also needs to be considered in the PJOK learning process. PJOK learning is different from other subjects, because every practice contained in PJOK subjects requires special attention from the security and safety aspects, so special strategies are needed in packaging learning so that it is effective. It can be understood that PJOK teachers have a very important role in the success of the learning process, especially PJOK subjects and are able to adapt to situations such as changing the curriculum to implementing the independent learning curriculum. The development of education is greatly influenced by the awareness of all elements of the school community to work together to realize the quality of learning and education that has long been aspired to.

METHOD

This research is descriptive research with a qualitative research approach. Qualitative research methods are also known as naturalistic methods because they were initially more commonly used for research in the field of cultural anthropology Sugiyono (2021, p. 8). It is called a qualitative method because the data they collect and analyze is more qualitative in nature. The research used is a qualitative research method or case study approach. This research focuses intensively on one particular object studying it

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as a case. The design of this research is phenomenon description research where the researcher observes various existing problems and then explains the phenomenon so that it can be better understood (Ariesanti et al., 2023). Case study data can be obtained from all parties concerned, in other words, this study was collected from various sources (Gunawan, 2022). Case study research will lack depth if it only focuses on a certain phase or one particular aspect before obtaining a general picture of the case.

The main data source in this qualitative research is the results of interviews with previously determined respondents. The respondents referred to here are 3 PJOK teachers and a sample of 36 class X students from a total of 288 class XE students at SMA Negeri 6 Yogyakarta. Researchers also used additional data sources as support, namely using the Independent Learning Curriculum document issued by the Ministry of Education, Culture, Research and Technology, as well as a guidebook or guide for implementing the Independent Learning Curriculum in Physical Education, Sports and Health subjects. Apart from that, school guidelines and policies regarding the implementation of the Independent Learning Curriculum in these subjects at SMA Negeri 6 Yogyakarta and other supporting data in the form of documentation in the form of photos of students' activities and portfolios. Data analysis techniques are methods used by researchers when processing data into a series of information to make it easier to understand and make it easier for researchers to interpret the data. According to Sugiyono (2016:244) data analysis is an effort to systematically search for and compile data obtained from interviews, field notes and documentation, so that the data can be easily understood by oneself and others. In general, data analysis is a search for patterns in behavioral data that emerge, objects related to the focus of the research.

DISCUSSION

In this discussion the researcher will present a description of the discussion according to the researcher's findings, so that this discussion will integrate existing findings and at the same time modify them with existing theory. The findings of this research are a description of data obtained in the field through observation, interviews and documentation that are identified to be in accordance with the expected objectives, the results will be linked to existing theory. 1. Teacher Strategy in Seeing Technology in PJOK Learning Based on the Merdeka Learning Curriculum for Class Learning strategies according to (Sri, nd 2019) can be used to achieve various goals of providing learning material at various levels, for different students, in different contexts. Learning strategies in the 2013 curriculum, which was the previous curriculum before the independent learning curriculum as it is currently, there are 5 types of learning strategies that can be carried out by teachers: a. Discovery Learning (DL) Strategy or Uncovering Learning b. Inquiry Learning (IL) Strategy or Learning Investigation c. Problem Based Learning (PBL) strategy or problem-based learning d. Project Based Learning (PjBL) strategy or project-based learning e. Scientific Learning (SL) Strategy or Scientific Learning.

The use of these learning strategies can be used in accordance with the conditions that will be carried out by PJOK teachers by changing the old curriculum to a new curriculum, namely the independent learning curriculum, where this curriculum is expected to be very pro-student, the teacher rearranges and chooses what learning strategies are appropriate to use for The needs of students in today's developments, especially learning strategies in the implementation of the independent learning curriculum. Therefore, with the change in the curriculum from the previous one to the independent learning curriculum, it is hoped that it will be perfected by being able to utilize the learning strategies contained in curriculum 13 adapted to the needs of the independent learning curriculum which is pro-student. Not only that, these strategies are expected to be able to meet educational needs. current era.

CONCLUSION

Based on the results of the research and discussion above, it can be concluded that strategy is very influential in facing the challenges of implementing the independent learning curriculum in PJOK subjects, especially in the use of technology in learning, the meaningfulness of PJOK in lifelong learning, and increasing students' learning motivation. : 1. The teacher's strategy in using technology in PJOK learning is by selecting learning strategies that suit needs and is also a strategy for implementing technology as is often used, namely the PjBL learning strategy, where this learning strategy uses audio-visual technology such as videos on YouTube and uses various kinds. applications such as Google Drive, Quizizz, Kahoot, WA groups and the like where the choice of platform is adjusted to the learning strategy used. Also, the teacher's learning strategy is centered on students so that students can participate in learning and can explore their knowledge widely and enable students to think creatively. The use of educational technology begins with planning and work meetings for an understanding in determining how important it is to use technology in PJOK learning based on the independent learning curriculum. 2. The teacher's strategy for making PJOK meaningful in lifelong learning is to make learning PJOK fun, safe and comfortable so that it can motivate students to learn and develop in the field of PJOK and be able to apply it in everyday life. In supporting the learning process, PJOK teachers make learning implementation plans (RPP) according to the situation, conditions and materials to be implemented, create and prepare teaching materials and monitoring

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and evaluation guides according to competency achievement indicators, apply varied learning so that students do not get bored. 3. The strategy implemented by teachers in increasing motivation to learn PJOK subjects at SMA Negeri 6 Yogyakarta is by providing an understanding of the importance of PJOK in everyday life, providing rewards for students who are active in learning, punishment or penalties for students who violate the rules of the game learn PJOK, use interesting media when learning and make learning PJOK a motivating lesson in terms of career.

The results of this research are about teacher strategies, so it is necessary for educators to improve their quality so that learning becomes more creative and effective. Apart from that, when learning is packaged with the right strategy, optimal learning outcomes can be achieved. With the independent learning curriculum, it is hoped that PJOK teachers will be able to continue to develop creative, innovative and effective learning in terms of PJOK material literature and learning media that are packaged even more attractively. The research conducted by researchers proves the theory that PJOK teacher strategies in learning have a positive relationship with learning activities so that they run well. The PJOK teacher strategy has a big function and role in improving the smoothness of learning activities. Based on the facts in the field as a whole, the teacher's strategy in facing the challenges of implementing the independent learning curriculum is positive. This can be seen from the results of interviews and observations which state positive PJOK learning outcomes for students. In PJOK learning, to increase students' learning motivation, strategies are needed in providing learning and selecting materials and learning support tools that are as interesting and varied as possible so that students are more enthusiastic and enthusiastic in participating in learning. Therefore, teachers are required to have a variety of creativity. In this research, it was proven that PJOK teachers at SMA N 6 Yogyakarta have good strategies to support the success of PJOK learning by utilizing various applications to convey material so that it is easily accepted by students.

The results of the research can be an illustration of the strategies used by teachers in using technology, the significance of PJOK in lifelong learning, and students' learning motivation in PJOK subjects. Apart from that, it is hoped that the results of this research can be a direction for teachers and students to always have good character, especially students towards teachers during learning so that they always respect and pay attention to explanations, and be orderly when carrying out the tasks given by the teacher as a form of citizen. both implemented in everyday life as social control in facing the era of globalization.

REFERENCES

- 1) A., ... Sumarsih, MP (2022). Teacher Education and Educational Sciences. Indonesian Science Media.
- 2) Firdausiyah, A., & Akhmadi, A. (2021). The Urgency of Curriculum Principles and Factors in Achieving Educational Success (Curriculum Implementation Analysis Study 2013). *Islamic Academics*, 3(2), 63-75.
- 3) Gunawan, I. (2022). *Qualitative Research Methods: Theory and Practice*. Literary Earth.
- 4) Ministry of Education and Culture. (2022). *Implementation of the Independent Curriculum*. <https://kurikulum.gtk.kemdikbud.go.id/>
- 5) Nugroho, T., & Narawaty, D. (2022). 2013 Curriculum, Emergency Curriculum, and Prototype Curriculum (2020-2021) or Merdeka Curriculum (2022) for English Language Subjects: A Comparative Study. *Sinistra: Proceedings of the National Seminar on Language, Arts, and Literature*, 1, 373–382
- 6) Sri, A. (ND). Learning strategies. <https://doi.org/10.33477/Bs.V2i2.376>
- 7) Subakti, H., Zakaria, MP, Muslikhah, RI, Sayekti, SP, Ismail, JK, Badi'ah,
- 8) Sugiyono. (2016). *Educational Research Methods: Quantitative, Qualitative and R&D Approaches*. Alphabeta Publishers
- 9) Wang, X., Chen, Y., & Zhu, W. (2021). A Survey On Curriculum Learning. *IEEE Transactions On Pattern Analysis And Machine Intelligence*, 44(9), 4555– 4576.



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Effect of Petai Bark Extract Gel on *Tyrosinase* and *TRP1* Gene Expression (In *Vivo* Experimental Study on Hyperpigmented Wistar Mice Exposed to UVB Model)



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ABSTRACT: UVB irradiation can induce the formation of Reactive Oxygen Species (ROS) which causes activation of melanin synthesis through activation of tyrosinase and tyrosinase related protein-1 (TRP1). Secondary metabolites contained in petai peel extract are known to play a role in inhibiting ROS production due to exposure to UVB rays. This study aims to determine the effect of administering petai peel extract gel on the expression of the tyrosinase and TRP1 genes in mouse skin tissue exposed to UVB. The research design was posttest only control group with a completely randomized design method. The samples studied were 24 mice exposed to UVB light with a wavelength of 302 nm and an energy of 390mJ/cm²/day 3 times a week for 2 weeks. This research was carried out in four groups, namely the healthy group (K1), the negative control group (K2), treatment 1 (K3) with 10% petai peel extract gel and treatment 2 (K4) with 20% petai peel extract gel. Tyrosinase and TRP1 gene expression was analyzed using qRT-PCR. qRT-PCR analysis showed that there was a significant decrease in tyrosinase and TRP1 gene expression between groups K3 (tyrosinase 3,19±2,12 and TRP1 4,96±3,42) and K4 (tyrosinase 0,65±0,44 and TRP1 2,22±1,18) compared to group K2 (tyrosinase 17,92±3,77 and TRP1 35,91±4,52). Administration of petai peel extract gel can reduce the expression of tyrosinase and TRP1 genes in hyperpigmentation mice exposed to UVB light.

KEYWORDS: UVB exposure, petai peel extract, tyrosinase, TRP1

I. INTRODUCTION

Hyperpigmentation is the formation of black pigment on the skin due to an increase in the amount of melanin caused by exposure to ultraviolet B (UVB) rays.¹ UVB radiation can stimulate melanin production in skin cells, especially melanoocytes, which are responsible for causing black color to the skin.² *Tyrosinase* and *tyrosinase-related protein 1 (TRP-1)* are enzymes involved in melanin biosynthesis.³ *Tyrosinase* plays a role in the early stages of melanin synthesis, while *TRP1* is involved in the maturation and spread stages of melanin.⁴ Excessive expression of these two enzymes can lead to excessive melanin production, thus contributing to hyperpigmentation.⁵ Some standard hyperpigmentation therapies such as retinol, hydroquinone, and tranexamic acid cause cancer in long-term use.⁶ Therefore, a safe and effective therapeutic approach is needed to prevent hyperpigmentation due to UVB exposure, one of which is using natural antioxidant compounds.

The use of some chemical agents such as arbutin, azelaic acid, kojic acid, and hydroquinone in the prevention of hyperpigmentation is reported to have adverse side effects, including genotoxicity, skin irritation, contact dermatitis, and an increased risk of skin cancer.⁷ In 2015, approximately 4.2% of 142 subjects exposed to three times the minimum erythema dose (MED) UVB 390mJ/cm² experienced hyperpigmentation.⁸ In Indonesia, cases of hyperpigmentation account for about 0.25-4% of all cases of skin diseases.^{9,10} Standard treatment of skin hyperpigmentation focuses on physical and chemical protection against UVB exposure without affecting melanin production pathways such as *tyrosinase* and *TRP1*.⁷

The use of natural antioxidants is proven to inhibit melanin synthesis and prevent hyperpigmentation.¹¹ One of the natural antioxidants is *Parkia speciosa* extract known as petai or bitter bean. *Parkia speciosa* bark contains bioactive compounds such as flavonoids and tannins, which have been shown to have antioxidant and anti-inflammatory activity.^{12,13} Petai skin polyphenolic compounds such as *cinnamic acid*, *isoferulic acid*, *caffeic acid*, and *ferulic acid* have antioxidant activity by inhibiting melanocyte degradation so that hypermelanogenesis does not occur.^{13,14} Previous research reported that antioxidant compounds can inhibit

Effect of Petai Bark Extract Gel on Tyrosinase and TRP1 Gene Expression (In Vivo Experimental Study on Hyperpigmented Wistar Mice Exposed to UVB Model)

the expression of *tyrosinase* and *TRP1* in melanocyte cells so that excessive melanin production does not occur.¹⁵ However, no studies have examined the effect of petai peel extract on *tyrosinase* and *TRP1* gene expression in models of hyperpigmentation due to UVB exposure.

Previous research has shown that administering extracts containing flavonoids and polyphenols either through topical application or oral administration can reduce free radical levels¹⁶, which has the potential to prove the effect of petai peel extract on *tyrosinase* and *TRP1* gene expression in the skin of hyperpigmented mice due to UVB exposure. Based on this information, the purpose of this study was to evaluate the effect of petai peel extract on *tyrosinase* and *TRP1* gene expression in wistar strain rats that experienced UVB-induced hyperpigmentation.

II. MATERIAL AND METHOD

Study Design and Experimental Animals

This research is an *in vivo* experimental research with *Post Test Only Control Group Design*. The study subjects used 24 male rats of wistar strains aged 2-3 months with a body weight of 200-250 grams according to the criteria of inclusion and inclusion, adapted for 1 week. This study used 4 with the following details: 2 treatment and intervention groups, 1 treatment group that did not get intervention (control) and 1 group of healthy mice. Data measurement was carried out after the intervention. On the 15th day, female mice BALB/C were taken skin tissue samples to check MMP1 levels and IL-6 levels.

Research Materials

The materials used in this study consisted of materials for treatment such as water base gel, ketamine, xylazine, ethanol, aquades, rat feed, and chloroform.

Research Equipment

This research uses several equipment to make animal models including UV light (broadband with a peak emission of 302 nm) with an energy of 390 mJ/cm², razors, exposure cages, maintenance cages, drinking water for rats and hair cutters. The tools used for data collection are vacutainer, hematocrit tube, 5 mL pot, 6 mm biopsy punch, centrifuge, micropipette, 1000 uL micropipette tip, and 1.5 mL vial tube. Tools used for data analysis include microplate readers, microscopes, *staining jars*, *coated desk glass*, *cover glass*, and laptops.

How to Make Petai Skin Extract

The peel of ±500 grams petai is cut into small pieces, dried at 50 – 60 ° C and mashed into a dry powder. Then the dry powder is extracted through a maceration process using 70% ethanol for 72 hours then filtered and the filtrate is accommodated, the residue then macerated again by the same method. The ethanol content is evaporated using a *rotary evaporator* to obtain a viscous extract. The extract content was validated by qualitatively measuring secondary metabolite compounds by drip reactions, namely the measurement of flavonoids, alkaloids, terpenoids, tannins, saponins, and steroids. The viscous extract obtained is then stored at 2-8°C.

Alkaloid Content Check

Examination of alkaloid content using Wagner examination. Here is the procedure for Wagner's examination: **(1)** An extra 3 mL of petai skin is placed in a porcelain dish. **(2)** Added 5 mL HCl 2 M. **(3)** Stirred and cooled at room temperature. **(4)** Added 0.5 g NaCl then stirred and filtered. **(5)** The filtrate obtained is added HCl 2 M as much as 3 drops. **(6)** Filtrate plus Wagner reagent. **(7)** The formation of precipitate indicates the presence of alkaloid content.

Standard Curve Making of Quercetin

Method for determining the total content of flavonoids by creating a standard calibration curve of quercetin. Procedure for making quercetin solution: **(1)** Variation of quercetin solution concentration of 5, 10, 15, 20 and 25 mg/L. **(2)** Each solution is taken as much as 2 mL **(3)** Added 0.1 mL AlCl₃ 10% and 0.1 mL CH₃COONa 1 M. **(4)** The mixture is allowed to stand at room temperature for 30 minutes. **(5)** A maximum wavelength measurement is made at one of the concentrations. **(6)** The maximum wavelength measurement result is used to measure the absorbance of each fraction.

Determination of Total Flavonoids of Petai Skin Extract

The determination of total flavonoids in petai bark extract was: **(1)** Each fraction weighed 0.06 g and dissolved in 10 mL of methanol. **(2)** The solution is taken as much as 2 mL then added 0.1 mL AlCl₃ 10% and 0.1 mL CH₃COONa 1 M. **(3)** The mixture is allowed to stand for 30 minutes at room temperature. **(4)** Absorbance was measured at a wavelength of 433 nm using a UV-Vis spectrophotometer. **(5)** The results of this wavelength measurement are then compared with the quercetin standard curve.

Effect of Petai Bark Extract Gel on Tyrosinase and TRP1 Gene Expression (In Vivo Experimental Study on Hyperpigmented Wistar Mice Exposed to UVB Model)

Quantitative Analysis of Tyrosinase and TRP1 gene expression using RT-PCR

(1) RNA extraction and cDNA synthesis⁵⁸ RNA isolation of skin tissue is carried out using the reagent TRIzol[®], (Invitrogen Life Technologies) and cDNA manufacturing using iScript cDNA Synthesis Kit (Bio-Rad iScript gDNA Clear cDNA synthesis Kit Catalog) using Reverse Transcriptase PCR (RT-PCR) thermal cyclers C1000 (Bio-Rad)

(2) Determination of tyrosinase and TRP1 amplified gene expression using PCR-RFLP technique, using PCR 2x PCR Master mix solution (iNtRON[®], catalog number 25027) in a 0.2 mL vial tube with a total volume of 50 uL for 1 sample. PCR was performed using the thermal cycle of DNA: Applied Veriti Biosystems.

Table 1. PCR Mix Components

Component	Kind	Sequences
Primer	Forward Tyrosinase	5'- AATCGCTTAGGTAAGAA-3'
	Reverse Tyrosinase	5'- GTTGCTGAGGTATCGCCAGGAA-3'
Primer	Forward TRP1	5'-GCTTAAATTGCCAATTGAATA-3'
	Reverse TRP1	5'-AGGGAGGGGACTTATCTG-3'
Reagent	Trizol Reagen	
RNA transcribed	High Capacity cDNA Reverse Transcription	
cDNA	SYBR Green	

(3) The calculation of tyrosinase and TRP1 gene expression is calculated in a ratio value compared to the house keeping expression of the GAPDH gene so that the unit of calculation is the ratio of mRNA gene expression level to house keeping gene expression.

III. RESULT

Hyperpigmentation Model Validation

In this study using a hyperpigmentation model. Animal models induced hyperpigmentation with 302 nm UVB irradiation with an energy intensity of 390mJ/cm² for three times a week for two weeks. Validation of hyperpigmentation was observed at day 14 in one healthy mouse and one negative control mouse (K2). In Fontana masson staining shows that there is a significant increase in melanin production which is indicated by brown pigment in the epidermis (melanocyte cells). In the group given UVB irradiation (negative control) the amount of melanin increased to 46.5% (Figure 1).

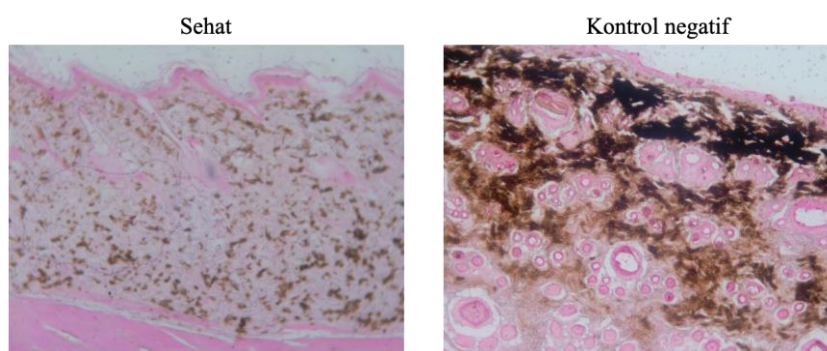


Figure 1. Validation of hyperpigmentation by masson fontana staining (A) Healthy mice and (B) UVB irradiated mice. 100x magnification

Effects of 10% and 20% Doses of Petai Skin Extract Gel on Tyrosinase Gene Expression

In this study, researchers found that petai bark extract gel was able to reduce tyrosinase and TRP1 gene expression in hyperpigmentation mice significantly dose-dependent models (Table 1; Figure 2).

Effect of Petai Bark Extract Gel on Tyrosinase and TRP1 Gene Expression (In Vivo Experimental Study on Hyperpigmented Wistar Mice Exposed to UVB Model)

Table 1. Tyrosinase and TRP1 Gene Expression Research Data

Variable	Group				pvalue
	Sehat=5 Mean±SD (K1)	Control negative n=5 Mean±SD (K2)	Petai bark extract gel dosage 10% n=5 Mean±SD (K3)	Petai bark extract gel dosage 20% n=5 Mean±SD (K4)	
Express there Tyrosinase	1.00±0.01	17.92±3.77	3.19±2.12	0.65±0.44	
<i>Saphiro wilk</i>	0,421	0,150	0,137	0,215	
<i>Levene test</i>				0,001	
<i>One way ANOVA</i>				0,001***	
Expressive of having TRP1	1.01±0.01	35.91±4.52	4.96±3.42	2.22±1.18	
<i>Saphiro wilk</i>	0,421	0,448	0,017*	0,158	
<i>Levene test</i>				0,001	
<i>Kruskal-Wallis Test</i>				0,001***	

Information:

*Saphiro Wilk test (p < 0.05 = abnormal)

** Levene's Test (p < 0.05 = tidak homogeneous)

Kruskal Wallis/ one way ANOVA (p < 0.05 = there is a difference in meaning)

Based on the results of the research shown in table 1. The average expression of the tyrosinase gene in the K4 group was the lowest (0.65±0.44), then followed by the average expression of the tyrosinase gene in the K3 group (3.19±2.12). The highest ratio in the negative control treatment group (K2) was 17.92±3.77. The mean value of the healthy group expression is used as the *base line* value of the ratio, so that all treatment groups are compared to the healthy group that is worth the ratio of one. Tyrosinase gene expression data of all groups are normally distributed, shown by *Shapiro Wilk* results obtained a value of p > 0.05 and also have inhomogeneous data variants shown by the results of *Levene's Test* with a value of p = 0.001 (p < 0.05). The distribution and variant of tyrosinase gene expression data are normal and inhomogeneous, then parametric statistical analysis with *the one way ANOVA* test produces a value of p = 0.001 (p < 0.05) so that it is stated that there is a significant difference in the average expression of the tyrosinase gene between the four groups. The significant *results of the ANOVA one-way* test were followed by a *post hoc Tamhane* test to see which group was the most influential.

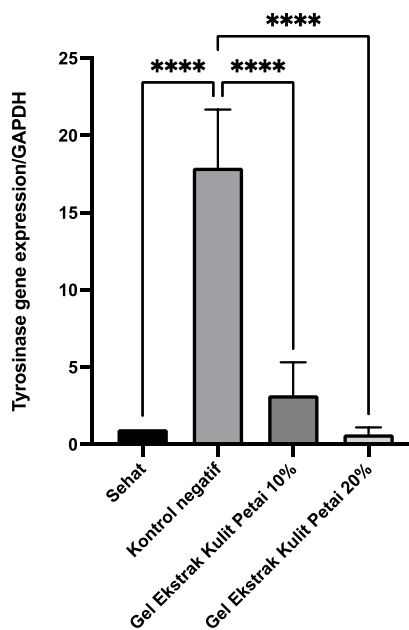


Figure 2. Tyrosinase gene expression graph in the entire study group

Effect of Petai Bark Extract Gel on Tyrosinase and TRP1 Gene Expression (In Vivo Experimental Study on Hyperpigmented Wistar Mice Exposed to UVB Model)

Table 2. *Post hoc Tamhane* test of tyrosinase gene expression in each group

Group	Comparison Group	Sig.	95% confidence interval	
			Lower Limit	Upper Limit
K1	K2	0,001*	-43,285	-29,827
	K3	0,203	-9,807	1,927
	K4	0,288	-3,243	0,827
K2	K3*	0,001*	25,642	39,590
	K4	0,001*	28,864	41,839
K3	K4*	0,513	-2,884	8,348

The * sign ($p < 0.05$) indicates a significantly different group.

Based on the data above, the average comparison between the K2 group with K3 (0.001) and K2 with K4 (0.001) showed a significant difference, while the comparison between the K3 and K4 groups (0.513) there was no significant difference. In the comparison of K1 and K2, a value of 0.001 ($p < 0.05$) was obtained so that there was a significant difference between the two groups. The most significant decrease in tyrosinase gene expression was shown in the administration of 20% petai skin extract with a lower limit value of -2.884 and an upper limit value of 8.348. The results of *Tamhane's post hoc* test on tyrosinase gene expression data showed that the administration of petai skin extract gel that can reduce tyrosinase gene expression in male rats of wistar strain hyperpigmentation model

In this study, researchers found that petai skin extract gel was able to reduce TRP1 gene expression in hyperpigmented mice significantly dose-dependent model (Table 1) Based on the results of the study shown in Table 1. The average expression of the TRP1 gene in the K4 group (2.22 ± 1.18) was the lowest, then followed by the average expression of the TRP1 gene in the K3 group (4.96 ± 3.42). The highest TRP1 gene expression data was in the negative control group of 35.91 ± 4.52 . The TRP1 gene expression data of groups K1, K2, and K4 are normally distributed, but the K3 group data ($p < 0.005$) are not normally distributed based on *Shapiro Wilk's* results. The distribution of TRP1 gene expression data is abnormal, so non-parametric statistical analysis with *the Kruskal-Wallis* test produces a value of $p = 0.001$ ($p < 0.05$) so that there is a significant difference in the average expression of the TRP1 gene between the four groups. The results of *the significant Kruskal-Wallis* test were followed by the *Mann-Whitney* test to see which group was the most influential.

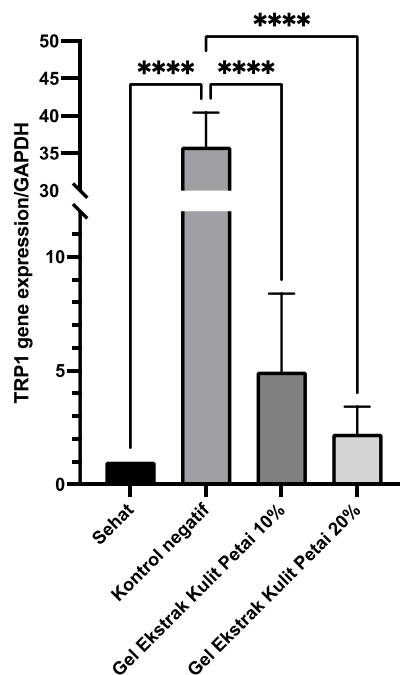


Figure 3. Graph of TRP1 gene expression across research groups

Effect of Petai Bark Extract Gel on Tyrosinase and TRP1 Gene Expression (In Vivo Experimental Study on Hyperpigmented Wistar Mice Exposed to UVB Model)

Table 3. Mann-Whitney TRP1 Test in Each Group

Group	Comparison Group	Sig.	95% confidence interval	
			Lower Limit	Upper Limit
K1	K2*	0,001	0,225	0,771
	K3	0,677	-2,538	0,135
	K4	0,272	-2,528	0,315
K2	K3*	0,000	-3,002	-2,887
	K4*	0,000	-2,992	-2,215
K3	K4	0,090	-1,373	1,563

The * sign indicates a significantly different group.

Based on the data above, an average comparison of K2 (negative control) with K3 (10% petai skin extract gel) (0.000) and K4 (20% petai skin extract gel) (0.000) was obtained, which means that there is a significant difference, while K3 and K4 (0.090) have no significant difference. In the comparison of groups K1 and K2 obtained a value of 0.001 ($p < 0.05$) so that there is a significant difference between the two groups. The highest TRP1 gene expression value was most significantly shown in the administration of 20% petai skin extract gel with a lower limit value of -2.992 and an upper limit value of -2.215. The results of the Mann-whitney test on TRP1 gene expression data showed that the administration of petai skin extract gel that can reduce TRP1 gene expression in male rats of Wistar strain hyperpigmentation model.

IV. DISCUSSION

Exposure to UVB radiation is a major risk factor for skin hyperpigmentation, characterized by increased expression of melanin-forming enzymes such as tyrosinase, TRP1, and TRP2.^{23,25} UVB radiation has been shown to increase oxidative stress due to DNA damage so that it can activate melanin formation pathways such as the *nuclear factor kappa beta* (NF- κ B) pathway and the *melanocyte inducing transcription factor* (MITF) pathway.^{19,26} In the process of melanogenesis, tyrosinase plays a role in converting L-tyrosine into L-3,4-dihydroxyphenylalanine (L-DOPA).²⁷ L-DOPA is then oxidized to L-DOPAquinone, which then forms eumelanin and pheomelanin.²⁸ Thus causing a blackish color on the skin. Recent research confirms that petai peel extract containing various secondary metabolites such as flavonoids, tannins, and saponins can suppress the formation of ROS due to its antioxidant activity.^{17,21,29} The extract's ability to suppress ROS could potentially prevent melanin production.¹⁸

This study aimed to determine the effect of petai skin extract gel administration on tyrosinase and TRP1 gene expression in mouse hyperpigmentation models. Test animals were exposed to UVB radiation at 302 nm with an energy intensity of 390mJ/cm² three times a week for two weeks. The results showed that in the negative control group there was an increase in the amount of melanin in mice up to 46.5%. In the administration of petai peel extract gel, it was shown to reduce the expression of tyrosinase and TRP1 genes in the K3 (petai peel extract gel 10%) and K4 (petai fruit peel extract gel 20%) groups significantly compared to the hyperpigmentation control group (negative control). This suggests that petai bark extract gel can prevent hyperpigmentation through the mechanism of lowering the expression of tyrosinase and TRP1 genes.

Secondary metabolite compounds derived from petai fruit peel extract such as flavonoids, phenolics, saponins, tannins and terpenoids are thought to inhibit MITF activity through inhibition of the PI3K/Akt pathway.^{4,19,20} Previous research has also reported that flavonoid compounds can inhibit TGF- β via the cAMP/protein kinase A pathway and induce GLI2, then suppress MITF, a central transcription factor in melanogenesis.³⁰ Inhibitory MITF will prevent the synthesis of tyrosinase enzyme, so L-tyrosine cannot be converted into L-DOPA. Decreased L-DOPA levels were also reported to decrease TRP1 and TRP2 expression.²⁴ Secondary metabolite compounds in extracts such as flavonoids and phenolic compounds are reported to inhibit TGF- β thereby suppressing melanogenesis by signaling through specific ligand heteromeric receptors, namely serine/threonine kinase receptors that phosphorylate and activate (R)-SMAD receptors. This leads to the formation of complexes with (Co)-Smad, Smad4, and transcriptional regulation of target genes, ultimately suppressing the expression of melanogenesis-regulating enzymes such as tyrosinase, TRP1, and TRP2.^{4,23}

Petai bark extract inhibits tyrosinase, consequently inhibiting the activity of TRP1 and TRP2 which correlate with the pathways of eumelanin and pheomelanin formation. Excessive suppression of TRP1 expression can inhibit melanin synthesis. Previous research reported that increased TRP1 expression correlated with increased melanin due to UVB irradiation.^{23,31} However, increased TRP2 expression is associated with melanoma cell proliferation. In this study, significant and dose-dependent application of petai peel

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extract gel prevented hyperpigmentation. This showed that gel application of petai bark extract decreased the expression of tyrosinase and TRP1 genes, thereby preventing melanin formation in melanocyte cells.

The limitation of this study is the lack of examination of ROS and MITF levels after application of petai fruit peel extract gel, so that the direct molecular mechanism of the extract regarding the prevention of melanin production is still unknown.

V. CONCLUSION

1. Pemberian ekstrak kulit petai pada dosis 10% dan 20% secara bermakna berpengaruh terhadap penurunan ekspresi gen tyrosinase pada tikus jantan galur Wistar model hiperpigmentasi yang diinduksi sinar UVB.
2. Pemberian ekstrak kulit petai pada dosis 10% dan 20% secara bermakna berpengaruh terhadap penurunan ekspresi gen TRP1 pada tikus jantan galur Wistar model hiperpigmentasi yang diinduksi sinar UVB.

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REFERENCES

- 1) Buechner N, Schroeder P, Jakob S, Kunze K, Maresch T, Calles C *et al.* Changes of MMP-1 and collagen type I α 1 by UVA, UVB and IRA are differentially regulated by Trx-1. *Exp Gerontol* 2008; **43**: 633–637.
- 2) Wölfle U, Esser PR, Simon-Haarhaus B, Martin SF, Lademann J, Schempp CM. UVB-induced DNA damage, generation of reactive oxygen species, and inflammation are effectively attenuated by the flavonoid luteolin in vitro and in vivo. *Free Radic Biol Med* 2011; **50**: 1081–1093.
- 3) Niu C, Aisa HA. Upregulation of Melanogenesis and Tyrosinase Activity: Potential Agents for Vitiligo. *Molecules* 2017; **22**. doi:10.3390/molecules22081303.
- 4) Kim SS, Kim MJ, Choi YH, Kim BK, Kim KS, Park KJ *et al.* Down-regulation of tyrosinase, TRP-1, TRP-2 and MITF expressions by citrus press-cakes in murine B16 F10 melanoma. *Asian Pac J Trop Biomed* 2013; **3**: 617–622.
- 5) Xue L, Li Y, Zhao B, Chen T, Dong Y, Fan R *et al.* TRP-2 mediates coat color pigmentation in sheep skin. *Mol Med Rep* 2018; **17**: 5869–5877.
- 6) Hada M, Mondul AM, Weinstein SJ, Albanes D. Serum retinol and risk of overall and site-specific cancer in the ATBC study. *Am J Epidemiol* 2020; **189**: 532–542.
- 7) Baliña LM, Graupe K. The Treatment of Melasma 20% Azelaic Acid versus 4% Hydroquinone Cream. *Int J Dermatol* 1991; **30**: 893–895.
- 8) Rittié L, Fisher GJ. Natural and sun-induced aging of human skin. *Cold Spring Harb Perspect Med* 2015; **5**: 1–14.
- 9) Bibbins-Domingo K, Grossman DC, Curry SJ, Davidson KW, Ebell M, Epling JW *et al.* Screening for skin cancer US preventive services task force recommendation statement. *JAMA - Journal of the American Medical Association* 2016; **316**: 429–435.
- 10) Ibrahim N, Haluska FG. Molecular pathogenesis of cutaneous melanocytic neoplasms. *Annual Review of Pathology: Mechanisms of Disease* 2009; **4**: 551–579.
- 11) Pérez-Cano FJ, Castell M. Flavonoids, inflammation and immune system. *Nutrients* 2016; **8**: 8–11.
- 12) Andy S, Najatullah, Nugroho Trilaksana, Neni Susilaningsih. The Effect of Ethanolic Extract from Moringa oleifera Leaves in Collagen Density and Numbers of New Capillary Vessel Count on Wistar Rats Burn Wound. *Bioscientia Medicina : Journal of Biomedicine and Translational Research* 2022; **6**: 1936–1941.
- 13) Siow HL, Gan CY. Extraction of antioxidative and antihypertensive bioactive peptides from Parkia speciosa seeds. *Food Chem* 2013; **141**: 3435–3442.
- 14) Izzah Ahmad N, Abdul Rahman S, Leong Y-H, Azizul NH. A Review on the Phytochemicals of Parkia Speciosa, Stinky Beans as Potential Phytomedicine. *J Food Sci Nutr Res* 2019; **02**. doi:10.26502/jfsnr.2642-11000017.
- 15) Tuerxuntayi A, Liu Y qiang, Tulake A, Kabas M, Eblimit A, Aisa HA. Kaliziri extract upregulates tyrosinase, TRP-1, TRP-2 and MITF expression in murine B16 melanoma cells. *BMC Complement Altern Med* 2014; **14**: 1–9.
- 16) Mustafa NH, Ugusman A, Jalil J, Kamisah Y. Anti-inflammatory property of Parkia speciosa empty pod extract in human umbilical vein endothelial cells. *J Appl Pharm Sci* 2018; **8**: 152–158.
- 17) Milac AL, Negroiu G. The Multiple Roles of Tyrosinase-Related Protein-2/L- Dopachrome Tautomerase in Melanoma: Biomarker, Therapeutic Target, and Molecular Driver in Tumor Progression. *Human Skin Cancers - Pathways, Mechanisms, Targets and Treatments* 2018. doi:10.5772/intechopen.70513.
- 18) Gui JS, Jalil J, Jubri Z, Kamisah Y. Parkia speciosa empty pod extract exerts anti-inflammatory properties by modulating

Effect of Petai Bark Extract Gel on Tyrosinase and TRP1 Gene Expression (In Vivo Experimental Study on Hyperpigmented Wistar Mice Exposed to UVB Model)

NFκB and MAPK pathways in cardiomyocytes exposed to tumor necrosis factor-α. *Cytotechnology* 2019; **71**: 79–89.

- 19) Zukhiroh Z, Putra A, Chodidjah C, Sumarawati T, Subchan P, Trisnadi S *et al.* Effect of Secretome-Hypoxia Mesenchymal Stem Cells on Regulating SOD and MMP-1 mRNA Expressions in Skin Hyperpigmentation Rats. *Open Access Maced J Med Sci* 2022; **10**: 1–7.
- 20) Iqbal IY. PEMBERIAN KRIM EKSTRAK ETANOL BIJI PETAI (*Parkia speciosa*) 20% SAMA EFEKTIF DENGAN KRIM HIDROKUINON 4% DALAM MENGHAMBAT PEMBENTUKAN JUMLAH MELANIN PADA KULIT MARMUT (*Cavia porcellus*) YANG DIPAPAR SINAR ULTRAVIOLET B IRAH YUNITA IQBAL. Denpasar, Indonesia.
- 21) Freyhaus H Ten, Dagnell M, Leuchs M, Vantler M, Berghausen EM, Caglayan E *et al.* Hypoxia enhances platelet-derived growth factor signaling in the pulmonary vasculature by down-regulation of protein tyrosine phosphatases. *Am J Respir Crit Care Med* 2011. doi:10.1164/rccm.200911-1663OC.
- 22) Padhi S, Sarangi RL, Ramdas A, Ravichandran K, Varghese RGB, Alexander T *et al.* Cutaneous hyperpigmentation in megaloblastic anemia: A five year retrospective review. *Mediterr J Hematol Infect Dis* 2016; **8**. doi:10.4084/MJHID.2016.021.
- 23) Rong J, Shan C, Liu S, Zheng H, Liu C, Liu M *et al.* Skin resistance to UVB-induced oxidative stress and hyperpigmentation by the topical use of *Lactobacillus helveticus* NS8-fermented milk supernatant. *J Appl Microbiol* 2017; **123**: 511–523.
- 24) Li L, Ngo HTT, Hwang E, Wei X, Liu Y, Liu J *et al.* Conditioned medium from human adipose-derived mesenchymal stem cell culture prevents uvb-induced skin aging in human keratinocytes and dermal fibroblasts. *Int J Mol Sci* 2020; **21**. doi:10.3390/ijms21010049.
- 25) Alam MB, Bajpai VK, Lee JI, Zhao P, Byeon JH, Ra JS *et al.* Inhibition of melanogenesis by jineol from *Scolopendra subspinipes mutilans* via MAP-Kinase mediated MITF downregulation and the proteasomal degradation of tyrosinase. *Sci Rep* 2017; **7**: 1–12.
- 26) Khatib S, Nerya O, Musa R, Shmuel M, Tamir S, Vaya J. Chalcones as potent tyrosinase inhibitors: The importance of a 2,4-substituted resorcinol moiety. *Bioorg Med Chem* 2005; **13**: 433–441.
- 27) Oh TI, Yun JM, Park EJ, Kim YS, Lee YM, Lim JH. Plumbagin suppresses α-MSH-induced melanogenesis in B16F10 mouse melanoma cells by inhibiting tyrosinase activity. *Int J Mol Sci* 2017; **18**. doi:10.3390/ijms18020320.
- 28) Siebenga PS, van Amerongen G, Klaassen ES, de Kam ML, Rissmann R, Groeneveld GJ. The ultraviolet B inflammation model: Postinflammatory hyperpigmentation and validation of a reduced UVB exposure paradigm for inducing hyperalgesia in healthy subjects. *European Journal of Pain (United Kingdom)* 2019; **23**: 874–883.
- 29) Lin MH, Hung CF, Sung HC, Yang SC, Yu HP, Fang JY. The bioactivities of resveratrol and its naturally occurring derivatives on skin. *J Food Drug Anal* 2021; **29**: 15–38.
- 30) Lai X, Wichers HJ, Soler-Lopez M, Dijkstra BW. Structure of Human Tyrosinase Related Protein 1 Reveals a Binuclear Zinc Active Site Important for Melanogenesis. *Angewandte Chemie - International Edition* 2017; **56**: 9812–9815.



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The Effect of Cocoa Pod Husk (*Theobroma cacao* L.) Extract on Increasing Gingival Fibroblast and Collagen Density in Wistar Rats Induced by *Porphyromonas gingivalis*



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ABSTRACT: Periodontal disease is an inflammatory disease of the oral cavity which characterized by inflammation of the gingiva. *Theobroma cacao* L. is a herbal plant that has antibacterial and anti-inflammatory effects, which is starting to be widely researched as an alternative therapy for inflammation in the oral cavity. The aim of this study was to examined the effect of the ethanol extract gel of cocoa pod husk (*Theobroma cacao* L.) on increasing the number of fibroblasts and the collagen fiber density in the gingiva of rats that have been induced by *Porphyromonas gingivalis*. The sample used 24 male Wistar rats divided into 3 groups. Each group was induced by porphyromonas gingivalis every 3 days for 14 days then anointed with placebo gel (negative control group), metronidazole gel (positive control group), and cocoa pod ethanol extract gel (CPH gel) for 7 and 14 days. Gingival tissue was taken after euthanasia, after which histological preparations were made, and fibroblasts were observed under a microscope and analyzed using quantitative pathology 0.3.2 software, while for collagen density analyzed using Adobe Photoshop CS6 software. The results showed there was a significant difference of the number of fibroblasts between each group ($p < 0.05$). however there was no significant difference between positive control and cocoa pod husk extract at day 14 ($p > 0.05$). The treatment group on day 7 and 14 was higher than the other groups. It was conclude that the ethanol extract of cacao pod husk (*Theobroma cacao* L.) potential to increase the number of fibroblasts and collagen fibers density in gingival tissue of periodontitis rats.

KEYWORDS: gingival fibroblast, collagen fibers, cocoa pod husk, *Theobroma cacao* L

I. INTRODUCTION

Periodontal disease is an inflammatory disease with the highest prevalence in the world. DataWorld Health Organization (WHO) shows that 90% of the world's population suffers from gingivitis and 80% of them are children aged 12 years and under (Zefanya *et al.*, 2021). The main cause of gingivitis is subgingival plaque bacteria which includes gram-negative anaerobes such as *Porphyromonas gingivalis* (Tonetti *et al.*, 2017). *P. gingivalis* always associated with damage to the periodontal tissue, especially gingivitis (Samaranayake, 2012). Bacteria *P. gingivalis* it produces virulence factors such as *gingipain*, *collagenase*, *fibrinolysin*, *phospholipase*, *fimbriae*, *polysaccharide capsule*, and *liposaccharide* which can cause chronic inflammation of the gingiva. (Samaranayake, 2012). This virulence factors trigger immune cells to produce proinflammatory cytokines such as *Interleukin 1-β* (IL-1β), *Interleukin-6* (IL-6), *Tumor Necrosis Factor-α* (TNF-α) and *Prostaglandin-2* (PGE-2) which can activate tissue fibroblasts, resulting in increased proliferation (Baek *et al.*, 2015).

Fibroblasts play an important role when entering the proliferative phase of the healing process. Under normal circumstances, fibroblast division activity is rarely seen, but when an injury occurs, fibroblasts will immediately migrate to the area and stimulate collagen synthesis gradually so that they are able to heal the wound properly. Fibroblasts will also stimulate macrophages to produce growth factor which aims to synthesize vascularization (Sea *et al.*, 2019). An increase in the number of fibroblasts indicates a healing process. Factors slowing down the healing process are location, wound size, tissue vascularization, and the functional role of the tissue itself (Smith *et al.*, 2019). Collagen is a key component in the phase of wound healing. Display

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of collagen fibrils to the blood will cause platelet aggregation and activation thereby releasing chemotactic factors that start the wound healing process. In the early phase of the wound healing process, the amount of collagen degradation is low, but increases with the maturation of the wound. In the healing process, the main cells involved are fibroblasts and collagen. Fibroblasts are cellular elements that are found in the gingival connective tissue that proliferate and actively synthesize matrix components in the process of wound healing and repair of damaged tissue (Mercandetti, 2002).

In the healing process of gingivitis can be assisted by using chemicals and drugs with herbal ingredients, which can reduce inflammation and cure gingivitis. One of the herbal ingredients that has begun to be widely researched is the cocoa plant (*Theobroma cacao* L.). Based on the results of phytochemical tests, cocoa pod extract contains several active compounds, namely saponins, alkaloids, tannins, flavonoids and triterpenoids (Nugroho *et al.*, 2019). Cocoa is one of the largest commodity products in Indonesia, as the third largest producer in the world. In general, the seeds of the cocoa pods are taken, while the cocoa pod husk is the biggest waste from the cocoa processing process. Cocoa pod husk are very abundant as agricultural waste and have not been utilized properly, even though cocoa pod husk contain active compounds: *flavonoids, saponins, tannins, alkaloids and terpenoids* (Rahayu *et al.*, 2023). Based on previous research, cocoa pod extract at a dose of 100 mg/mL worked effectively as an anti-inflammatory in reducing TNF- α , COX-2 and MMP-8 expression through inhibiting inflammatory cytokine activity and was effective in inhibiting the growth of *P. gingivalis* (Rahayu *et al.*, 2020^a; Rahayu *et al.*, 2020^b). This study aimed to analyze the effect of cocoa pod husk (*Theobroma cacao* L.) extract on increasing gingival fibroblast and collagen density in wistar rats induced by *P. gingivalis*.

II. MATERIALS AND METHODS

This research is a laboratory experimental study with a post test only control group design. Ethical approval was obtained from the Health Research Ethics Commission (KEPK) of the Faculty of Dentistry, University of Jember with number 1760/UN25.8/KEPK/DL/2022. Preparation of ethanol extract gel from cocoa pods takes place at Laboratory of Biology Pharmacy, Faculty of Pharmacy, University of Jember, maintenance and care of experimental animals, preparation and rejuvenation of *P. gingivalis* bacterial suspension, tissue preparation with Haematoxylin eosin and Mallory trichrome staining at Laboratory of Microbiology, Faculty of Dentistry, University of Jember

All rats were induced *Porphyromonas gingivalis* (ATCC 33277) once every 3 days for 14 days. After that, the buccal sucus of the maxillary first molar in the left region was given placebo gel once a day for 7 days in the negative control group, metronidazole gel once a day for 7 days in the positive control group. Administration with cocoa pod extract (*Theobroma cacao* L.) (100 mg/ml) once a day for 7 days in the treatment group. Then the upper left jaw of periodontitis rats examined and cut using a scalpel, taken by multiplying 5mm long pieces of tissue in the mesial and distal sulcus of the first molar teeth. The sample is put in buffered formalin for 24 hours so that the tissue is not damaged then decalcified with 10% formic acid. The research data were obtained from observing histological preparations from each group. The number of fibroblasts and collagen density in the gingiva was carried out on day 7 and 14. Observations were made with a binocular microscope with the help of optilab with a magnification of 400X. The sample was observed for the intensity of the pink color arising from HE staining for the observation of fibroblasts which was determined based on the Quantitative Pathology-0.3.2 software while the intensity of the collagen fibers was observed for the blue color. The purplish appearance of Mallory's trichrome coloring was determined based on adobe photoshop CS6 software (Rahayu *et al.*, 2020^b).

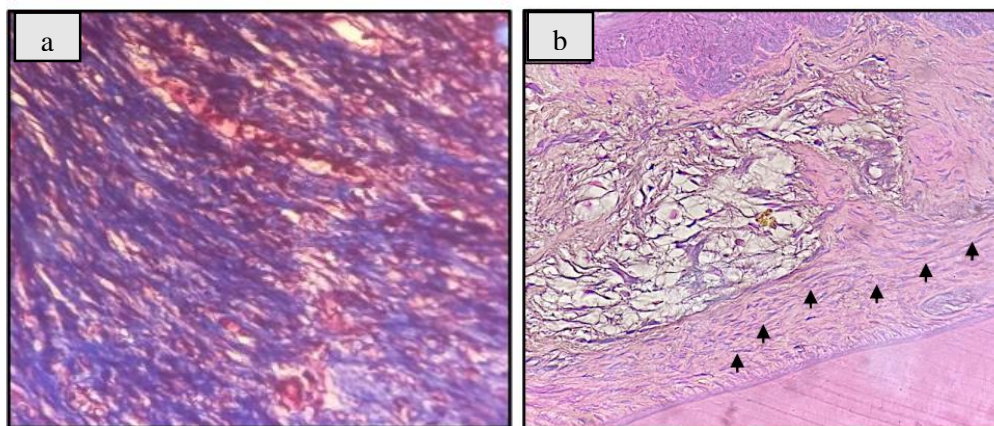


Figure 1. (a) Collagen density at 400x magnification with Trichrome Mallory staining, (b) Fibroblasts at 400x magnification with HE staining.

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The data obtained were then analyzed using the One-Way ANOVA test from SPSS. The sample used was 24 male Wistar rats which were divided into three groups (negative control group, positive control group and treatment group). Each group consisted of 8 rats which were divided into 2 subgroups with each subgroup consisting of 4 male Wistar rats whose data showed the mean and standard deviation in each sample group. The data obtained were tested for normality using the Shapiro-Wilk and homogeneity tests using the Levene Test. Once the data were known to be normally distributed and homogeneous, the data were analyzed using the One-way ANOVA test to determine whether there were significant differences in the number of fibroblasts and collagen density in all groups. The results of the one way ANOVA test showed that there were differences in the average number of fibroblasts and collagen density in the negative control group, the positive control group and the treatment group. Then the data was tested to find out the average difference between study groups using the Post Hoc Least Significant Difference (LSD) test.

III. RESULTS

Based on the results of calculating the average number of fibroblasts, graphs of the average fibroblasts for each group were obtained on day 7 and day 14.

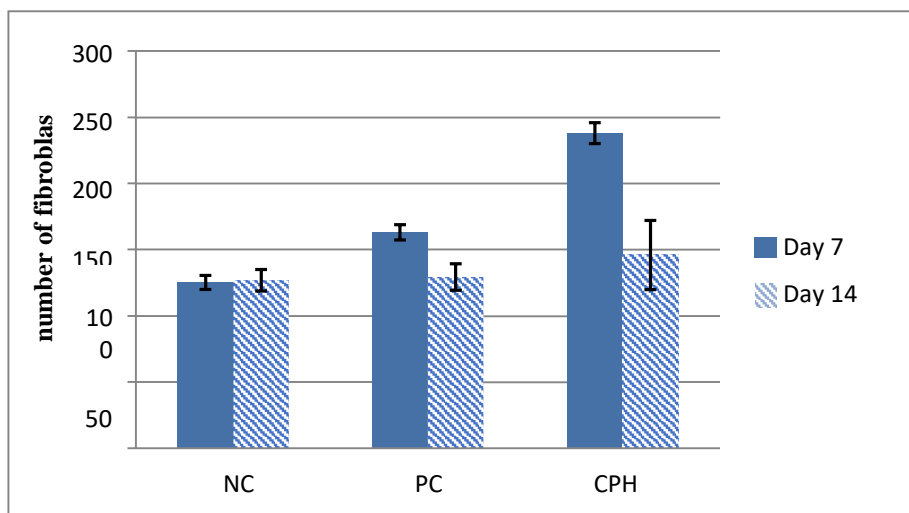


Figure 2. Histogram graph of the average number of fibroblasts in the negative control, positive control and cocoa pod husk groups on day 7 and 14.

The results of calculating the average number of gingival fibroblasts presented in Figure 2 show that the highest number of fibroblasts was in the cocoa pod extract gel group and the lowest number of fibroblasts was in the negative control group. The cocoa pod extract gel group and the positive control group had a higher number of fibroblasts than the negative control group, which means there was an increase in the number of fibroblasts.

Table 1. One-way ANOVA test results on the number of rat gingival fibroblasts

	Sum Of Squares	Df	Mean Square	F	Sig.
Between Groups	36068.517	5	7213.703	44.189	.000
Within Groups	2938.423	18	163.246		
Total	39006.940	23			

The results of the one-way ANOVA test in Table 1 show that the significance value is <0.05 , which is 0.000, which means that there is a significant difference, at least one pair of groups is significantly different. Then the next test, namely Least Significant Difference (LSD) to find out the differences between the two different groups, is presented in Table 2 below.

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Table 2. Results of the Least Significant Difference (LSD) test for the number of gingival fibroblasts in rats

	NC7	PC7	CPH7	NC14	PC14	CPH14
NC7	-	0.006*	0.006*	1.000	0.787	0.250
PC7		-	0.000*	0.009*	0.086	0.433
P7			-	0.000*	0.000*	0.000*
CPH7				-	0.869	0.325
PC14					-	0.913
CPH14						-

Based on the results of the LSD test, a significant value ($p < 0.05$) showed that there was a significant difference between the NC7 group and the PC7 and CPH7 groups; between groups PC7 against CPH7 and NC14; between the CPH7 group and the NC14 group, the PC14 group, the CPH14 group. Whereas in the NC7 group against NC14, PC14 and CPH14; between the PC7 group and the CPH14 group, the CPH14 group; between the NC14 group and the PC14 group, the CPH14 group; between the PC14 group and the CPH14 group there was no significant difference with a significance value ($p > 0.05$). Groups that were not significantly different meant that they had the same number of fibroblasts. This shows that cocoa pod extract gel and metronidazole gel have equal ability to increase the number of fibroblasts.

Based on the results of calculating collagen density, graphs of the average fibroblasts for each group were obtained on the day 7 and 14.

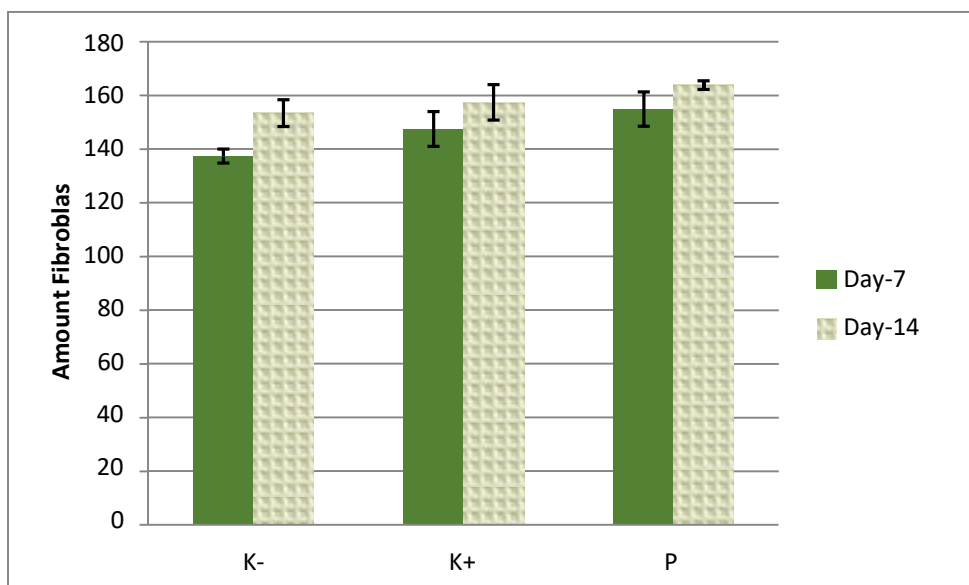


Figure 3. Histogram graph of the average amount of collagen in the negative control, positive control and treatment groups on 7 and 14 day.

Based on Figure 3 the treatment group showed the highest average collagen density when compared to the other groups, both on day 7 (154.9) and day 14 (163.83). In addition, it showed that the highest collagen density was in the cocoa pod extract gel group and the lowest collagen density was in the negative control group. The cocoa pod extract gel group and the positive control group had higher collagen density than the negative control group, which meant that there was an increase in collagen density.

Table 3. One-way ANOVA test results for rat gingival collagen density

	Sum Of Squares	Df	Mean Square	F	Sig.
Between Groups	36068.517	5	7213.703	44.189	.000
Within Groups	2938.423	18	163.246		
Total	39006.940	23			

The Effect of Cocoa Pod Husk (*Theobroma cacao* L.) Extract on Increasing Gingival Fibroblast and Collagen Density in Wistar Rats Induced by *Porphyromonas gingivalis*

The results of the one-way ANOVA test in Table 4 show that the significance value is <0.05 , which is 0.000, which means that there is a significant difference, at least one pair of groups is significantly different. Then the next test, namely Least Significant Difference (LSD) to find out the differences between the two different groups, is presented in Table 4 below.

Table 4. One-way ANOVA test results for rat gingival collagen density

	NC7	PC7	CPH7	NC14	PC14	CPH14
NC7	-	0.006*	0.006*	1.000	0.787	0.250
PC7		-	0.000*	0.009*	0.086	0.433
CPH7			-	0.000*	0.000*	0.000*
NC14				-	0.869	0.325
PC14					-	0.913
CPH14						-

Based on the results of the LSD test, a significant value ($p < 0.05$) showed that there was a significant difference between the NC7 group and the PC7 and CPH7 groups; between groups NC7 against CPH7 and KNC14; between the CPH7 group and the NC14 group, the PC14 group, the CPH14 group. Whereas in the NC7 group against NC14, PC14 and CPH14; between the PC7 group and the PC14 group, the CPH14 group; between the NC14 group and the PC14 group, the CPH14 group; between the PC14 group and the CPH14 group there was no significant difference with a significance value ($p > 0.05$). Groups that were not significantly different meant that they had the same number of fibroblasts. This shows that cocoa pod extract gel and metronidazole gel have equal ability to increase the number of fibroblasts.

IV. DISCUSSION

The results showed that the ethanol extract gel of cocoa pod husk increased the number of fibroblasts in the gingiva of gingivitis rats after *P. gingivalis* induction. This was shown by the average number of fibroblasts in the gingiva of gingivitis rats given cocoa pod ethanol extract gel which was higher than that of gingivitis rats given metronidazole gel and placebo gel. The mean number of fibroblasts in the positive group showed higher results than the negative control group by administering CMC-Na gel. This shows that administration of metronidazole gel can increase the number of fibroblasts, metronidazole gel eliminates *P. gingivalis* by interfering with DNA synthesis and bacterial cell nuclei to prevent colonization or further infection. Thus, inflammation can occur in a short time and be followed by tissue regeneration, one of which is the process of fibroblast proliferation (Atiqah *et al.*, 2021; Cialdai *et al.*, 2022).

The gingivitis rats that were given cocoa pod extract gel had a significantly different number of fibroblasts ($p < 0.05$) from the gingivitis rats that were given placebo gel. This shows that giving cocoa pod extract gel can increase the number of fibroblasts. Cocoa pod skin contains flavonoids, saponins, tannins, alkaloids which can help improve the quality of connective tissue and epithelium in the healing process. In the healing process, compounds are needed that can form collagen by triggering proliferation so that there is an increase in the number of fibroblasts. The content of flavonoids, saponins, tannins, alkaloids has an effect that can play a role in the increase in fibroblasts in the tissue. The anti-inflammatory mechanism of flavonoids is by irreversibly inhibiting the action of *cyclooxygenase* (COX) and lipoxygenase enzymes which results in reduced synthesis of inflammatory mediators such as prostaglandins, especially PGE2, prostacyclin, thromboxane, and leukotrienes which causes the time of the inflammatory process to accelerate which is characterized by increased fibroblast proliferation (Luthfi *et al.*, 2020).

The saponin content of cocoa pods acts as an anti-inflammatory and increases the number of fibroblasts thereby triggering *vascular endothelial growth factor* (VEGF) and increasing the number of macrophages that migrate to the injured area, thereby increasing cytokine production and activating fibroblasts. Saponins inhibit bacterial growth by entering the cell membrane by diffusion. The tannin content in cocoa pod skin has potential as an antioxidant and antibacterial which is useful for stopping bleeding, accelerating inflammation and healing of mucous membranes, and regeneration. new network. These fibroblasts then play a role in the synthesis of collagen which is the main element of the extracellular matrix which is useful for forming strength in scar tissue in wounds (Diller & Tabor, 2022; Rahayu *et al.*, 2023).

The ability of the active substances contained in cocoa pod extract (*Theobroma cacao* L.) to increase the density of collagen is due to the anti-inflammatory effect of flavonoids which consist of catechins, anthocyanins and tannins. *Catechins* and *anthocyanins* in high concentrations act as anti-inflammatory agents by inhibiting the release of arachidonic acid and the release of lysosomal enzymes from the membrane by blocking the cyclooxygenase pathway. The tannins contained in cocoa pod extract

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have the ability as an antibacterial agent, thereby inhibiting bacterial growth and playing a role in fibroblast migration and proliferation. Saponins can increase the permeability of bacterial cell membranes when interacting with bacterial cells resulting in hemolysis of bacterial cells (Schilrreff & Alexiev, 2022).

The increase in average density in the treatment group was also due to the ability of flavonoids, especially quercetin contained in cocoa pod extract (*Theobroma cacao* L.) which could stimulate the induction of *transforming growth factor* (TGF- β). TGF- β has a role in stimulating collagenization and TGF- β has three isoforms namely TGF- β 1, TGF- β 2, TGF- β 3. TGF- β is the main component. TGF- β . This function increases the migration and proliferation of fibroblasts in the area of inflammation. An increase in growth factor secretion can accelerate fibroblast migration and proliferation, furthermore fibroblasts play a very important role in the formation of collagen (Abnaof *et al*, 2014).

V. CONCLUSION

The conclusion obtained from this study was that the ethanol extract gel of cocoa pod (*Theobroma cacao* L.) was effective in increasing the number of fibroblasts and collagen fibers in the gingiva of rats after *P. gingivalis* induction.

REFERENCES

- 1) Abnaof K, Mallela N, Walenda G. TGF- β stimulation in human and murine cells reveals commonly affected biological processes and pathways at transcription level. *BMC Syst Biol*. 2014. 8: 55.
- 2) Atiqah AN, Poetri AR, Niam MH. The difference of effectivity between mangosteen peel extract and metronidazole on fibroblast proliferation. *Odonto: Dental Journal*. 2021; 8(1) : 80-85.
- 3) Baek KJ, Ji S, Kim YC, Choi Y. Association of the invasion ability of *Porphyromonas gingivalis* with the severity of periodontitis. *Virulence*. 2015; 6(3), 274-281.
- 4) Cialdai F, Risaliti C, Monici M. Role of fibroblasts in wound healing and tissue remodeling on Earth and in space. *Front Bioeng Biotechnol*. 2022 Oct 4;10:958381.
- 5) Diller RB, Tabor AJ. The Role of the Extracellular Matrix (ECM) in Wound Healing: A Review. *Biomimetics (Basel)*. 2022 Jul 1;7(3):87.
- 6) Luthfi M, Juliastuti WS, Risky YA, Wijayanti EH, Rachmawati AE, Asyhari, NPO. Expression of fibroblast cells after extraction of wistar rat teeth after topical application of okra fruit (*Abelmoschus esculentus*) gel. *Infectious disease reports*. 2020; 12(1) : 40-43.
- 7) Mercandetti M, Cohen A. 2002. Wound Healing and Repair. *E Medicine*.
- 8) Nazir MA. Prevalence of periodontal disease, Its association with systemic diseases and prevention. *Int J Health Sci (Qassim)*. 2017; 1(2):72-80.
- 9) Nugroho SW, Rukmo M, Prasetyo EA, Yuanita, T. Antibakteri ekstrak kulit buah kakao (*Theobroma cacao*) *Streptococcus sanguinis*. *Conservative Dentistry Journal*. 2019; 9(1), 19–21.
- 10) ^aRahayu YC, Dharmayanti AWS, Larasati AT. The effect of proanthocyanidin cocoa pod rind extract (*Theobroma cacao* L.) on MMP-8 expression in gingival tissue of periodontitis rats model. *Denta Jurnal Kedokteran Gigi*. 2020; 14, 88-93.
- 11) ^bRahayu YC, Dharmayanti AWS, Putri YE, Irmawati A. The analysis of proanthocyanidins cacao peel extract (*Theobroma cacao* L.) potential on the expression of tnf- α and cox-2 on periodontitis rat. *Int. J. Pharmaceut. Res*. 2020; 2, 4337-43.
- 12) ^cRahayu YC, Yuwono B, Wandansari A. The Effectiveness of proanthocyanidins cacao pods (*theobroma cacao* l) on increasing socket epithelial thickness post tooth extraction in wistar rats. *Journal of Dentomaxillofacial Science*. 2020; 5(1): 12-16.
- 13) Rahayu YC, Setiawatie EM, Rahayu RP, Ramadan DE. Analysis of antioxidant and antibacterial activity of cocoa pod husk extract (*Theobroma cacao* L.). *Dental Journal*. 2023; 56(4):220-225.
- 14) Samaranayake, L.h. 2012. *Essential Microbiology for Denstistry*. Churchill Livingstone: Elsevier Limited.
- 15) Schilrreff P, Alexiev U. Chronic inflammation in non-healing skin wounds and promising natural bioactive compounds treatment. *Int J Mol Sci*. 2022 Apr 28;23(9):4928.
- 16) Smith PC, Martin ez C, Martin ez J, Mc Culloch CA. Role of fibroblast populations in periodontal wound healing and tissue remodeling. *Frontiers in physiology*. 2019; 10(270): 1-11.
- 17) Tonetti M S, Jepsen S, Jin L, Otomo-Corgel J. Impact of the global burden of periodontal diseases on health, nutrition and wellbeing of mankind: A call for global action. *Journal of clinical periodontology*. 2017. <https://doi.org/10.1111/jcpe.12732>.



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The Effect of Sapodilla Leaf Extract (*Manilkara Zapota L.P Royen*) on IL-1 and TNF- α Expression in Male White Rats Wistar Strain Induced with UVB Light



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ABSTRACT: Excessive UVB exposure causes health problems in humans, the effect on the skin is molecular and cellular changes. Sunburn is the most obvious acute clinical effect, resulting in the production of TNF- α by keratinocytes, IL-1 is a cytokine that influences TNF- α . Skin wounds release various damage associated molecular patterns (DAMPs) which will activate inflammatory signaling pathways such as NLRP3 inflammasomes and toll-like receptors (TLRs) which cause increased production of inflammatory cytokines. The aim of this study was to examine the anti-inflammatory effect of *Manilkara zapota* leaf extract which was assessed based on the expression of IL-1 and TNF- α in Wistar rats exposed to UVB. Post-test only control group design experimental research using rats (*Rattus norvegicus*) as research objects, divided into 4 groups, namely (K1) control rats without treatment, (K2) rats exposed to UVB light then given placebo cream, (K3) rat group exposed to UVB light then given 25% sapodilla leaf extract cream, and (K4) mice were exposed to UVB light then given 50% sapodilla leaf extract cream. The average expression of IL-1 using the One-Way ANOVA test was 0.197 ($p < 0.05$), which means there was no significant difference in the average expression of IL-1 between groups. Meanwhile, the average TNF- α expression between groups was 0.036 ($p < 0.05$), the results showed that there was a significant difference in the average TNF- α expression between groups, TNF- α expression using the Post Hoc LSD test of sapodilla leaf extract cream 50% dose (K4) reduced TNF- α expression to a lesser extent than K1 or K2. Administration of leaf extract cream (*Manilkara zapota*) affected the expression of TNF- α , but did not affect the expression of IL-1 in a mouse model experiencing sunburn.

KEYWORDS: sunburn, *Manilkara zapota* cream, IL-6, TNF- α

I. INTRODUCTION

Excessive exposure to solar radiation can cause health problems in humans. Solar radiation has many effects on human health, all of which are supported by molecular (e.g., DNA damage) and cellular (e.g., *Langerhans* and dermal dendritic cell migration) changes.¹ Sunburn (erythema) is the most obvious acute clinical effect and skin cancer is the most common chronic effect. The World Health Organization (WHO), estimated about 11 million people each year experience sunburn.²

Sunburn wound healing is a complex process consisting of inflammatory cell infiltration, cell proliferation, and tissue remodeling phases to restore skin integrity and function. Exposure to ultraviolet B results in the production of TNF- α by keratinocytes. TNF- α plays an important role in the inflammatory cascade. Interleukin-1 (IL-1) is a cytokine that affects TNF- α . Skin wounds releasing various *damage associated molecular patterns* (DAMPs) activate inflammatory signaling pathways such as NLRP3 inflammasome and *toll-like receptors* (TLRs) that cause increased production of inflammatory cytokines.³

Sapodilla leaf extract (*M. Zapota*) has a very significant flavonoid content known to have anti-inflammatory effects. The health benefits of sapodilla have been reported to be that its leaves can exhibit anti-inflammatory and antipyretic activity. Previous data showed the antioxidant function of *Manilkara zapota* from polyphenols, especially gallic acid or catechin, and also neo-bioactive polyphenols with methyl 4-O-galloylchlorogenate and 4-O-galloylchlorogenic acid in Methanol-extracted *Manilkara zapota*. Phytoconstituents such as flavonoids, saponins, tannins, glycosides shown by phytochemical screening in crude extract of *M. Zapota leaves* have anti-inflammatory effects. The mechanism of action of flavonoid compounds as anti-inflammatory can go

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through several pathways by inhibiting cyclooxygenase (COX) and lipooxygenase activity, inhibition of leukocyte accumulation, inhibition of neutrophil degranulation, and histamine inhibition. *M. zapota* has an effect in inhibiting the activity of the enzyme α -glucosidase significantly in low concentrations ($IC_{50} 2.51 \pm 0.15 \mu\text{g/mL}$).⁴

Crude methanol extract of *M. Zapota* leaves is known to have antioxidant activity of $3,523 \pm 0,382 \text{ mmol}$ trolox equivalent/gram. Photochemical analysis showed *M. Zapota* contains flavonoids, steroids, glycosides, anthraquinones, antrons, coumarins, phenols, and tannins. Phenols extracted from plants are antioxidants that can terminate free radicals.⁵ *M. Zapota* leaves are known to have antioxidant, antimicrobial, anti-inflammatory, anti-tumor, anti-cancer, antipyretic, anti-diarrheal, anti-nociceptive, and ability to lower uric acid levels. Based on the analysis conducted, *M. Zapota* leaves have a total phenol capacity, flavonoid capacity, and antioxidant capacity that is higher than other plant parts. This can be due to high ultraviolet exposure to the leaves. A higher proportion of flavonoids are found in leaves in tropical regions compared to cold conditions due to the high UV radiation obtained.⁶ Currently, research on the effects of *M. Zapota* leaves is still limited. In vivo as well as in vitro studies have been conducted on this leaf extract. Recent research examined the effects of *M. zapota* bark in vivo on wistar rats. In the study, there was an increase in epithelial tissue, collagen proliferation, and keratinization in wound healing activities in experimental animals given *M. Zapota*.⁷ The goal of sunburn wound treatment is rapid wound healing to prevent infection and minimize complications. Even so, there are still no studies that examine the effect of giving *Manilkara zapota* leaf extract on the healing process of the skin in burns. This study will evaluate the anti-inflammatory effect of *Manilkara zapota* leaf extract assessed based on IL-1 and TNF- α expression in UVB-induced wistar rats.

II. MATERIAL AND METHOD

Study Design and Experimental Animals

This research is an experimental study *post-test only control group design*. The study subjects used 28 male rats of the Wistar strain (*Rattus norvegicus*) aged 2-3 months, with a body weight of 190-210 grams that met the inclusion and inclusion criteria, adapted for 7 days. The study subjects were randomly divided into 4 groups, namely the rat group as a control without treatment (healthy control) (K1), the rat group with UVB light for 3 days then given placebo cream for 3 days as much as 1.5 grams (K2), the rat group with UVB light for 3 days then given sapodilla leaf extract cream (*Manilkara zapota*) 25% for 3 days as much as 1.5 grams (K3), and the rat group with UVB light for 3 days then given 50% sapodilla leaf extract cream for 3 days as much as 1.5 grams (K4). After treatment for 3 days, Day 4 Wistar rat skin tissue samples were taken to analyze IL-1 and TNF- α expression using the *Enzyme-linked immunosorbent assay* (ELISA) method.

Research Materials

Research materials include ethanol extract of *Manilkara zapota* leaves, aquabides, ketamine, 70% alcohol, 80%, paraffin, Fine test ELISA kit Rat TNF- α , Fine test ELISA kit Rat IL-1.

Research Equipment

This study used several equipment, namely a cage measuring 55 x 22 x 22 cm equipped with a feed and drinking bin, UV-B lamps, digital scales, PVC pipes, 3 and 5 ml syringes, tools for making examination samples (scalpel knives), ethanol extraction tools *Manilkara zapota* leaves: ovens, maceration bottles, rotary evaporators, and supporting tools for making cream preparations: porcelain cups, water heater, mortar.

Making *Manilkara zapota* Leaf Extract Cream

Samples of fresh Sapodilla leaves as much as 1 kg, washed thoroughly using running water. The leaves are then dried in an oven at 40°C. Simplisia is checked for moisture content with a *moisture balance* (Ministry of Health RI, 1985). The drying result of simplisia is considered good if the moisture content is below 10%. Simplisia is then carried out dry sorting to remove dirt that is still left during the drying process, cut into small pieces, and weighed then blended into powder. Leaf powder is sifted with a sieve the size of 20 mesh. 450 grams of leaf simplisia powder was extracted using maceration method with 96% ethanol solvent as much as 1,500 ml. Leaf simplisia powder is put into a dark-colored bottle separately. Then simplisia is soaked using ethanol solvent for 3 days and occasionally stirred 3 times a day, after 3 days then filtered and the sandpaper is re-macerated for 2 days with 96% ethanol as much as 1,500ml. Repetition is carried out twice. The collected filtrate is then thickened using a *rotary evaporator* at 40°C until a thick extract is obtained. The thick extract of sapodilla leaves obtained is calculated in yield, then made in the form of 25% and 50% cream.⁸

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Treatment of Experimental Animals

Rats that have been adapted for 7 days are anesthetized with a mixture of ketamine (60 mg / kgbb) and xylazine (20mg / bb), then the hair on the dorsal part of the rat is shaved clean with a size of 5x5 cm. The rats' backs were exposed to UV light (broadband with peak emission 302 nm) with a minimum dose of erythema 160 mJ/cm²/day for 3 days. The rats were then given treatment according to their group. Topical treatment is given once a day for 3 days after UV irradiation B.

III. RESULT

Flavonoid and phenol content of sapodilla leaf extract (*Manilkara zapota*) and validation results of HE staining in UV-B exposed rats

Qualitatively, sapodilla leaves contain phenol and flavonoid compounds.⁹ Quantitative analysis of the content of sapodilla leaf extract obtained phenol levels with 3 repetitions obtained an average result of 170.1 mg / ml, while the results of flavonoid levels analyzed with 3 repetitions obtained an average result of 56.8 mg / ml.

The study subjects were exposed to UV light (broadband with peak emission 302 nm) with a minimum dose of erythema 160 mJ/cm²/day for 3 days. Day 4 skin tissue samples were taken to make anatomical histopathology preparations with HE staining, the results of observations were carried out by anatomical pathology experts.

The results of anatomical pathology examination showed that the black arrow of the HE preparation in the treatment group found sunburn cells while in the control group no sunburn cells were found, observations were made with a microscope at 40x magnification.

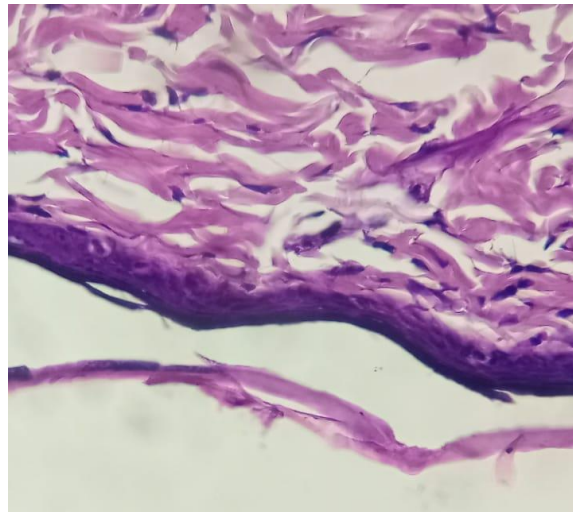


Figure 1. Control group HE staining results at 40x magnification

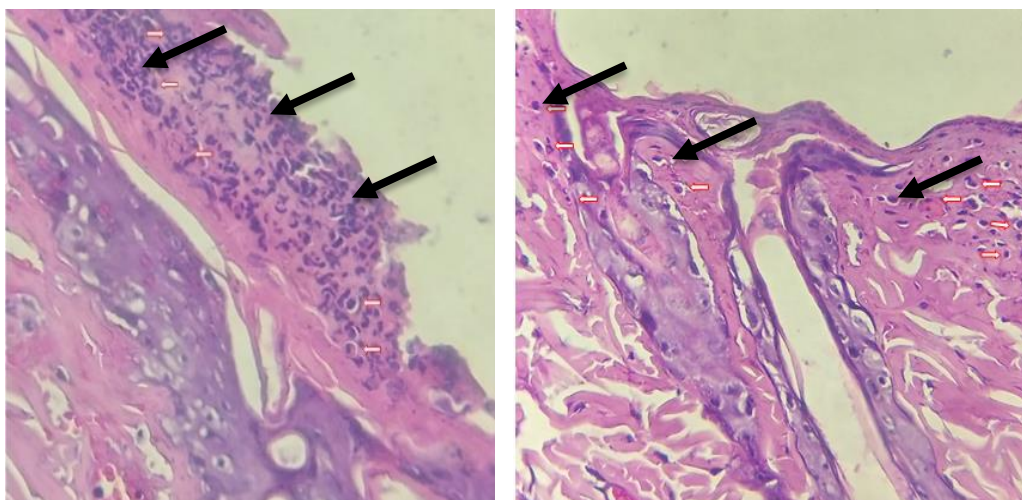


Figure 2. Results of HE staining UV-B exposed mice in the treatment group at 40x magnification

Analysis of IL-1 expression in UV-B exposed rats by administering sapodilla leaf extract cream

The results of descriptive analysis of IL-1 expression in each group of research subjects are shown in table 1 as follows:

The Effect of Sapodilla Leaf Extract (*Manilkara Zapota* L.P Royen) on IL-1 and TNF- α Expression in Male White Rats Wistar Strain Induced with UVB Light

Table 1. Results of descriptive IL-1 expression test and *One way anova* test for each group of rats exposed to UV-B by giving sapodilla leaf extract cream.

Group	K1 (Control)	K2 (Placebo)	K3 Dosage 25%	K4 (Dose 50%)	<i>P value</i>
IL-1 expression (pg/mL)					
Rat 1	89.51	84.15	101.21	79.31	
Rat 2	65.07	63.29	74.85	82.59	
Rat 3	92.49	71.50	62.51	72.96	
Rat 4	82.08	59.00	98.38	97.17	
Rat 5	99.49	65.75	95.24	99.47	
Rat 6	79.51	72.28	92.85	54.27	
Mean \pm SD	84.69 \pm 12.01	69.32 \pm 8.82	88.82 \pm 26.06	82.59 \pm 17.62	
<i>Shapiro-Wilk</i>	0,878*	0,722*	0,163*	0,929*	
<i>Leuvene Test</i>					0,084*
<i>One way Anova</i>					0,197

Description: * *Shapiro-Wilk* = Normal ($p > 0.05$)

* *Leuvene Test* = Homogen ($p > 0.05$)

* *One way Anova* = Signifikan ($p < 0,05$)

The mean expression of IL-1 in the positive control (K1) was 84.69 pg / mL, the average expression of IL-1 was lowest in the placebo cream group (K2) 69.32 pg / mL, while the average expression of IL-1 was highest in the treatment group of 25% (K3) dose of sapodilla leaf extract cream was 88.82 pg / mL and the average expression of IL-1 in the 50% (K4) dose of sapodilla leaf extract cream treatment group was 82.59 pg / mL.

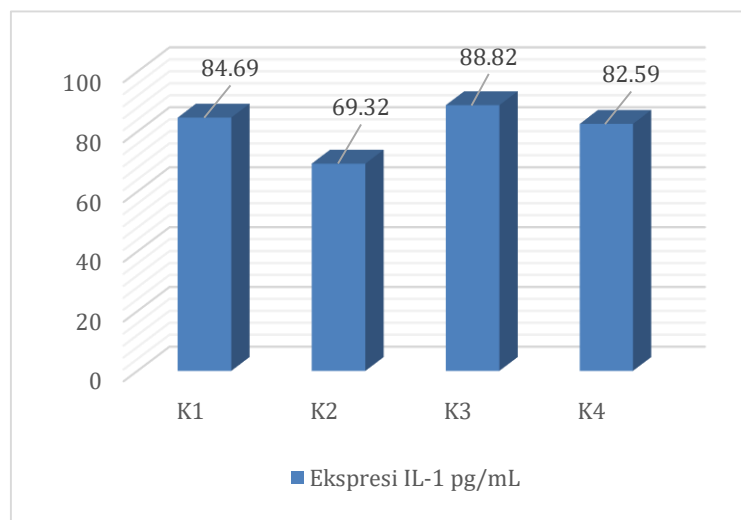


Figure 1. Graph of average IL-1 expression between groups of UV-B exposed rats with sapodilla leaf extract cream

Table 1 shows that IL-1 expression data are normally distributed ($p > 0.05$), and have homogeneous data variations with results of 0.084 ($p > 0.05$). The results of the data were normally distributed and homogeneous, eligible for parametric statistical tests, to compare the average IL-1 expression between groups, carried out *One way anova* test and *Posh Hoc LSD test* to see which dose was most influential.

The average result of IL-1 expression between groups as evidenced by the *One way anova Test* to determine the presence or absence of meaningful differences between groups. *The One way anova* test obtained a p value of 0.197 ($p > 0.05$) which means there is no significant difference in the average IL-1 expression between groups, so there is no need to continue the *Posh Hoc LSD test*. It can be concluded that the administration of sapodilla leaf extract cream was not significantly different in reducing IL-1 expression compared to the positive group without treatment.

The Effect of Sapodilla Leaf Extract (Manilkara Zapota L.P Royen) on IL-1 and TNF- α Expression in Male White Rats Wistar Strain Induced with UVB Light

Analysis of TNF- α expression in UV-B exposed rats with sapodilla leaf extract cream

The results of descriptive analysis of TNF- α expression in each group of study subjects are shown in table 2 as follows:

Table 2. The results of the descriptive test of TNF- α expression and *One way anova test* for each group of rats exposed to UV-B by giving sapodilla leaf extract cream

Group	K1 (Control)	K2 (Placebo)	K3 Dosage 25%	K4 (Dose 50%)	<i>P value</i>
Expresi TNF-α (ng/L)					
Rat 1	294.07	304.73	304.73	301.39	
Rat 2	309.45	282.37	282.37	316.81	
Rat 3	271.46	317.18	317.18	284.22	
Rat 4	250.45	262.94	262.94	290.22	
Rat 5	326.4	335.72	335.72	276.01	
Rat 6	300.75	363.91	363.91	260.11	
Mean \pm SD	292.09 \pm 27.26	311.14 \pm 36.37	336.99 \pm 26.06	288.12 \pm 19.74	
<i>Shapiro-Wilk</i>	0,901*	0,992*	0,094*	1,000*	
<i>Leuvene Test</i>					0,527*
<i>One way Anova</i>					0,036*

Description: * *Shapiro-Wilk* = Normal ($p > 0.05$)

* *Leuvene Test* = Homogen ($p > 0.05$)

* *One way Anova* = Signifikan ($p < 0,05$)

The average expression of TNF- α was lowest in the 50% (K4) treatment group of sapodilla leaf extract cream at 288.12 ng / L, compared to the positive control group (K1) at 292.09 ng / L, while the average expression of IL-1 was highest in the 25% dose of sapodilla leaf extract cream group at 336.99 ng / L, and the average expression of IL-1 in the placebo cream group (K2) was 311.14 ng / L.

Table 2 shows that TNF- α expression data are normally distributed ($p > 0.05$), and have homogeneous data variation ($p > 0.05$). The results of normally distributed and homogeneous data are eligible for parametric statistical tests, to compare the average TNF- α expression between groups, One-Way ANOVA test and Post Hoc LSD test to see which dose has the most effect.

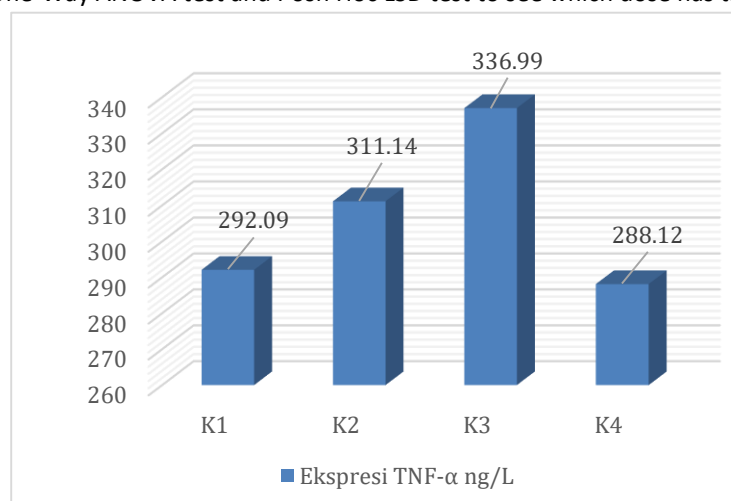


Figure 2. Average expression of TNF- α between groups of UV-B exposed rats with sapodilla leaf extract cream

Analysis of the difference in the average expression of TNF- α between groups with *the One way anova Test* obtained a *p value* of 0.036 ($p < 0.05$). The results showed a significant difference in the average expression of TNF- α between groups. Furthermore, a *post hoc* LSD test was carried out to determine the most influential dose of sapodilla leaf extract cream, shown in the following table 3:

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Table 3. Test results of *Post Hoc LSD* TNF- α TNF- rats exposed to UV-B by giving sapodilla leaf extract cream

Group	K1	K2	K3	K4
K1(Control)		0,276	0,016*	0,818
K2(Placebo)			0,144	0,191
K3(Dosis 25%)				0,009*

Description: * Means $p < 0.05$

The results of the *Post Hoc LSD* test showed that the difference in the average expression of TNF- α between groups, giving 50% (K4) dose of sapodilla leaf extract cream decreased TNF- α expression lower than the positive group (K1) without treatment or the group with placebo cream treatment, but in the group giving 25% dose of sapodilla leaf extract cream did not experience a decrease in TNF- α expression with the highest results between treatment groups.

IV. DISCUSSION

This study aims to observe the effect of giving leaf extract cream (*Manilkara zapota*) in repairing skin damage due to dermatoheliosis (*Sunburn*) caused by UVB exposure. UV radiation induces proinflammatory cytokines such as the production of TNF- α and IL-1 by keratinocytes, dermal fibroblasts and other inflammatory cells. TNF- α stimulates the release of many cytokines and chemokines.¹⁰ Previous research in mice with administration of etanercept (TNF blocker, 4 mg/kg/hr) blocked TNF α inhibiting UVB-induced macrophages, mast cells, and neutrophils. The skin of UVB-irradiated mice contained more mature collagen than mice treated with etanercept and UVB+etanercept.¹⁰ Thus, this study tries to contribute and provide an alternative with the use of natural herbal antioxidants in the form of sapodilla leaf extract cream formulations to repair skin damage due to UVB exposure. Excessive UVB exposure causes sunburn characterized by abnormal keratinocytes that occur prematurely and vacuoles known as sunburn cells, mild epidermal spongiosis, thinning of Langerhans cells, enlargement of endothelial cells, and dermal infiltration of neutrophils. Induces proinflammatory cytokines including IL-1 and TNF- α in the skin. TNF- α stimulates chemotaxis of inflammatory cells in the skin. These cells secrete metalloproteinases (MMPs) and other enzymes that damage the skin matrix.¹⁰

Continuous exposure of the skin to radiation causes topical skin damage and causes an inflammatory response, resulting in premature skin aging, defined as "photoaging", which is characterized by wrinkles, weakness, dryness, roughness, and pigmentation.¹¹ UVB radiation can rapidly induce TNF- α expression in keratinocytes (KCs), dermal fibroblasts and mast cells, causing an inflammatory cascade of skin.¹⁰

In this study showed a decrease in TNF- α expression with the administration of 50% dose of sapodilla leaf extract cream compared to the positive group and placebo cream group. *Manilkara zapota* leaf extract has anti-inflammatory activity that inhibits the release of TNF- α which suppresses inflammation and tissue damage. At a dose of 25% sapodilla leaf extract cream did not experience a decrease in TNF- α expression, the antioxidant content in the preparation was still smaller than free radicals so that it could not reduce TNF- α expression, the increasing trend was thought to be due to the immune response, the high level of cell apoptosis in the inflammatory environment, in addition to the absence of pre-test examination of TNF- α expression so that it could not distinguish TNF- α expression before and after treatment.

Binding results in the recruitment of several factors including TRADD, RIP1, TRAF2, and cIAP 1 and 2 resulting in the formation of complex I signaling via the NF- κ B or MAPK pathway to activate p65 or AP1. Signaling complex I results in transcription of inflammatory genes (chemokines, cytokines) and catabolic matrix (MMPs, ADAMTSs) as well as pro-survival genes (cIAP1 and 2, cFLIP, TRAF1, TRAF2). The mechanism of TNFR1 bound to sTNF- α can be internalized and initiate the formation of Complex II or DISC leading to division of procaspase 8 and eventually apoptosis of cells.¹²

Cell death caused by injury causes the release of IL-1 α which signals through IL-1R to induce an inflammatory response. IL-1R is constitutively expressed by various cell types and activation of NF- κ B and MAPK downstream of IL-1R induces the production of proinflammatory mediators such as cyclooxygenase type-2 (COX-2), IL-6, TNF- α . TNF further increases the production of IL-1 α and IL-1 β , amplifying the inflammatory stimulation provided by the initial release of IL-1 α .¹³

UVB radiation activates MAPK signals such as ERK1, JNK and p38, enhancing inflammatory markers such as TNF- α , IL-6 and COX-2.¹⁴ Excess UVB exposure disrupted epidermal barrier function in mice in a dose-dependent manner that caused an acute inflammatory response or exacerbation of chronic inflammatory skin disease. The dominant source of cytokines in the epidermis is keratinocytes and most of the cytokines secreted from keratinocytes in UVR irradiation are interleukins (IL-1, IL-3, IL-6, IL-8, IL-33). UV-damaged keratinocytes secrete noncoding RNA that can activate TLR3 and induce inflammatory responses, such as an increase in IL-1.¹⁴

The results of IL-1 expression examination did not occur significant changes because IL-1 transcriptional stimulation occurred

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within 30 minutes, and could be maintained for hours.¹⁵ IL-1 plays a role in determining cell fate with respect to modulation of apoptotic pathways, cell proliferation and differentiation.¹⁶ After UV exposure, keratinocytes secrete elevated levels of activated IL-1 family proteins that depend on inflammatory activation.¹⁷ However, in the skin of mice, IL-1 production could not be detected in keratinocytes after UVR exposure or other inflammatory stimuli.¹⁵

In general, IL-1 cannot be detected or expressed in pro form at very low levels, in tissues and resting cells. The secretion of its active form can be induced in a wide variety of cells including human (but not mice) keratinocytes and a subset of myeloid cells (macrophages, monocytes, and dendritic cells) in response to infection, physical injury, or sun damage.¹⁶ Irreversible damage to sunlight keratinocytes undergo apoptosis to remove damaged or mutated cells. UVR-induced apoptosis can be triggered by ROS formation or CD95 receptor activation. However, elevated CD95 regulation alone does not account for UV-induced apoptosis, which suggests there are other factors involved. In vitro studies on cultured keratinocytes show that IL-1 may protect against TNF- α and CD95-mediated apoptosis, but not against UV-induced cell death.¹⁵

Longer UV exposure with larger doses is necessary. The duration of UV exposure further increases IL-1 levels, the release of IL-1 α from dead cells is a major driver of many inflammatory processes. IL-1 α is referred to as "alarmin" and is a critical hazard-related molecular pattern (DAMP) during sterile injury.¹³ The TNF- α pathway in complex I is tasked with repairing cell damage faster, while in complex II where cell apoptosis occurs, IL-1 plays a role in inflammatory conditions, IL-1 persists during the apoptosis process so that high IL-1 expression is often detected in chronic inflammatory conditions.

This study proved that the cream formulation of *Manilkara zapota* leaf extract affected TNF- α expression and did not affect IL-1 in rat models experiencing *sunburn*. However, studies still need to continue in animal models of UVB exposure in the early stages of IL-1 activation a few hours after UV exposure and observe the effect of IL-1 expression on chronic exposure longer than 6 days. Analysis of IL-1 and TNF- α pre-test also needs to be done to determine differences in expression before and after treatment to observe genetic and environmental factors that affect IL-1 and TNF- α expression.

V. CONCLUSION

1. Administration of leaf extract cream (*Manilkara zapota*) had no effect on IL-1 expression in UVB-induced wistar rats.
2. Giving leaf extract cream (*Manilkara zapota*) affects TNF- α expression in UVB-induced wistar rats.

ACKNOWLEDGEMENT

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REFERENCES

- 1) Alfredsson L, Armstrong BK, Allan Butterfield D, et al. Insufficient sun exposure has become a real public health problem. *Int J Environ Res Public Health*. 2020;17(14):1-15. doi:10.3390/ijerph17145014.
- 2) Katsubo : Bizu rabi. 2012-Haru. Entaburein; 2012.
- 3) Xiao T, Yan Z, Xiao S, Xia Y. Proinflammatory cytokines regulate epidermal stem cells in wound epithelialization. *Stem Cell Res Ther*. 2020;11(1). doi:10.1186/s13287-020-01755-y.
- 4) Islam S, Alam MB, Ann HJ, Park JH, Lee SH, Kim S. Metabolite profiling of manilkara zapota l. Leaves by high-resolution mass spectrometry coupled with esi and apci and in vitro antioxidant activity, α -glucosidase, and elastase inhibition assays. *Int J Mol Sci*. 2021;22(1):1-17. doi:10.3390/ijms22010132.
- 5) Ramos A, Alvarez MR, Delica K, et al. Antioxidant and Anticancer Activities of Manilkara zapota and Lansium domesticum Leaves Coupled with Metabolomics analysis using Molecular Networking. *Vietnam Journal of Chemistry*. 2022;60(5):578-588. doi:10.1002/vjch.202100110.
- 6) Mohd Tamsir N, Mohd Esa N, Omar SNC, Shafie NH. Manilkara zapota (L.) P. Royen: Potential source of natural antioxidants. *Malaysian Journal of Medicine and Health Sciences*. 2020;16(8):196-204.
- 7) Alsareii SA, Alzerwi NAN, Alasmari MY, et al. Manilkara zapota L. extract topical ointment application to skin wounds in rats speeds up the healing process. *Front Pharmacol*. 2023;14(June):1-15. doi:10.3389/fphar.2023.1206438.
- 8) Puspitasari AD, Yuita NE, Sumantri S. KRIM ANTIOKSIDAN EKSTRAK ETANOL DAUN KOPI ARABIKA (*Coffea Arabica*). *Jurnal Ilmiah Teknosains*. 2017;3(2). doi:10.26877/jitek.v3i2.1884.
- 9) Hernández-Bolio, Dzul-Romero, Velázquez, Cresencio, Hernández-Núñez, Aguirre-Crespo. The Influence of Drying Temperatures on the Metabolic Profiles and Antioxidant Activity of Manilkara zapota Leaves. *Metabolites*. 2019;9(10):217. doi:10.3390/metabo9100217.

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- 10) Sharma MR, Mitrani R, Werth VP. Effect of TNF α blockade on UVB-induced inflammatory cell migration and collagen loss in mice. *J Photochem Photobiol B*. 2020;213. doi:10.1016/j.jphotobiol.2020.112072.
- 11) Chiu HW, Chen CH, Chen YJ, Hsu YH. Far-infrared suppresses skin photoaging in ultraviolet B-exposed fibroblasts and hairless mice. *PLoS One*. 2017;12(3). doi:10.1371/journal.pone.0174042.
- 12) Lee KJ, Park KH, Hahn JH. Alleviation of ultraviolet-B radiation-induced photoaging by a TNFR antagonistic peptide, TNFR2-SKE. *Mol Cells*. 2019;42(2):151-160. doi:10.14348/molcells. 2018.0423.
- 13) Malik A, Kanneganti TD. Function and regulation of IL-1 α in inflammatory diseases and cancer. *Immunol Rev*. 2018;281(1):124-137. doi:10.1111/imr.12615.
- 14) Ansary TM, Hossain MR, Kamiya K, Komine M, Ohtsuki M. Inflammatory molecules associated with ultraviolet radiation-mediated skin aging. *Int J Mol Sci*. 2021;22(8). doi:10.3390/ijms22083974.
- 15) Nasti TH, Timares L. Inflammasome activation of IL-1 family mediators in response to cutaneous photodamage. In: *Photochemistry and Photobiology*. Vol 88. ; 2012:1111-1125. doi:10.1111/j.1751-1097.2012.01182.x.
- 16) Shah H, Rawal Mahajan S. Photoaging: New insights into its stimulators, complications, biochemical changes and therapeutic interventions. *Biomedicine and Aging Pathology*. 2013;3(3):161-169. doi:10.1016/j.biomag.2013.05.003.
- 17) Weber A, Wasiliew P, Kracht M. Interleukin-1 (IL-1) pathway. *Sci Signal*. 2010;3(105). doi:10.1126/scisignal.3105cm1.



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The Effect of Sapodilla Leaf Extract on IL-6 and TGF- β Levels of Skin Tissue (Experimental Study on Male White Rats of Wistar Strain Exposed to UV Light)



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ABSTRACT: Excessive exposure to ultraviolet light affects cell and tissue homeostasis which has a damaging effect on DNA characterized by the formation of reactive oxygen species (ROS). Inflammation due to UV rays is the main cause of oxidative stress in the skin. Healing of wounds caused by sunburn through a complex process consisting of inflammatory cell infiltration, cell proliferation, and tissue remodeling phases to restore normal skin integrity and function, rapid healing and epithelialization to prevent infection and minimize functional and aesthetic complications. The researchers aimed to see the effect of administering sapodilla leaf extract cream (*Manilkara zapota*) on IL-6 and TGF- β levels in Wistar rats with sunburn. Experimental study with a post test only control group design using a total of 30 mice as experimental animals, divided randomly into 4 treatment groups consisting of a control group, a placebo group, a sapodilla leaf cream group with a dose of 25% and a 50% cream group. Mouse skin tissue exposed to UV was analyzed using the ELISA method to determine the levels of IL-6 and TGF- β . There was no significant difference in the average IL-6 levels between treatment groups with the one way anova difference test, a p value of 0.25 ($p < 0.05$), there was a significant difference in the average TGF- β levels for each group with a p value of 0.005 ($P < 0.05$), *Manilkara zapota* leaf extract cream had a significant effect on TGF- β levels at a dose of 50%. Administration of *Manilkara zapota* leaf extract cream has a dose-dependent effect on IL-6 and TGF- β levels in skin tissue of mice exposed to UV.

KEYWORDS: *Manilkara zapota* extract cream, IL-6, TGF- β , UV

I. INTRODUCTION

Excessive exposure to ultraviolet light in humans can cause health problems. UV light affects the homeostasis of cells and tissues providing a DNA-damaging effect characterized by the formation of reactive oxygen species (ROS). ROS increases the peroxidation of lipid components of cell membranes, alters the structure and increases oxidation resulting in oxidative stress. Inflammation due to UV rays is a major cause of oxidative stress on the skin.¹ Acute inflammation associated with *helper T* (Th)1 cells, *activates transforming growth factor beta* (TGF- β) signaling and contributes to collagen degradation, causing gene mutations and genome instability.² The ability to fight oxidative stress decreases, resulting in an increase in *Interleukin 6* (IL-6), acting as a pro-inflammatory mediator released in times of inflammation. IL-6 signaling blockade has been shown to be effective in treating conditions characterized by chronic inflammation.³ Sapodilla leaf extract contains flavonoids that are very significant known to have anti-inflammatory effects.⁴

Indonesia is a country located on the equator, with tropical climatic conditions as well as scorching sunlight and a fairly high level of humidity. *Sunburn* is caused by excessive exposure to the sun's UV rays.⁵ Excessive sun exposure presents risks and side effects to human health. According to *the World Health Organization* (WHO), it is estimated that around 11 million people each year experience sunburn.⁶ Solar radiation is becoming the most important environmental risk factor for skin cancer, a major cause of *photoaging*, and also an exacerbation factor for some dermatoses.⁷ Clinical and epidemiological data link cumulative sun exposure intensity and number of sunburns to skin damage.⁸ The increase in the number of sunburns experienced is directly correlated with an increased risk of skin cancer.⁵ The incidence of cancer in Indonesia (136.2/100,000 population) ranks 8th in Southeast Asia,

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while in Asia ranks 23rd. The development of traditional medicine today is greatly increased so that the use of traditional medicine is preferred and the price is more affordable, as well as the side effects caused are not dangerous to life.

Wound healing caused by *sunburn* goes through a complex process consisting of inflammatory cell infiltration, cell proliferation, and tissue *remodeling* phases to normalize skin integrity and function. Sapodilla leaf extract can result in a decrease in IL-6 and an increase in TGF- β production.⁹ Sapodilla has recently been shown to trigger apoptosis in various cell lines by activating mitochondrial pathways. Manila leaves contain phytochemical compounds of alkaloids, flavonoids, saponins, tannins, terpenoids and glycosides. Flavonoids can inhibit the formation of arachidonate acid and the secretion of lysosomal and endothelial enzymes so that proliferation and exudation from the inflammatory process are inhibited.⁴

The ultimate goal of sunburn management and treatment is rapid healing and epithelialization to prevent infection and minimize functional and aesthetic complications.¹⁰ Proper wound care results in therapeutic success.⁶ Natural compounds have been used for thousands of years to treat wounds. Natural compounds found in many plants and animals are widely available sources for wound care including the treatment of burns due to sun exposure.¹¹ *Manilkara zapota* (L.) is a plant from the *Sapotaceae* family widely cultivated throughout the tropical world. Extract from *Manilkara zapota* (L.) is known to have a high antioxidant content that has the potential to be used as a natural therapy in wound healing.¹² Therefore, researchers intend to examine the effect of sapodilla leaf extract on IL-6 and TGF- β levels in UV-induced wistar rats.

II. MATERIAL AND METHOD

Study Design and Experimental Animals

The study is an experimental study *Post Test Only Control Group Design*. The study subjects used 30 male rats of *wistar* strain aged 10-12 weeks, with a body weight of 190-210 grams that met the inclusion and inclusion criteria, adapted for 7 days. The study subjects were randomly divided into 4 groups, namely the group of rats without treatment (K1), the group of rats exposed to UV light for 3 days and given placebo cream (base cream) for 3 days (K2), the group of rats exposed to UV light for 3 days and given 25% sapodilla leaf extract cream for 3 days (K3), and the group of rats exposed to UV light for 3 days with 50% sapodilla leaf extract cream for 3 days (K4). The examination was carried out on day 7 using skin tissue with the ELISA method to measure IL-6 and TGF- β levels.

Research Materials

Research materials include *Manilkara zapota* sapodilla leaf extract, aquabides, ketamine, ingredients for preparation preparation: 70% alcohol, 80%, paraffin, Fine test ELISA kit Rat IL-6, Fine test ELISA kit Rat TGF- β .

Research Equipment

This study used several equipment, namely a cage measuring 55 x 22 x 22 cm equipped with a feed and drinking bin, UV-B lamp, digital scale, PVC pipe, scalpel knife, oven, maceration bottle, rotary evaporator, porcelain dish, water heater, mortar, specimen tube, and name tag.

How to Make *Manilkara zapota* Leaf Ethanol Extract Works

(1) 1 kg of fresh *Manilkara zapota* leaves, washed thoroughly using running water. (2) *Manilkara zapota* leaves are then dried in an oven at 40°C. (3) Simplisia is checked for moisture content with moisture *balance* (Ministry of Health RI, 1985). The drying result of simplisia is considered good if the moisture content is below 10%. (4) Simplisia is made powder by blending, then sifted with a 20 mesh sieve. (5) The preparation of *Manilkara zapota* leaf extract is carried out by maceration method. (6) A total of 450 grams of *Manilkara zapota* leaf simplisia powder was weighed, put into a jar, then added 96% ethanol filter liquid as much as 1,500 mL. (7) The mixture is stirred until all powder is wetted, covered, and left for 3 days protected from light. (8) The next stage is routine stirring 3 times a day. (9) After 3 days the maceration results are filtered, the pulp is remacerated for 2 days with a volume of 96% ethanol as much as 1,500 mL. (10) Maserat is thickened using a rotary evaporator at 40°C until a thick extract is obtained. (11) The thick extract of *Manilkara zapota* leaves obtained is calculated in yield, then made in the form of 25% and 50% cream.¹³

Treatment of Experimental Animals

(1) Rats that have been adapted for 7 days are anesthetized with a mixture of ketamine (60 mg / kgbb) and xylazine (20mg / bb), then the hair on the dorsal part of the mouse is shaved clean with a size of 5x5 cm. (2) The rat's back was exposed to UV light (broadband with peak emission 302 nm) with a minimum dose of erythema 160 mJ/cm²/day for 3 days. (3) The rats were then given treatment according to their group. (4) Topical treatment is given once a day for 3 days after UV B irradiation.

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III. RESULT

Results of analysis of flavonoid levels and total phenol of sapodilla leaf extract

Test results of flavonoid content of sapodilla leaf extract (*Manilkara zapota*) by testing flavonoid levels and total phenols. The average flavonoid content of sapodilla leaf extract (*Manilkara zapota*) was 56.8 mg / ml, while the average phenol content of *Manilkara zapota* leaf extract preparation was 170.1 mg / ml. The phytochemical screening results of Sapodilla leaf extract are positive for alkaloids, flavonoids, terpenoids, glycosides, tannins and saponins. ¹⁴

Validation results of Hematoxilin eosin (HE) staining of rat skin tissue that experienced sunburn

Results of observations on samples with mouse models given exposure to UVB light, UV light exposure (broadband with peak emission 302 nm) with erythema doses of 160 mJ / cm² / day for 3 days. The next day (day 7) skin tissue samples were taken to make H&E staining. Analysis results in the treatment group there were sunburn cells on the yellow arrow while in the control group no sunburn cells were found, as in figure 1 below:

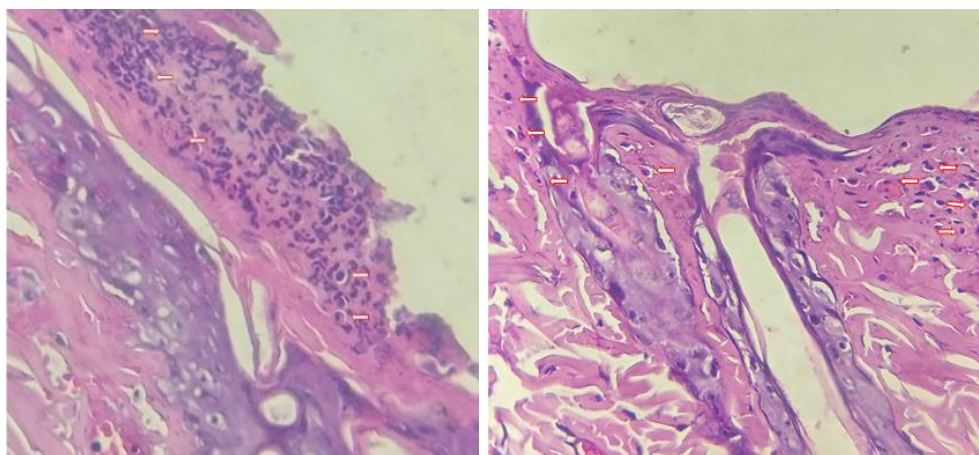


Figure 1. H&E staining results of treatment group with 40x magnification

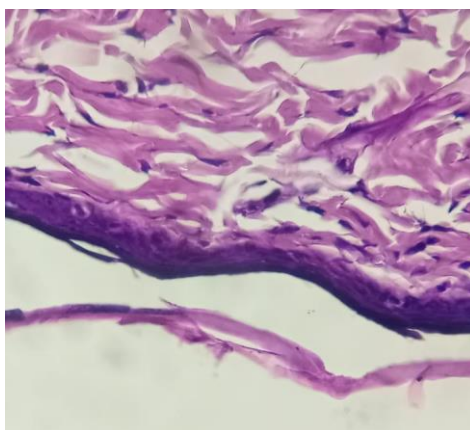


Figure 2. Control group H&E staining results with 40x magnification

Results of IL-6 Rate examination in UVB-shown mice

The results of the examination of average IL-6 levels, after treatment with the administration of *Manilkara zapota* leaf extract cream for 3 (day 4 to day 6), day 7 Wistar rat skin tissue was taken to be analyzed IL-6 levels by the ELISA method. The average test results of IL-6 levels in each group are shown in table 1 below:

Table 1. Descriptive test results and One way Anova IL-6 levels

Group	K1 Without Treatment	K2 Base cream	K3 Cream Dosage 25%	K4 Cream Dosage 50%	P value
Kadar IL-6 (ng/L)					
Wistar 1	9.59	10.23	12.45	8.61	

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<i>Wistar 2</i>	10.76	10.34	9.83	8.94
<i>Wistar 3</i>	11.16	8.37	8.79	8.37
<i>Wistar 4</i>	9.07	10.05	10.89	10.39
<i>Wistar 5</i>	11.9	11.48	9.75	9.71
<i>Wistar 6</i>	9.91	10.16	9.25	9.26
Mean	10,39	10,10	10,16	9,21
SD	± 1.06	± 0.99	± 1.32	± 0.74
<i>Shapiro-Wilk</i>	*0,89	*0.25	*0.42	*0.83
<i>Leuvene Test</i>				*0.54
<i>One way Anova</i>				0,25

Description: * *Shapiro-Wilk* = Normal ($p > 0.05$)

* *Leuvene Test* = Homogen ($p > 0,05$)

* *One way Anova* = Signifikan ($p < 0,05$)

The average IL-6 levels with the ELISA method, the highest levels were found in the K1 group and the lowest levels in the K4 group. There is a downward trend in IL-6 levels with the administration of 50% dose of *Manilkara zapota* leaf extract cream which still has to be proven by statistical tests to see the difference significantly or not.

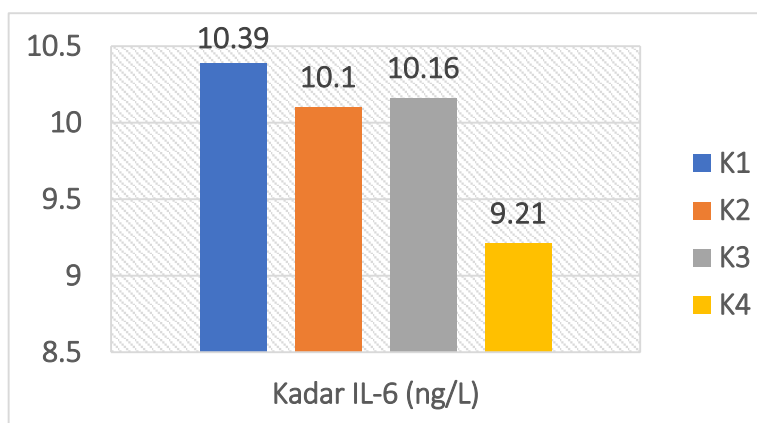


Figure 3. Graph of average IL-6 levels between groups

Descriptive analysis to determine the normality of data with the Shapiro-Wilk test known to all normally distributed groups ($p > 0.05$), and determine the homogeneity of data with the Leuvene Test obtained results of 0.54 ($p > 0.05$) which means that the distribution of IL-6 level data between groups has homogeneous data variance. The average normal and homogeneous IL-6 levels carried out by One way *Anova* difference test obtained results of 0.25 ($P < 0.05$). It can be concluded that there is no significant difference in average IL-6 levels between treatment groups

Results of TGF- β rate examination in UVB-shown mice

The results of the average examination of TGF- β levels in each group using the ELISA method using rat skin tissue samples, shown in Table 2 below:

Table 1. Descriptive test results and *One way Anova* TGF- β levels

Group	K1 Without Treatment	K2 Base cream	K3 cream Dosage 25%	K4 cream Dosage 50%	<i>P value</i>
Up to TGF-β (ng/L)					
Rat 1	506.39	460.07	436.22	387.13	
Rat 2	567.10	428.01	440.02	490.39	
Rat 3	500.76	485.14	518.29	459.91	

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Mouse 4	527.34	509.21	430.69	360.16
Rat 5	511.37	477.15	424.87	463.05
Rat 6	518.71	499.36	469.76	471.05
Mean	521,94	476,49	453,30	438,61
SD	24,01	29,29	35,44	52,13
<i>Shapiro-Wilk</i>	*0,13	*0.77	*0.07	*0.16
<i>Leuvene Test</i>				*0.11
<i>One way Anova</i>				0,005

Description: * *Shapiro-Wilk* = Normal ($p > 0.05$)
 * *Leuven Test* = Homogen ($p > 0,05$)
 * *One way Anova* = Signifikan ($p < 0,05$)

The average TGF-β levels obtained the highest levels in the K1 group and the lowest in the K4 group. There was a decrease in TGF-β levels by giving *Manilkara zapota* leaf extract cream at a dose of 50.

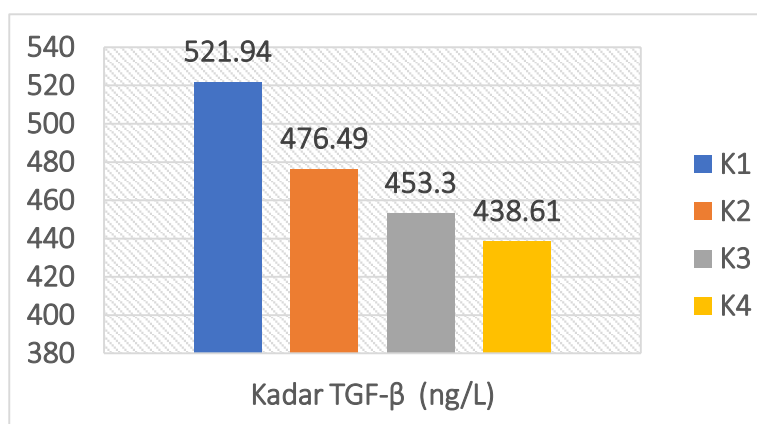


Figure 4. Graph of average TGF-β levels between treatment groups

The descriptive test of determining the normality of the average TGF-β levels with the *Shapiro-Wilk test* showed the results of each normally distributed group ($p > 0.05$), and the determination of data homogeneity with the *Leuvene Test* obtained results of 0.106 ($p > 0.05$) the results showed that the data on TGF-β levels between groups had a homogeneous distribution of data. Average normally distributed and homogeneous TGF-β levels are eligible for the *One-way Anova test*. *One way anova test results* show a significant value of 0.005 ($P < 0.05$). So it was concluded that there was a significant difference in the average TGF-β levels between groups.

The results of the *One way anova test* are meaningfully carried out *Post Hoc Tests* to see the differences between the two groups and get the most influential dose between the treatment group and the control group. Comparison of each group with *Post Hoc Tests* as follows:

Table 2. Hasil uji *Post Hoc Tests* at TGF-β

Group	K1	K2	K3	K4
K1		*0,045	*0,004	*0,001
K2			0,228	0,090
K3				0,497

Description: * Means $p < 0.05$

The results of the *Post Hoc LSD test* showed that the difference in the average TGF-β levels between groups in graph 5.3, obtained the results of giving *Manilkara zapota* leaf extract cream dose of 50% had the most significant influence on TGF-β levels with a value of 0.001 ($p < 0.05$). It can be concluded that *Manilkara zapota* leaf extract cream has an effect on TGF-β levels between

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control groups compared to the treatment group at a dose of 50% which has the most significant effect.

IV. DISCUSSION

Analysis conducted to observe the effect of *sapodilla leaf extract* cream (*Manilkara zapota*) in improving the condition of skin that experiences *sunburn* due to UV exposure. *Sunburn cells* (SCs) are radiation-induced burns to the skin caused by too much UV exposure, The biggest risk factor for sunburn is the amount of time the skin is exposed to UV rays, plus its intensity. Skin keratinocytes in SCs undergoing apoptosis show morphological features such as picnotic nuclei with eosinophilic cytoplasm, mitochondrial swelling and rupture.¹⁵

UV-B exposure increases ROS which plays an important role in activating the MAPK pathway, leading to increased infiltration of inflammatory mediators and epidermal hyperplasia. Inflammatory mediators are released from keratinocytes, fibroblasts, tumor cells, leukocytes and the endothelial lining of blood vessels.^{16,12} Excess UV radiation secretes pro-inflammatory cytokines (IL-1, IL-6 and TNF- α), and IL-6 levels in serum peak about 12 hours after UVB irradiation. The role of IL-6 in inflammation caused by UV-B light, is involved in the production of various types of matrix metalloproteinases (MMPs) by stimulating fibroblasts. Increased production of IL-6 after UV-B irradiation leads to increased expression of MMP1 and MMP9, thereby contributing to the degradation of the extracellular matrix.¹⁵

The results showed that IL-6 levels did not experience significant differences between treatment groups, giving sapodilla leaf extract cream (*Manilkara zapota*) did not affect IL-6 levels after UVB exposure for three days followed by cream for three days. The use of local skin tissue samples also did not express IL-6 significantly, based on the length of UVB exposure, skin tissue collection was carried out on the seventh day which showed improvement was not in the inflammatory stage but had moved to the proliferation stage so that it became the cause of insignificant IL-6 levels.^{17,18} The antioxidant content of the sapodilla leaf extract cream also intervened for a decrease in IL-6 levels.

In contrast to TGF- β levels, the results showed a decrease in TGF- β levels in the *cream* dose group of 25% and 50%. Synergistic modulation by increasing antioxidant capacity, modulating MAPK/AP-1/MMP-1 and TGF- β /SMAD signaling pathways, stimulating type I procollagen synthesis, and restoring damaged architectural structures.¹⁵ UV-B radiation decreases the extracellular matrix content of the skin either due to changes in collagen synthesis or collagen degradation.^{19,20} Activation of the TGF- β gene is responsible for dermal collagen synthesis.¹⁵ The mechanism behind dermal collagen synthesis involves the interaction of TGF- β with the TGF- β cell surface receptor complex ((T β R I-III). The interaction of TGF- β with T β R II results in activation of T β RI serine/threonine kinase activity, resulting in phosphorylation and activation of Smad2 and Smad3 (transcription factors). Smad4, another transcription factor, combined with phosphorylated Smad2 and Smad3, forms complexes that translocate to the nucleus. It activates the TGF- β gene by binding to its promoter region and inducing collagen synthesis. UV-B radiation results in the activation of another transcription factor, SMAD 7, which synergizes the action of TGF- β , thereby inhibiting the TGF- β /SMAD 2-3 signaling pathway and blocking collagen synthesis, thereby increasing the skin collagen produced and loss of skin integrity.^{15,19}

This study showed that the administration of sapodilla leaf extract cream had an effect on TGF- β levels in the skin tissue of male Wistar rats exposed to UV-B light and described a decrease in IL-6 levels but not significant. Further research can be carried out simultaneously between UVB exposure and the administration of sapodilla leaf extract cream, so that it can compare TGF- β and IL-6 levels in *sunburn* intervened by sapodilla leaf extract cream with a shorter treatment time. Design treatment with pre and post tests needs to be done to ensure differences between groups before and after in order to unravel the causes of other influencing factors such as genetic factors of mouse subjects and their environment.

V. CONCLUSION

1. Giving sapodilla leaf extract cream (*Manilkara zapota*) had no effect on IL-6 levels in UVB-induced wistar rats.
2. Giving sapodilla leaf extract cream (*Manilkara zapota*) affects TGF- β levels in UVB-induced wistar rats.

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REFERENCES

- 1) Bosch R, Philips N, Suárez-Pérez JA, et al. Mechanisms of photoaging and cutaneous photocarcinogenesis, and photoprotective strategies with phytochemicals. *Antioxidants*. 2015;4(2):248-268. doi:10.3390/antiox4020248.

The Effect of Sapodilla Leaf Extract on II-6 And TGF- β Levels of Skin Tissue (Experimental Study on Male White Rats of Wistar Strain Exposed to UV Light)

- 2) Ke Y, Wang XJ. TGF β Signaling in Photoaging and UV-Induced Skin Cancer. *Journal of Investigative Dermatology*. 2021;141(4):1104-1110. doi:10.1016/j.jid.2020.11.007.
- 3) Noorbakhsh SI, Bonar EM, Polinski R, Amin MS. Educational Case: Burn Injury—Pathophysiology, Classification, and Treatment. *Acad Pathol*. 2021;8:23742895211057240. doi:10.1177/237428952110572.
- 4) Ganguly A, Mahmud Z Al, Uddin MMN, Rahman SMA. In-vivo anti-inflammatory and anti-pyretic activities of Manilkara zapota leaves in albino Wistar rats. *Asian Pac J Trop Dis*. 2013;3(4):301-307. doi:10.1016/S2222-1808(13)60073-0.
- 5) Guerra KC, Crane JS. Sunburn. *StatPearls [Internet]*; 2022.
- 6) Markiewicz-Gospodarek A, Kozioł M, Tobiasz M, Baj J, Radzikowska-Büchner E, Przekora A. Burn Wound Healing: Clinical Complications, Medical Care, Treatment, and Dressing Types: The Current State of Knowledge for Clinical Practice. *Int J Environ Res Public Health*. 2022;19(3):1338. doi:10.3390/ijerph19031338.
- 7) Queirós CS, Freitas JP. Sun Exposure: Beyond the Risks. *Dermatol Pract Concept*. Published online October 31, 2019:249-252. doi:10.5826/dpc.0904a01.
- 8) Hung M, Beazer IR, Su S, Bounsanga J, Hon ES, Lipsky MS. An Exploration of the Use and Impact of Preventive Measures on Skin Cancer. *Healthcare*. 2022;10(4):743. doi:10.3390/healthcare10040.
- 9) Alrashood ST, Al-Asmari AK, Alotaibi AK, et al. Protective effect of lyophilized sapodilla (Manilkara zapota) fruit extract against CCl₄-induced liver damage in rats. *Saudi J Biol Sci*. 2020;27(9):2373-2379. doi:10.1016/j.sjbs.2020.05.010.
- 10) Haghdoost F, Baradaran Mahdavi MM, Zolfaghari B, et al. The effect of Quercus brantii gall extract on burn wound healing in rat. *Iran J Basic Med Sci*. 2016;9(10):1144-1150.
- 11) Trinh XT, Long NV, Van Anh LT, et al. A Comprehensive Review of Natural Compounds for Wound Healing: Targeting Bioactivity Perspective. *Int J Mol Sci*. 2022;23(17):9573. doi:10.3390/ijms 23179573.
- 12) Karle PP, Dhawale SC, Navghare V V., Shivpuje SS. Optimization of extraction conditions and evaluation of Manilkara zapota (L.) P. Royen fruit peel extract for in vitro α -glucosidase enzyme inhibition and free radical scavenging potential. *Futur J Pharm Sci*. 2021;7(1):151. doi:10.1186/s43094-021-00305-4.
- 13) Puspitasari AD, Yuita NE, Sumantri S. KRIM ANTIOKSIDAN EKSTRAK ETANOL DAUN KOPI ARABIKA (Coffea Arabica). *Jurnal Ilmiah Teknosains*. 2017;3(2). doi:10.26877/jitek.v3i2.1884.
- 14) Prihardini, Wiyono AS. Pengembangan Dan Uji Antibakteri Ekstrak Daun Sawo Manila (Manilkara Zapota) Sebagai Lotio Terhadap Staphylococcus aureus The Development And Antibacteria Test Of Manila Sapodilla Leaf (Manilkara Zapota) AS A LOTIO TO Staphylococcus aureus. *Jurnal Wiyata*,. 2019;2(1):87-92.
- 15) Tanveer MA, Rashid H, Tasduq SA. Molecular basis of skin photoaging and therapeutic interventions by plant-derived natural product ingredients: A comprehensive review. *Heliyon*. 2023;9(3). doi:10.1016/j.heliyon.2023.e13580.
- 16) Ciążyńska M, Olejniczak-Staruch I, Sobolewska-Sztychny D, Narbutt J, Skibińska M, Lesiak A. Ultraviolet radiation and chronic inflammation-molecules and mechanisms involved in skin carcinogenesis: A narrative review. *Life*. 2021;11(4). doi:10.3390/life11040326.
- 17) MacLeod AS, Mansbridge JN. The Innate Immune System in Acute and Chronic Wounds. *Adv Wound Care (New Rochelle)*. 2016;5(2):65-78. doi:10.1089/wound.2014.0608.
- 18) Larouche J, Sheoran S, Maruyama K, Martino MM. Immune regulation of skin wound healing: Mechanisms and novel therapeutic targets. *Adv Wound Care (New Rochelle)*. 2018;7(7):209-231. doi:10.1089/wound.2017.0761.
- 19) Zhang T, Wang XF, Wang ZC, et al. Current potential therapeutic strategies targeting the TGF- β /Smad signaling pathway to attenuate keloid and hypertrophic scar formation. *Biomedicine and Pharmacotherapy*. 2020;129. doi:10.1016/j.biopha.2020.110287.
- 20) Ghafouri-Fard S, Askari A, Shoorei H, et al. Antioxidant therapy against TGF- β /SMAD pathway involved in organ fibrosis. *J Cell Mol Med*. Published online January 1, 2023. doi:10.1111/jcmm.18052.



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Height, Push-Off Angle, Explosive Power: Do they Correlate with Volleyball Athlete Jumping Performance?



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ABSTRACT

Background and Study Aim: Jump performance is the main asset in attacking volleyball. Jump performance is influenced by various factors that affect this indicator, such as body balance, upper and lower body coordination, as well as explosive power. The purpose of this study was to investigate the relationship between height, push-off angle, explosive power, and jumping performance in volleyball student athletes.

Material and Methods: The method used was a correlational, 7 male volleyball student athletes as samples (age = 21.00 ± 1.732 years, height = 167.86 ± 1.864 cm). Sampling technique used is purposive sampling, Shapiro-Wilk and Levene's test to determine normality and homogeneity. Data calculations were processed using the help of IBM SPSS version 26.0., with decision making $p < 0.05$.

Results: Variable Push-Off Angle and Explosive Power show significant results ($p < 0.05$). The Pearson correlation value for Push-Off Angle is -0.781 , while the correlation value for Explosive Power is 0.908 . Conversely, the variable Height does not show significant results ($p > 0.05$), with a Pearson Correlation value of -0.334 . The findings indicate that the aspect of Explosive Power provides a significant contribution with a positive relationship. This is followed by the aspect of Push-Off Angle, but the results show that this aspect provides a moderate contribution with a negative relationship. Additionally, the aspect of Height shows a negative relationship and a low contribution value.

Conclusions: The Study's findings conclude that Push-Off Angle and Explosive Power have a significant correlation and play a crucial role in enhancing Jump Performance. However, Body Height does not exhibit a significant correlation with Jump Performance. These findings also conclude that the aspect that plays a crucial role in jump performance is explosive power.

KEYWORDS: Volleyball Athlete; Jumping Performance; Correlational Study

I. INTRODUCTION

Characteristics of the volleyball game is with a high vertical jump[1], this vertical jump is related to the lower body muscles [2], which leg power plays a role in this case[3]. The characteristic of this vertical jump is related to one of the techniques in volleyball[4], that is, smashes [5] which is a heavy punch, with the attack dipping sharply towards the opponent's court[6]. This is one of the most popular techniques used by athletes to collect point coffers [7]. Thus, subconsciously a high vertical jump is the most important indicator in executing a smash [3], which is supported by various variables that affect these indicators, such as body balance [8], coordination of the upper and lower body[9], and explosive power[10].

Volleyball is a complex and dynamic movement [11], meaning that the game requires more of a good physical component[12], in order to support the appearance of a more optimal performance[13], what is meant by these important components are coordination, balance, agility, speed, strength, explosive power, flexibility, and reaction speed[14]. Limb explosive power is the key to high jumps[15], there is no leg explosive power so there is no jump[16]. This is explained by Saç, that the explosive power of the limbs plays an important role in terms of jumping [17], to produce a high jump it requires a large explosive power of the limbs[18], to get it, the athlete must carry out continuous training[19].

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However, other factors also potentially have a significant impact on vertical jumping and maximal explosive power, such as knee flexion angle[20], knee joint range of motion[21], and ankle dorsiflexion [22]. This because by reducing the knee and upper body inclination angles, the center of mass (CoM) can be lowered, and as a result, the acceleration path before take-off can be enhanced[7]. This theory has been explained by previous research[20], [22] which indicates that increasing the angular velocity of hip and knee joints, combined with the efficient use of arm swings, can enhance vertical jumping during the take-off phase [4], [23].

The concept of vertical jumping is closely related to the height of the athlete as well. Typically, volleyball players have tall body postures and are capable of quick movements in all directions[24]. The average height from female volleyball players is approximately 1.80 ± 0.06 meter meters [25], while for males, the average height is around 193.6 ± 8.4 cm[26]. One theory explains that when a volleyball player performs a spike, jump serve, and block, it is important for them to have an above-average height so that they can combine the power and strength of their lower extremities during vertical jumps[27]. Other studies also indicate that body composition, including height, has a significant correlation with jumping ability[28].

Several findings indicate that lower extremities, such as explosive power, push-off angle, and height, make positive contributions to the performance of volleyball athletes in jumping. [29] This research demonstrates a significant correlation between the results of the Countermovement jump (CMJ) test and jump height. Other findings also reveal a stronger correlation between explosive strength and jump height [30]. Furthermore, this study confirms the crucial role of knee angle in the take-off phase to achieve maximum vertical height[23]. Other findings provide insights that increasing the acceleration of knee extension angle correlates with jump height[22].

Based on the findings of previous studies that indicate a positive correlation between height, push-off angle, and explosive power with jump height, researchers are interested in further exploring these variables. This is due to the lack of research that combines these three variables in a single study. Therefore, the researchers aim to combine the variables of height, push-off angle, and explosive power in one study to provide new contributions to this research field. Furthermore, this study will be conducted in a different location with a different sample. In this research, the goal is to determine the extent to which height, push-off angle, and explosive power variables contribute to vertical jump performance in volleyball athletes.

II. MATERIALS AND METHODS

A. Participants

The research protocol was approved by the Department of Sports Science, Sports Coaching Education Program, Faculty of Education at Tanjungpura University, Pontianak, Indonesia, on September 14, 2020. The sampling technique used purposive sampling, and the sample selection criteria included: 1) members of the core volleyball team at a university, 2) Male gender, and 3) experience participating in championships in accordance with rules of the Indonesian Volleyball Association (PBVSI). A total seven male volleyball players from the core team of the Sports Coaching Education Program volunteered to participate in this study. The average age was 21.00 ± 1.732 years, and their average height was 167.86 ± 1.864 cm. To ensure the athletes' eligibility for this study, brief health information was collected from each athlete. No pain complaints were reported during the testing process.

B. Research Design

In this study, we analyzed the variables of push-off angle in the skill of a volleyball spike performed by participants. The analysis was conducted using the Kinovea software (Version 0.9.4). Volleyball spike skill videos were recorded using a single camera (Canon EOS 400d) with a 170° field of view, MOV video format, 720 fps, and a screen resolution of 1280×720 in a 16:9 aspect ratio. The camera was aimed at the subject and the court shown in Figure 1. To measure explosive power of the volunteers, the researchers used a simple modified vertical jump testing device. To measure height, a height measuring tool was employed. Meanwhile, jump performance was assessed using a vertical jump test.

Each athlete was instructed to wear fitted clothing, such as shorts and sleeveless shirts. Furthermore, all athletes were asked to warm up according to their normal routine to ensure optimal performance. After warming up, the athletes prepared to perform the volleyball spike skill, including the initial stage, jump, contact, and landing. Each athlete was given three attempts to perform the spike skill to obtain information about the push-off angle and jump height from our sample, which consisted of the main volleyball players from the Sports Coaching Education Program. Data collection took place on the volleyball court of the Department of Sports Science, Sports Coaching Education Program, Faculty of Education at Tanjungpura University, Pontianak.

C. Statistical Analysis

The data analysis procedure in this study includes calculating the mean, standard deviation (SD), and variance as descriptive statistical indicators. Additionally, the Pearson correlation test is used to assess the correlations between all identified variables

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based on similar research. Furthermore, we conducted the Shapiro-Wilk test to assess the normality of the data and the Levene test to determine data homogeneity. Statistical significance was analyzed at a significance level of 0.05 ($p < 0.05$). The data obtained were analyzed using SPSS statistical software (SPSS for Windows, version 26.0, SPSS Inc., Chicago, Illinois, USA).

III. RESULTS

Table 1 presents the results of the description of the independent variables, providing information about the mean values \pm SD, and variance of the variables observed in the study.

Table 1. The Results of the Description Observed Variables

	N	Variances	Means	SD
Age	7	3.000	21.00	1.732
Height	7	3.476	167.86	1.864
Push-off Angle	7	204.143	153.86	14.288
Explosive power	7	12.238	34.29	3.498
Jumping Performance	7	42.286	53.43	6.503

Table 2. Analysis Results of Push-Off and Jumping Performance

Initial Name	Push-Off Angle (°)	Jumping Performance, (cm)
B	153	53
D	183	46
DW	136	62
F	154	58
H	153	50
R	151	48
U	147	57

Note: °- angle, cm-centimeter

Table 2 presents the results of the analysis of the push-off angle and jump performance, with the push-off angle aspect analyzed using the Kinovea software. Meanwhile, jump performance was assessed using the vertical jump test. Based on the analysis measuring the push-off angle using the Kinovea software, among the seven samples, the maximum value of the push-off angle was 183°. Meanwhile, the minimum value of the push-off angle was 136°. This was followed by an analysis of jump performance using the vertical jump test, where the maximum jump performance value was 62 cm and the minimum jump performance value was 46 cm.

Table 3 shows the results of the Shapiro-Wilk test, indicating that all examined variables have a normal distribution, with values of $p > 0.05$.

Table 3. Results of the Normality Tests of Research Data

Shapiro-Wilk				
		Statistic	df	Sig.
Variables	Height, (cm)	0.898	7	0.319
	Push-off Angle, (°)	0.820	7	0.064
	Explosive Power, (kg)	0.941	7	0.644
	Jumping Performance, (cm)	0.969	7	0.888

Table 4. Results of the Homogeneity Test of Research Data

Levene statistics	Based on Mean	df1	df2	Sig.
	1.909	3	24	0.115

Table 5 displays the correlation results between height, push-off angle, and explosive power with volleyball jump performance. Significant correlations are observed at the 0.05 level (2-tailed). A significant positive correlation is found between

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explosive power and jump performance ($p < 0.05$). Conversely, a significant negative correlation is observed between height and jump performance ($p > 0.05$), and between push-off angle and jump performance ($p < 0.05$).

Table 5. The Relationship or Connection Between Independent Variables and Dependent Variables

Correlations				
Variables		Height	Push-off Angle	Explosive Power
Jumping Performance	Pearson Correlation	-0.334	-0.781	0.908
	Sig. (2-tailed)	0.464	0.038	0.005

IV. DISCUSSIONS

This research aims to test whether height, push-off angle, and explosive power are related to jump efficiency in a group of male university-level volleyball athletes. The data analysis results show varying correlations between these variables, reflected in the range of Pearson Correlation values from -0.334 to 0.908. However, these findings indicate a significant relationship between the independent and dependent variables ($p < 0.05$). Nevertheless, in the case of height, this relationship cannot be considered significant ($p > 0.05$).

One crucial aspect of physical ability in volleyball is the capacity to perform vertical jump [31]. Players are expected to demonstrate optimal performance in vertical jumps, which directly relates to their attacking abilities during matches [32]. This involves various indicators, including body balance, lower body muscle strength, coordination between the upper and lower body, and explosive strength [2,8–10].

In the context of our study, the correlation results between height and jump performance reinforce previous findings that jumping ability and height play a central role in volleyball [24]. With an average height reaching 193.6 ± 8.4 cm, players can easily perform spikes, blocks, and jump serves by combining the explosive power of their lower extremities during vertical jumps [26,27]. However, other results suggest a different direction, indicating a negative correlation between height and jump performance [33]. This is in line with the Pearson correlation results showing a figure of -0.334 and significant non-significance ($p > 0.05$). Therefore, it can be concluded that height does not significantly contribute to jump performance in volleyball, and height is not a primary factor in determining jump performance.

Height and arm length play a primary role in determining the maximum height that can be achieved, while the ability to jump most efficiently involves utilizing motor skills, particularly explosive muscle strength [27]. Silva et al., [34] argues that explosive power affects vertical jump performance. Then, reinforced by Thattarauthodiyil & Shenoy [35] which states that an important element for successful athlete performance, especially in vertical jump performance, is leg muscle strength. Findings made by Slovák et al., [36] provides evidence that about 56% explosive strength works on jump height.

A characteristic of volleyball is intense anaerobic endurance that combines explosive movement (that is, in both vertical and horizontal directions) with short recovery durations [34]. Therefore, explosive power is an important component of vertical jump performance [35]. In addition, explosive power is considered as an important element in a competitive event [37]. The data indicates that the explosive power of the leg muscles has a significant influence and plays a crucial role in enhancing jump performance when performing a spike in volleyball. These findings are consistent with the correlation analysis results in our study, which show a positive relationship between explosive power and jump performance.

However, explosive power is not the only important component of jump height, but hip, ankle, and knee strength are also correlated with jump height [1,38], arm swing contributed to this section [39]. Not only that, muscle flexibility, body coordination, and good jumping technique are also correlated [35–37]. And the angle of repulsion of the legs can also affect the height of the jump. Optimal leg kick angle optimizes energy transfer and maximizes jumping potential. This can be seen in the findings Putra et al., [43] his findings provide information that the repulsion angle affects the jump height, at a leg repulsion angle of 136° can produce a jump height of 61 cm, while the repulsion angle of 183° can produce a jump height of around 45 cm. These findings confirm that knee flexion angle, knee joint range of motion, and ankle dorsiflexion have the potential to significantly affect jump performance [20–22]. This is because by reducing the angle of knee inclination and upper body, the center of mass (CoM) can be lowered, allowing for increased acceleration before take-off [7]. Some of these results align with the findings of our study, which also emphasizes the significant relationship between these variables and jump performance. However, it's important to note that in the correlation analysis, a negative relationship was found between the push-off angle and jump performance, with a Pearson Correlation value of -0.781. That is, the smaller the angle of repulsion produced by

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student volleyball athletes, the higher the jump performance given with the help of leg muscle explosive power and support from height.

Ultimately, the results of this study can provide valuable contributions coaches in considering vertical jump performance. The key to success in executing a spike involves the speed of movement, explosive strength during jumps, and other factors [1,3,7,27]. However, it's important to note that height has less influence on jump performance in volleyball. This data can be analyzed together with coaches and fitness trainers to design effective training modules, especially in the context of plyometric training aimed at improving lower extremity strength and explosive power from the floor surface [44].

V. CONCLUSIONS

The findings of this investigation in this study conclude that the push-off angle and explosive power are important factor positively associated with significant jump performance. However, height does not exhibit a significant positive relationship with jump performance. In addition to the variables investigated in this study, there are many other indicators that play a crucial role but were not measured in this research. For future research, it is recommended to include other variables related to jump performance, involving a broader population. It is hoped that this study can serve as a reference foundation for further research or updated studies in the future.

REFERENCES

- 1) Y. Ikaeda, Y. Sasaki, and R. Hamano, "Factors Influencing Spike Jump Height," *J. strength Cond. Res.*, vol. 32, no. 1, pp. 267–273, 2018, doi: 10.1519/JSC.0000000000002191.
- 2) R. Kumar and D. A. Kumar, "Analysis of Kinematic and Anthropometric Variables of the Spike Execution Technique of Volleyball," *Int. J. Res. Appl. Sci. Biotechnol.*, vol. 7, no. 4, 2020, doi: 10.31033/ijrasb.7.4.15.
- 3) C. J. Sole, S. Mizuguchi, K. Sato, G. L. Moir, and M. H. Stone, "Phase characteristics of the countermovement jump force-time curve: A comparison of athletes by jumping ability," *J. Strength Cond. Res.*, vol. 32, no. 4, pp. 1155–1165, 2018, doi: 10.1519/JSC.0000000000001945.
- 4) J. Sarvestan, Z. Svoboda, and P. Linduška, "Kinematic differences between successful and faulty spikes in young volleyball players," *J. Sports Sci.*, vol. 38, no. 20, pp. 2314–2320, 2020, doi: 10.1080/02640414.2020.1782008.
- 5) U. Thattarauthodiyil and B. Shenoy, "Combined and comparative effects of plyometrics and dynamic stretching on vertical jump in volleyball players," *Turkish J. Sport. Med.*, vol. 57, no. 1, pp. 3–8, 2021, doi: 10.47447/tjism.483.
- 6) P. X. Fuchs, H. J. K. Menzel, F. Guidotti, J. Bell, S. P. von Duvillard, and H. Wagner, "Spike jump biomechanics in male versus female elite volleyball players," *J. Sports Sci.*, vol. 37, no. 21, pp. 2411–2419, 2019, doi: 10.1080/02640414.2019.1639437.
- 7) P. X. Fuchs, A. Fusco, J. W. Bell, S. P. von Duvillard, C. Cortis, and H. Wagner, "Movement characteristics of volleyball spike jump performance in females," *J. Sci. Med. Sport*, vol. 22, no. 7, pp. 833–837, 2019, doi: 10.1016/j.jsams.2019.01.002.
- 8) P. Y. Huang, A. Jankaew, and C. F. Lin, "Effects of plyometric and balance training on neuromuscular control of recreational athletes with functional ankle instability: A randomized controlled laboratory study," *Int. J. Environ. Res. Public Health*, vol. 18, no. 10, 2021, doi: 10.3390/ijerph18105269.
- 9) E. M. Mosier, A. C. Fry, and M. T. Lane, "Kinetic Contributions of the Upper Limbs During Counter-Movement Vertical Jumps With and Without Arm Swing," *J. Strength Cond. Res.*, vol. 33, no. 8, pp. 2066–2073, 2019, doi: 10.1519/JSC.0000000000002275.
- 10) A. B. Pratama and V. S. Sistiasih, "The Relationship Between Abdominal Muscle Strength and Limb Muscle Explosiveness To the Smash Ability of Volleyball Unit," *Int. J. Econ. Educ. Entrep.*, vol. 1, no. 2, 2021, doi: 10.53067/ije3.v1i2.15.
- 11) Samsudin, I. Setiawan, M. S. Taufik, and S. Solahuddin, "Volleyball fundamental movement learning model in primary school," *Phys. Educ. Theory Methodol.*, vol. 21, no. 3, pp. 194–199, 2021, doi: 10.17309/TMFV.2021.3.02.
- 12) L. dos S. Oliveira, T. B. M. A. Moura, A. L. F. Rodacki, M. Tilp, and V. H. A. Okazaki, "A systematic review of volleyball spike kinematics: Implications for practice and research," *Int. J. Sport. Sci. Coach.*, vol. 15, no. 2, pp. 239–255, 2020, doi: 10.1177/1747954119899881.
- 13) J. Afonso *et al.*, "Unilateral versus bilateral landing after spike jumps in male and female volleyball: A systematic review," *Symmetry (Basel)*, vol. 13, no. 8, pp. 1–20, 2021, doi: 10.3390/sym13081505.
- 14) D. Xu, X. Jiang, X. Cen, J. S. Baker, and Y. Gu, "Single-leg landings following a volleyball spike may increase the risk of anterior cruciate ligament injury more than landing on both-legs," *Appl. Sci.*, vol. 11, no. 1, pp. 1–14, 2021, doi: 10.3390/app11010130.

Height, Push-Off Angle, Explosive Power: Do they Correlate with Volleyball Athlete Jumping Performance?

- 15) D. Gupta, J. L. Jensen, and L. D. Abraham, "Biomechanics of hang-time in volleyball spike jumps," *J. Biomech.*, vol. 121, p. 110380, 2021, doi: 10.1016/j.jbiomech.2021.110380.
- 16) N. H. Darwesh, N. A. Qadir, and T. W. G. Sharif, "Forecast the accuracy of spike and blocking skills in terms of some physical measurements and physical and motor abilities of volleyball players," *Heal. Sport. Rehabil.*, vol. 8, no. 2, pp. 53–62, 2022, doi: 10.34142/HSR.2022.08.02.05.
- 17) A. Saç, "Knee extensor/flexor muscle torque and jump performance in male volleyball players: Effect of experience and torque-angle-velocity relationships," *J. Mens. health*, vol. 17, no. 4, pp. 218–225, 2021, doi: 10.31083/jomh.2021.065.
- 18) A. A. Setiyawan, A. Kristiyanto, and S. K. Purnama, "Factors determining the ability of jump volleyball providing," *Heal. Sport. Rehabil.*, vol. 7, no. 1, pp. 54–65, 2021, doi: 10.34142/HSR.2021.07.01.05.
- 19) W. Jiang and J. He, "Physical Fitness Improvements in Female Volleyball Players," *Rev. Bras. Med. do Esporte*, vol. 29, pp. 10–13, 2023, doi: 10.1590/1517-8692202329012022_0612.
- 20) D. N. Janicijevic, O. M. Knezevic, D. M. Mirkov, A. Pérez-Castilla, M. R. Petrovic, and A. García-Ramos, "Magnitude and reliability of mechanical outputs obtained during loaded squat jumps performed from different knee angles," *Sport. Biomech.*, vol. 20, no. 8, pp. 925–937, 2021, doi: 10.1080/14763141.2019.1618390.
- 21) W. H. Tai, H. Te Peng, C. Y. Song, J. Z. Lin, H. Bin Yu, and L. I. Wang, "Dynamic characteristics of approach spike jump tasks in male volleyball players," *Appl. Sci.*, vol. 11, no. 6, pp. 1–8, 2021, doi: 10.3390/app11062710.
- 22) P. X. Fuchs *et al.*, "Relationship between general jump types and spike jump performance in elite female and male volleyball players," *Appl. Sci.*, vol. 11, no. 3, pp. 1–8, 2021, doi: 10.3390/app11031105.
- 23) R. Kumar and D. A. Kumar, "Biomechanical Analysis of Take-off in Spiking Technique of Volleyball Based on Anthropometric and Kinematic Variables," *Int. J. Res. Appl. Sci. Biotechnol.*, vol. 7, no. 4, pp. 92–101, 2020, doi: 10.31033/ijrasb.7.4.11.
- 24) M. S. Younis, A. A. Ebid, K. M. Al Zughaibi, A. A. Abdelgalil, H. M. Sannan, and A. R. Ibrahim, "Anthropometric and Jumping Profiles of U19 Boys' Volleyball Players in the World Championship 2019," *J. Complement. Med. Res.*, vol. 14, no. 2, pp. 228–232, 2023, doi: 10.5455/jcmr.2023.14.02.35.
- 25) S. Jandová, "Jumping performance and take-off efficiency correlation with the basic anthropometric parameters in female volleyball players," *Acta Gymnica*, vol. 51, pp. 1–7, 2021, doi: 10.5507/ag.2021.020.
- 26) S. A. Emamian Shirazi, A. Hashemi Oskouei, and P. Hejazi Dinan, "Correlation of Vertical Jump Height with Ground Reaction Force and Anthropometric Parameters of Male Athletes," *Thrita*, vol. 11, no. 2, pp. 1–7, 2022, doi: 10.5812/thrita-131432.
- 27) S. Pocek *et al.*, "Anthropometric characteristics and vertical jump abilities by player position and performance level of junior female volleyball players," *Int. J. Environ. Res. Public Health*, vol. 18, no. 16, pp. 1–9, 2021, doi: 10.3390/ijerph18168377.
- 28) G. Altavilla, G. Esposito, R. Ceruso, F. Di Domenico, and T. D'Isanto, "Profile and Differences in Anthropometric Data and Jumping Ability Performance Between Elite and Amateur U16 Volleyball Players," *Phys. Educ. Theory Methodol.*, vol. 22, no. 2, pp. 237–241, 2022, doi: 10.17309/tmfv.2022.2.13.
- 29) H. BENELGUEMAR, S. BOUABDELLAH, and F. MOUISSI, "The Kinematical Analysis of Blocking Skill in Volleyball and Their Relationships with the Explosive Force of Lower Limbs," *Int. J. Sport. Exerc. Train. Sci.*, vol. 6, no. 2, pp. 73–79, 2020, doi: 10.18826/useabd.731462.
- 30) Z. M. Gillen, M. E. Shoemaker, B. D. McKay, N. A. Bohannon, S. M. Gibson, and J. T. Cramer, "Leg Extension Strength, Explosive Strength, Muscle Activation, and Growth as Predictors of Vertical Jump Performance in Youth Athletes," *J. Sci. Sport Exerc.*, vol. 2, no. 4, pp. 336–348, 2020, doi: 10.1007/s42978-020-00067-0.
- 31) R. Ramirez-Campillo *et al.*, "Effects of plyometric jump training on vertical jump height of volleyball players: A systematic review with meta-analysis of randomized-controlled trial," *J. Sport. Sci. Med.*, vol. 19, no. 3, pp. 489–499, 2020, [Online]. Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7429440/pdf/jssm-19-489.pdf>
- 32) C. Freitas-Junior, P. Gantois, L. Fortes, G. Correia, and P. Paes, "Effects of the improvement in vertical jump and repeated jumping ability on male volleyball athletes' internal load during a season," *J. Phys. Educ. Sport*, vol. 20, no. 5, pp. 2924–2931, 2020, doi: 10.7752/jpes.2020.s5397.
- 33) H. Acar and N. Eler, "The Relationship between Body Composition and Jumping Performance of Volleyball Players," *J. Educ. Train. Stud.*, vol. 7, no. 3, p. 192, 2019, doi: 10.11114/jets.v7i3.4047.
- 34) A. F. Silva, F. M. Clemente, R. Lima, P. T. Nikolaidis, T. Rosemann, and B. Knechtle, "The effect of plyometric training in volleyball players: A systematic review," *Int. J. Environ. Res. Public Health*, vol. 16, no. 16, p. 2960, 2019, doi: 10.3390/ijerph16162960.

Height, Push-Off Angle, Explosive Power: Do they Correlate with Volleyball Athlete Jumping Performance?

- 35) U. Thattarauthodiyil and B. Shenoy, "Combined and comparative effects of plyometrics and dynamic stretching on vertical jump in volleyball players," *Turkish J. Sport. Med.*, vol. 57, no. 1, pp. 3–8, Mar. 2022, doi: 10.47447/tjism.483.
- 36) L. Slovák, J. Sarvestan, F. Alaei, and D. Zahradník, "Predicting the volleyball spike jump height by the force-time curve variables of countermovement and volleyball spike jump," *J. Phys. Educ. Sport*, vol. 23, no. 2, pp. 424–430, 2023, doi: 10.7752/jpes.2023.02052.
- 37) X. Wang, C. Lv, X. Qin, S. Ji, and D. Dong, "Effectiveness of plyometric training vs. complex training on the explosive power of lower limbs: A Systematic review," *Front. Physiol.*, vol. 13, no. January, pp. 1–15, 2023, doi: 10.3389/fphys.2022.1061110.
- 38) J. M. Sarabia, M. Moya-Ramón, J. L. Hernández-Davó, and R. J. Fernandez-Fernandez, "The effects of training with loads that maximise power output and individualised repetitions vs. traditional power training," *PLoS One*, vol. 12, no. 10, pp. 1–14, 2017, doi: 10.1371/journal.pone.0186601.
- 39) G. Giatsis and M. Tilp, "Spike Arm Swing Techniques of Olympics Male and Female Elite Volleyball Players (1984-2021)," *J. Sport. Sci. Med.*, vol. 21, no. 3, pp. 465–472, 2022, doi: <https://doi.org/10.52082/jssm.2022.465>.
- 40) I. S. Sopa, "Developing Attack Point in Volleyball Game Using Plyometric Exercises at 13-14 Years Old Volleyball Players," *Sci. Hum. Kinet.*, vol. 12, no. 61, pp. 67–76, 2019, doi: 10.31926/but.shk.2019.12.61.2.41.
- 41) A. Sieroń, A. Stachoń, and J. Pietraszewska, "Changes in Body Composition and Motor Fitness of Young Female Volleyball Players in an Annual Training Cycle," *Int. J. Environ. Res. Public Health*, vol. 20, no. 3, 2023, doi: 10.3390/ijerph20032473.
- 42) R. Soibamcha and Y. S. Singh, "A Comparison of Physical and Physiological Among Manipur Hill and Valley Volleyball Players," *J. Pharm. Negat. Results*, vol. 13, no. 7, pp. 2835–2839, 2022, doi: 10.47750/pnr.2022.13.S07.377.
- 43) M. E. Putra, E. Supriatna, and I. D. P. Wati, "Analysis of Open Smash Techniques in Volleyball Coaching College Students," *Compet. J. Pendidik. KePelatihan Olahraga*, vol. 13, no. 2, pp. 262–269, 2021, doi: 10.26858/cjpk.v13i2.20525.
- 44) B. Arte, Yanse, A. Wahyudi, and Nasuka, "The Effect of Plyometric Exercise and Arm Muscle Strength on Smash Ability of Pervoba Volleyball Athletes Article Info," *J. Phys. Educ. Sport.*, vol. 9, no. 2, pp. 138–144, 2020, doi: 10.15294/jpes.v9i2.33991.



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Application of SSSC for Voltage Stability Improvement in the Nigerian 330 kV Transmission System using Particle Swarm Optimization Technique



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ABSTRACT: Load imbalance has always been a major cause of voltage instability of the power system network and increase in voltage instability affects the power system reliability. In this paper, static synchronous series capacitor (SSSC) FACTS device was implemented to improve the voltage stability in the Nigerian 330 kV transmission network using particle swarm optimization (PSO) technique. Modelled power system network in the power system analysis toolbox (PSAT) is simulated to determine the existing power flow analysis and the level of instability in the power system generation plants situated in the Northern region. The outcome of the power flow is thereafter, optimized with PSO by generating the relationship with a high prediction accuracy between voltage at each location and an inter-linked transmission line distance of the 330kV. The model was generated with least square method and the high prediction accuracy determination was carried out with R-square value of the polynomial order. The best model was optimized and the entire computations were carried out in MatLab resulting in the determination of the optimal location which was between Jebba transmission and Shiroro generation stations. SSSC FACTS controller was implemented on the optimized transmission line and the simulation results showed that the introduction of SSSC improved the voltage stability of the power system network.

KEYWORDS: FACTS, Matlab, Polynomial order, Power flow, PSAT, PSO, R-square, SSSC, Voltage stability

I. INTRODUCTION

The economic growth and development of any nation are intrinsically tied to the availability of energy (Omoroguiwa & Okpo, 2015). Performance evaluation of asynchronous motor, dynamic behaviour and fault resistance of induction motor investigated in (Okpo, Okoro, Awah & Akuru, 2019; Okpo, Okoro, Awah & Akuru, 2020; Abunike, Umoh, Okpo & Okoro, 2020), has given access to a reliable electricity supply which plays a pivotal role in empowering individuals and facilitating personal and economic development. The Nigerian power system network just as the power system across the world, comprises of transmission system, generation systems and distribution systems (Nelson & Odion, 2023; Edifon, Nkan, & Ben, 2016; Okpo & Nkan, 2016). It has been found that the rate of load demand is greater than the amount of electricity generated and this has cumulated into the high rate of the existence of voltage instability (Olanite, Tola, Nwohu, & Adegboye, 2023; Nkan & Okpo, 2016; Oduleye, Nkan, & Okpo, 2023). Other factors that causes voltage instability in the power system network includes; imbalance of the reactive power between the power supply and the load demand which occur due to increase in excitation limit of the generator, large occurrence of inductance on the transmission line network (Izuegbunam, Okafor, & Ogbogu, 2011; Okoro, et al., 2022). The Nigerian power generation systems generates power at voltage ratings of range 16kV to 25kV and then stepped up to the transmission voltage level of either 132 kV or 330 kV for onward transmission to the national grid hence, confirming that the major transmission voltage rating in the Nigerian power system network includes the 132 kV and the 330 kV networks (Olawejaju, Ogunjuyigbe, Ayodele, Mosetlhe, & Yusuff, 2023; Awah, Okoro, Nkan, & Okpo, 2023; Okpo, Nkan, Okoro, & Akuru, 2021). This implies that when the generating plants generates electricity, the voltage rating are increased to either 330 kV (for longer distance transmission) or 132kV. Other transmission voltage rating for shorter distances are 11 kV and 33 kV. The transmission voltage stability is affected due to high rate of power flow congestion as a result of high and constant increase in load demand (Negnevitsky, Voropai, Kurbatsky, Tomin, & Panasetzky, 2013). In the real power generation system, the occurrence of voltage instability is usually caused by the imbalance of transmission capability of the power system network,

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increase in the generation plant reactive power, exceeding the voltage control limits, and inadequate monitoring of the voltage sensitivity as a result of load increase (Das & Panigrahi, 2020; Zhang, Fu, Diao, Sheng, & Jia, 2018). Therefore it can be seen that the voltage stability problems in the modern Nigerian power system network is an issue related to existing power system constraints and increase in voltage collapse, hence, the introduction of flexible alternative currents transmission system (FACTS) which has been studied and found to be essential in the improvement of the voltage stability by effective control of the active and reactive power (Li, et al., 2020; Huang, Ma, & Wang, 2014; Triştiu, Iantoc, Poştovei, Bulac, & Arhip, 2019). The types of FACTS that are deployed for voltage stability improvement has been found to be any FACTS device with series components. Shunt FACTS controllers increase the stability of the system by improving the power flow of the transmission network (Constante & Wang, 2018; Ianţoc, Bulac, Picioroagă, Sidea, & Triştiu, 2021; Hu, et al., 2019; Otuo-Acheampong, Rashed, Haider, & Mensah, 2022). In this study, the static synchronous series compensator (SSSC) FACTS controller is deployed and utilized in voltage stability of the Nigerian 330 kV transmission system of the northern Nigeria.

II. REVIEW OF RELATED LITERATURE

In (Nkan, Okoro, Awah, & Akuru, 2019; Abunike, Umoh, Nkan, & Okoro, 2021; Innocent, Nkan, Okpo, & Okoro, 2021), the authors utilized voltage collapse predictive point which was centered on the quadratic line voltage stability index (q-LVSI) and the machine learning intelligent technique (AMI). The proposed model method was applied to the 30 bus network of the Nigerian 330 kV transmission network and the outcome of the model was validated with group method of data handling time series model (GMDH-time-series) which was a polynomial model utilized for the fitting of the artificial neural network model based on the inductive network learning and self-organization system. The outcome showed that AMI model and GMDH-time series models had an acceptable increased system stability of the power system network. (Nkan, Okoro, Obi, Awah, & Akuru, 2019; Ezeonye, Okpo, Nkan, & Okoro, 2020) in their works examined the essence of utilizing wind turbine system integrated to the permanent magnet synchronous machine for the voltage stability improvement of the Nigerian 330 kV power system network. Ant colony optimization technique was deployed to size the wind turbine system that would improve the voltage stability of the system when integrated into the power system network. The outcome with ant colony projected that a wind turbine power rating of 100 MW and convention power plant of 197 MW would control as much as 150 % increase of the load demand and the voltage stability was increased by 3.4%. The authors in (Nkan, Okoro, Awah, & Akuru, 2019; Innocent, Nkan, Okpo, & Okoro, 2021) utilized Newton Raphson power flow analysis in the determination of the power flow of the Nigerian 330 kV network and ODE 45 of Matlab programmed functions were deployed in determining the transient stability of the power generation plants. The major parameter considered was the level of voltage violation of the power system generation plants. The outcome of the results suggested the need to install additional power generation system to match with the load demand so as to minimize the rising load demand which was projected to reduce the voltage instability of the system. In (Nkan, Okpo, & Okoro, 2020; Williams, Okpo, & Nkan, 2023), the authors in their research works improved the voltage stability of an IEEE 14-bus, Nigerian 48-bus network with increasing integration of solar system network and continuation power flow. PSAT and DigiSILENT were utilized for the modeling of the power system network while MatLab was utilized in the performance of the computations of the system. The outcome of the simulations showed that the penetration of solar system in the power system network improved the voltage stability of the power system. This was achieved by increasing the real power of the solar system upto 10%. (Nkan, Okpo, Akuru, & Okoro, 2020; Ezeonye, Nkan, Okpo, & Okoro, 2022) also utilized a method that was dependent on power network integration characteristics of the power system network for the improvement of the voltage stability of the network. The proposed method utilized admittance matrix between load to load bus in inter connected power system of the Indian power system network. Furthermore, the author applied eigen matrix in the sub matrix of the admittance matrix that was partitioned in the generation and load buses. The model was also tested on the IEEE 30-bus system. The outcome presented showed that the proposed model improved the voltage stability of the power system. In (Natala, Nkan, Okoro, & Obi, 2023; Adebayo & Sun, 2021; Dong, Xie, Zhou, Shi, & Jiang, 2016) the authors proposed the use of integrated high-side-var-voltage control (IHSV 2C) for power generation plants to obtain the end powers of the systems. Hence, the use of IHSV 2C involves improvement of the voltage stability with a voltage control point (VCP), which usually occur by regulating the voltage reference point that improves the VAR support improving the voltage stability of the power system. The outcome showed that the use of IHSV 2C improved the voltage stability of the power system. In (Nkan, Okpo, & Inyang, 2023; Ismail, Wahab, Othman, & Radhan, 2022; Milano, 2016), the authors also utilized new line voltage stability index (BVSI) to obtain the weak transmission lines and was implemented on IEEE 14-bus, 30-bus and 118-bus systems. The proposed model was effective in determining the weakest transmission lines of all the IEEE systems utilized. In (Nkan, Okpo, & Okpura, 2023; Fu, Du, Wang, Zheng, & Xiao, 2023), the authors carried out a comparative analysis of current injection models of the power system network and the power injection models to determine the

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more efficient model for the voltage stability of the power system. The models were utilized and implemented on a 1479-bus network of island Irish transmission network and it was found that though the power injection model was more complex, it was also more effective in improving the voltage stability of the power system network. (Jameson, Nkan, & Okpo, 2024; Huang, Hill, & Zhang, 2020)in their works, utilized the differences in the voltage source converters (VSCs) which were VSC control loops. The operating states of the device were utilized for the voltage stability of the power system network. The outcome showed that the use of VSC had the expected voltage stability improvement. In (Kettner & Paolone, 2019), studies on the impact of power system structures on the voltage stability disturbances and the weighted load connectivity (WLC) which included an aggregate nonlinear recovery model and network topology characteristics were utilized in determining the voltage stability of the power system network. The monte carlo model was utilized in determining the level of voltage stability of the power system network.

III. MATERIALS AND METHOD

The procedure utilized for the method is shown in the flow diagram of fig.1. Modelled power system network in the power system analysis toolbox (PSAT) is simulated to determine the existing power flow analysis and the level of instability in the power system generation plants situated in the northern region. Optimized placement of FACTS controllers is carried out with particle swarm optimization (PSO) technique by generating the relationship with a high prediction accuracy between voltage at each location and an inter-linked transmission line distance of the 330 kV. The model is generated with least square method and the high prediction accuracy determination is carried out with R-square value of the polynomial order. The best model is optimized and the entire computations are carried out in MatLab. SSSC FACTS controller is implemented on the optimized transmission line and simulated to view the level of steady and dynamic voltage improvement of the system.

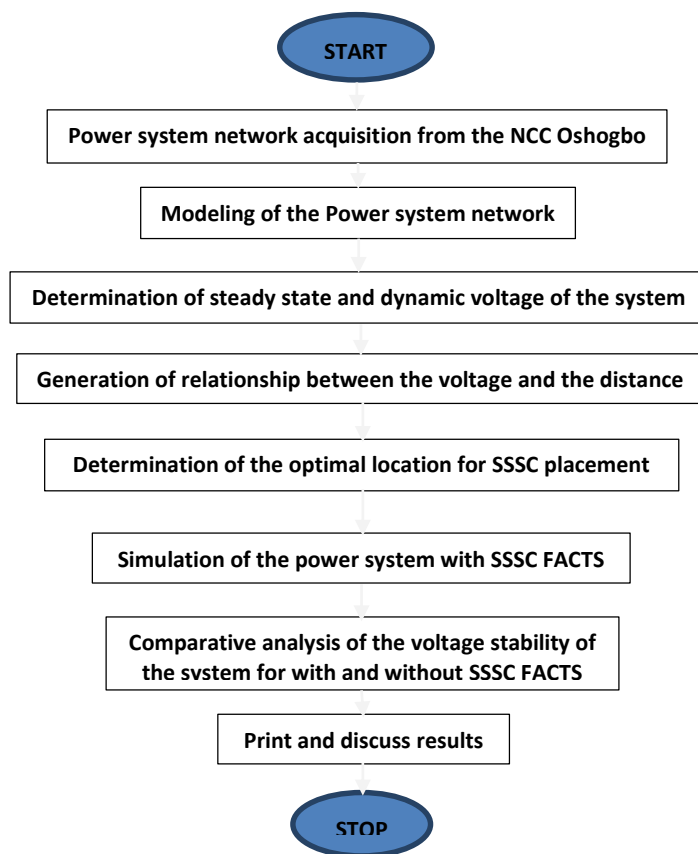


Fig.1. Flow diagram of the research procedure

The study utilized a real time data in the determination of the voltage stability improvement of the power system network. The data is a 32 bus network of the Nigerian 330 kV transmission network. The steady state improvement is on the entire network but the voltage stability is on the generation station of the power system network. The data utilized for the model is obtained from the national control center in Oshogbo, Osun state Nigeria, and the 32 bus network located mainly in the Northern region of the country. The obtained power system network data is simulated in power system analysis toolbox (PSAT) to obtain the steady state and transient stability of the voltage of the network. A polynomial relation between the voltage at

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each bus and the cumulative voltage of the interconnected network is generated. The polynomial order is increased to achieve the best model with R-square value greater than 95%. The outcome of the model is optimized with particle swarm optimization with the objective function being the polynomial model as shown in Equation 1.

$$P = a_0 + a_1d + a_2d^2 + \dots + a_nd^n \quad (1)$$

where P is the voltage, a represents the coefficient of the model, d is the distance in km and n is the order of the polynomial. The best order is optimized with PSO in MatLab to determine the distance with the highest active power amount. The FACTS utilized is placed in this location for voltage stability. The essence of utilizing PSO is to determine the optimal location for the placement of SSSC FACTS. The steady state and dynamic voltages of the power system without and with SSSC is compared and presented. The computations are carried out in MatLab and the power system simulation done in PSAT application software.

IV. RESULTS AND DISCUSSION

The steady state voltage of the power system network after simulating the power system network without SSSC FACTS device is shown in Table 1.

Table 1. steady state voltage of the powersystem network

Transmission lines	Voltage (kV)	Cumulative distance
1	320.07	0.47
2	320.53	5.67
3	316.63	315.67
4	320.57	396.67
5	319.16	404.67
6	316.49	648.67
7	317.39	718.67
8	318.73	875.67
9	320.79	908.67
10	320.82	1027.7
11	316.79	1108.7
12	320.85	1210.7
13	320.79	1461.7
14	318.43	1537.7
15	320	1601.7
16	316.71	1622.7
17	318.11	1678.7
18	320.58	1897.7
19	319.96	2079.7
20	320.8	2223.7
21	319.28	2283.7
22	316.18	2513.7
23	320.25	2710.7
24	320.67	2995.7
25	319.39	3260.7
26	319.79	3420.7
27	319.72	3660.7
28	317.96	3920.7
29	319.28	4224.7
30	316.86	4278.7
31	319.53	4374.7
32	316.16	4441.7
33	317.38	4502.7
34	316.23	4584.7
35	316.49	4779.7
36	320.12	4916.7

The best polynomial that was sent to the PSO tool was 7th order polynomial at R-square of 99.61%. The optimal distance obtained from the PSO optimization technique was 236.1km. The location had the least voltage of 314 kV. Hence, the distance

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was between Jebba TS and Shiroro GS. Therefore, the FACTS device was placed at the transmission line connecting Jebba transmission station and Shiroro Generating station (line 3 connecting bus 2 and bus 4). The power system model with SSSC FACTS controller is shown in fig.2. SSSC was implemented in the optimized location and simulation of the system was carried out. The steady state voltage of the power system without and with SSSC is shown in fig.3.

From the comparative graph of fig.3, the percentage voltage improvement is 4.3% at the least and the maximum is 5.7%. This simply implies that the introduction of the SSSC FACTS device improved the voltage of the power system networks. The comparative voltage stability with and without SSSC for Geregu GS is shown in fig.4. Here, the oscillations of the voltage for the system without FACTS are high and the introduction of SSSC damped the oscillations by 34.3%. Fig.5 depicts the voltage stability of the Jebba generation station where the oscillations of the power plant was damped to 34.2% with the introduction of the SSSC. Hence, the introduction of the SSSC improved the stability of the power system network.

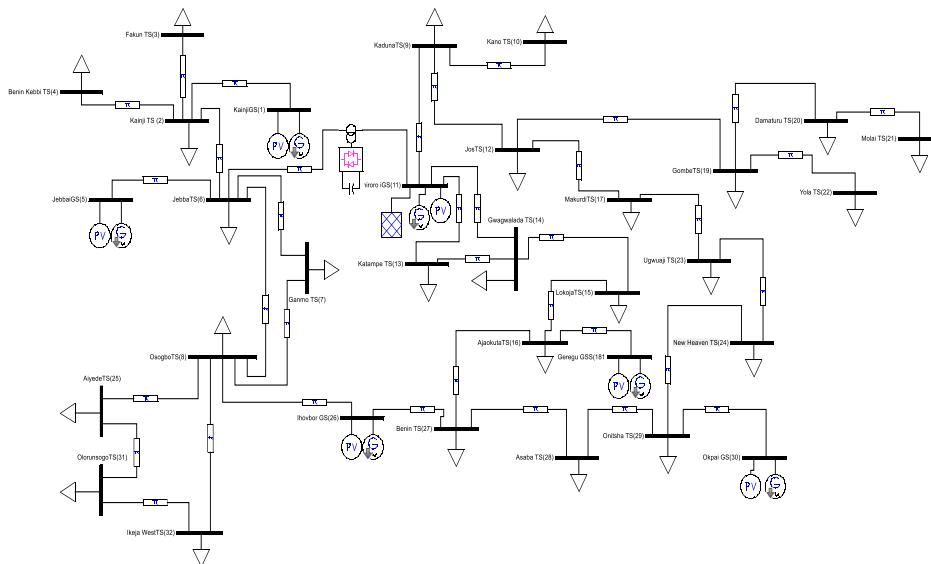


Fig.2. Power system model with SSSC

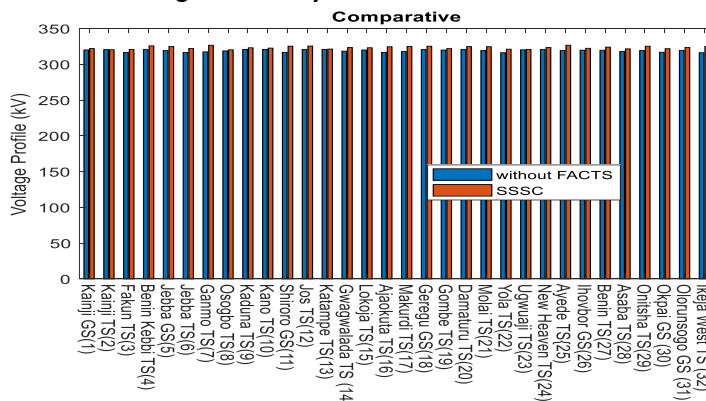


Fig.3. Comparative bar charts of steady state voltage without and with SSSC

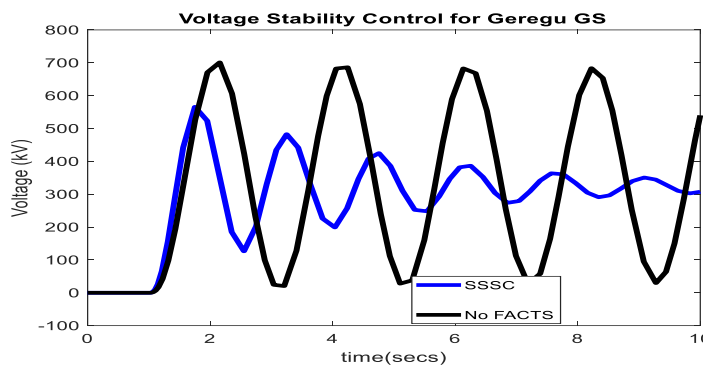


Fig.4. Voltage stability of the Geregu GS

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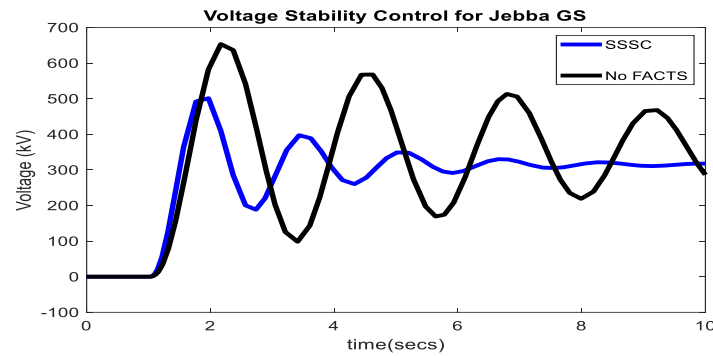


Fig.5. Voltage stability of Jebba GS

V. CONCLUSIONS

The major issue with increase in voltage instability has always been due to the power flow congestion and load imbalance as a result of increase in load demand. Static Synchronous Series Capacitors (SSSC) FACTS device was implemented in this study to improve the voltage stability of the power system network. The power system network was modeled and simulated and the voltage profile was obtained and utilized in generating the polynomial relationship between the voltage and the distance of the interconnected system. An optimal location was obtained when the model was subjected to Particle Swarm Optimization (PSO) technique to determine the optimal location which was on the line connecting Jebba and Shiroro GS buses. With the implementation of SSSC, both steady state voltage and dynamic voltage improvements were recorded.

REFERENCES

- 1) Abunike, E. C., Umoh, G. D., Nkan, I. E., & Okoro, O. I. (2021). Investigating the magnetic characteristics of 12/8 switched reluctance motor for enhanced starting torque. *Nigerian Journal of Technological Development*, 18(1), 70-75.
- 2) Abunike, E. C., Umoh, G. D., Okpo, E. E. & Okoro, O. I. (2020). A comparative approach for the analysis of switched reluctance motors with modified rotor pole geometry. *Nigerian Journal of Engineering*, 27(3).
- 3) Adebayo, I. G., & Sun, Y. (2021). Application of Network Structural Properties of a Power System for Voltage Stability Assessment in an Electric Power Grid. *International Conference on Sustainable Energy and Future Electric Transportation (SEFET)*. Hyderabad, India.
- 4) Awah, C. C., Okoro, O. I., Nkan, I. E., & Okpo, E. E. (2023). Impact of structural dimensions and poles on the torque performance of dual-stator permanent magnet machines. *Nigerian Journal of Technological Development*, 19(1), 68-79.
- 5) Constante, G., & Wang, J. (2018). Hierarchical Mechanism of Voltage Instability with Active Distribution Networks. *Clemson University Power Systems Conference (PSC)*. Charleston, SC, USA.
- 6) Das, S., & Panigrahi, B. K. (2020). Detection and Prevention of Voltage Instability Using PMU Data for Secured Operation of Power Systems. *IEEE Kansas Power and Energy Conference (KPEC)*. Manhattan, KS, USA.
- 7) Dong, Y., Xie, X., Zhou, B., Shi, W., & Jiang, Q. (2016). An Integrated High Side Var-Voltage Control Strategy to Improve Short-Term Voltage Stability of Receiving-End Power Systems. *IEEE Transactions on Power Systems*, 31(3), 2105-2115.
- 8) Edifon, A. I., Nkan, I. E., & Ben, I. A. (2016). Estimation and ranking of the photovoltaic energy potential for local government areas in Akwa Ibom State, Nigeria. *Science Journal of Energy Engineering*, 4(6), 68-77.
- 9) Ezeonye, C. S., Nkan, I. E., Okpo, E. E., & Okoro, O. I. (2022). Dynamic analysis and computer simulation of interior permanent magnet synchronous motor with intermittent loading. *Nigerian Journal of Technology (NIJOTECH)*, 41(1), 148-157.
- 10) Ezeonye, C. S., Okpo, E. E., Nkan, I. E., & Okoro, O. I. (2020). Effects of saliency and core losses on the dynamic behaviour of permanent magnet synchronous motor. *Bayero Journal of Engineering and Technology (BJET)*, 15(3), 124-133.
- 11) Fu, Q., Du, W., Wang, H., Zheng, Z., & Xiao, X. (2023). Impact of the Differences in VSC Average Model Parameters on the DC Voltage Critical Stability of an MTDC Power System. *IEEE Transactions on Power Systems*, 38(3), 2805-2819.
- 12) Hu, Y., Yang, X., Gu, W., Lang, Y., Wu, X., & Yu, Y. (2019). Identification of Power Angle Instability and Transient Voltage Instability Based on Deep Learning. *3rd Conference on Energy Internet and Energy System Integration (EI2)*. Changsha, China.

Application of SSSC for Voltage Stability Improvement in the Nigerian 330 kV Transmission System using Particle Swarm Optimization Technique

- 13) Huang, T., Ma, J., & Wang, W. (2014). Study on transient voltage stability of wind farm incorporated system with reactive power compensation device. *International Conference on Power System Technology*. Chengdu, China.
- 14) Huang, W., Hill, D. J., & Zhang, X. (2020). Small-Disturbance Voltage Stability of Power Systems: Dependence on Network Structure. *IEEE Transactions on Power Systems*, 35(4), 2609-2618.
- 15) IanȚoc, A. G., Bulac, C., PicioaroagĂ, I., Sidea, D. O., & Triștiu, I. (2021). Singular Value Decomposition Based Approach for Voltage Stability Assessment in Power Distribution Systems. *10th International Conference on ENERGY and ENVIRONMENT (CIEM)*. Bucharest, Romania.
- 16) Innocent, U. O., Nkan, I. E., Okpo, E. E., & Okoro, O. I. (2021). Dynamic response evaluation of a separately excited dc motor. *Nigeria Journal of Engineering*, 28(2), 56-61.
- 17) Innocent, U. O., Nkan, I. E., Okpo, E. E., & Okoro, O. I. (2021). Predicting the stability behaviour of three-horse power induction motor using eigenvalue method. *Bayero Journal of Engineering and Technology (BJET)*, 16(2), 66-81.
- 18) Ismail, B., Wahab, N. I., Othman, M. I., & Radhan, M. A. (2022). New Line Voltage Stability Index (BVSI) for Voltage Stability Assessment in Power System: The Comparative Studies. *IEEE Access*, 10, 103906-103931.
- 19) Izuogunam, F. I., Okafor, E. N., & Ogbogu, S. O. (2011). Multimachine transient stability analysis of the expanded 49 bus, 330KV Nigeria power system. *3rd IEEE International Conference on Adaptive Science and Technology (ICAST 2011)*. Abuja Nigeria.
- 20) Jameson, F. P., Nkan, I. E., & Okpo, E. E. (2024). Improvement of power transfer capability of Nigeria national grid with TCSC FACTS controller. *American Journal of Engineering Research (AJER)*, 13(1), 37-43.
- 21) Kettner, A. M., & Paolone, M. (2019). A Generalized Index for Static Voltage Stability of Unbalanced Polyphase Power Systems Including Thévenin Equivalents and Polynomial Models. *IEEE Transactions on Power Systems*, 34(6), 4630-4639.
- 22) Li, Y., Liu, H., Fan, Y., Tian, X., Xiao, Y., & Wang, C. (2020). Research on the Technology Requirement of Distributed Renewable Energy AC/DC Output System and Network Voltage Coordinated Control. *IEEE 4th Conference on Energy Internet and Energy System Integration (EI2)*. Wuhan, China.
- 23) Milano, F. (2016). On Current and Power Injection Models for Angle and Voltage Stability Analysis of Power Systems. *IEEE Transactions on Power Systems*, 31(3), 2503-2504.
- 24) Natala, H., Nkan, I. E., Okoro, O. I., & Obi, P. I. (2023). Investigation of the transfer capability of the Nigerian 330 kV, 58-bus power system network using FACTS devices. *ELEKTRIKA-Journal of Electrical Engineering*, 22(1), 53-62.
- 25) Negnevitsky, M., Voropai, N., Kurbatsky, V., Tomin, N., & Panasetsky, D. (2013). Development of an intelligent system for preventing large-scale emergencies in power systems. *IEEE Power and Energy Society General Meeting*. Vancouver, BC, Canada.
- 26) Nelson, F. C. & Odion, J. (2023). Core loss reduction in induction motor using finite element analysis. *Journal of Multidisciplinary Engineering Science and Research (JMESR)*, 2(9), 242-247.
- 27) Nkan, I. E., & Okpo, E. E. (2016). Electric power forecasting by the year 2020 using the least square method. *International Journal of Research and Advancement in Engineering Science*, 6(1), 205-215.
- 28) Nkan, I. E., Okoro, O. I., Awah, C. C., & Akuru, U. B. (2019). Investigating the dynamic stability of the Nigerian 48bus systems for improved system performance using FACTS. *27th Domestic use of Energy Conference*. South Africa.
- 29) Nkan, I. E., Okoro, O. I., Awah, C. C., & Akuru, U. B. (2019). Investigating the steady state stability of the nigerian 48-bus systems using FACTS devices. *Nigerian Journal of Technology (NIJOTECH)*, 38(3), 732-743.
- 30) Nkan, I. E., Okoro, O. I., Obi, P. I., Awah, C. C., & Akuru, U. B. (2019). Application of FACTS devices in a multi-machine power system network for transient stability enhancement: A case study of the Nigerian 330 kV 48-bus system. *IEEE AFRICON*. Accra, Ghana.
- 31) Nkan, I. E., Okpo, E. E., & Inyang, A. B. (2023). Enhancement of power system transient stability with TCSC: A case study of the Nigerian 330 kV, 48-bus network. *International Journal of Multidisciplinary Research and Analysis*, 6(10), 4828-4841.
- 32) Nkan, I. E., Okpo, E. E., & Okoro, O. I. (2020). Multi-type FACTS controllers for power system compensation: A case study of the Nigerian 48-bus, 330 kV system. *Nigerian Journal of Technological Development*, 63-69.
- 33) Nkan, I. E., Okpo, E. E., & Okpura, N. I. (2023). Optimum location of shunt FACTS devices for enhancement of power system loadability using continuation power flow. *International Multilingual Journal of Science and Technology (IMJST)*, 8(9), 6666-6674.

Application of SSSC for Voltage Stability Improvement in the Nigerian 330 kV Transmission System using Particle Swarm Optimization Technique

- 34) Nkan, I. E., Okpo, E. E., Akuru, U. B., & Okoro, O. I. (2020). Contingency analysis for improved power system stability of the Nigerian 330 kV, 48-bus system using series FACTS controllers. *AIUE Congress: International Conference on Use of Energy*. South Africa.
- 35) Oduleye, A. E., Nkan, I. E., & Okpo, E. E. (2023). High impedance fault detection and location in the Nigerian 330 kV transmission network using adaptive neuro-fuzzy inference system. *International Journal of Multidisciplinary Research and Analysis*, 6(11), 5390-5398.
- 36) Okoro, O. I., Abunike, C. E., Akuru, U. B., Awah, C. C., Okpo, E. E., Nkan, I. E., . . . Mbonwe, M. J. (2022). A Review on the State-of-the-Art Optimization Strategies and Future Trends of Wound-Field Flux Switching Motors. *IEEE PES/IAS PowerAfrica*. Kigali, Rwanda.
- 37) Okpo, E. E., & Nkan, I. E. (2016). Construtional features and performance analysis of 3-phase linear induction motor. *International Journal of Scientific Innovations and Sustainable Development* , 6(1), 176-185.
- 38) Okpo, E. E., Nkan, I. E., Okoro, O. I., & Akuru, U. B. (2021). Winding reconfiguration of 5.5 kW three-phase induction motor for improved performance. *IEEE PES/IAS PowerAfrica*. Nairobi, Kenya.
- 39) Okpo, E. E., Okoro, O. I., Awah, C. C. & Akuru, U. B. (2019). Performance evaluation of 5.5 kW six-phase asynchronous motor. *IEEE PES/IAS PowerAfrica, Abuja, Nigeria*, 639-644.
- 40) Okpo, E. E., Okoro, O. I., Awah, C. C. & Akuru, U. B. (2020). Investigating the dynamic behaviour of a six-phase induction motor under unbalanced faults. *IEEE PES/IAS PowerAfrica, Nairobi, Kenya*, 2020, 1-5.
- 41) Olanite, O. A., Tola, O. J., Nwohu, M. N., & Adegboye, B. A. (2023). Grid Integration of Wind Power System for Voltage Stability Enhancement. *2nd International Conference on Multidisciplinary Engineering and Applied Science (ICMEAS)*. Abuja, Nigeria.
- 42) Olarewaju, R. O., Ogunjuyigbe, A. S., Ayodele, T. R., Mosetlhe, T. C., & Yusuff, A. A. (2023). Assessing the Voltage Stability of Power System in the Presence of Increasing Solar PV Penetration. *IEEE AFRICON*. Nairobi, Kenya.
- 43) Omorogiuwa, E. & Okpo, E. E. (2015). PV-diesel hybrid power system for a small village in Nigeria. *International Journal of Scientific Research Engineering Technology*, 1(4).
- 44) Otu-Acheampong, D., Rashed, G. I., Haider, H., & Mensah, A. A. (2022). Using Artificial Bee Colony Algorithm for STATCOM sizing and placement to Prevent Voltage Instability on Pakistan Power System. *7th Asia Conference on Power and Electrical Engineering (ACPEE)*. Hangzhou, China.
- 45) Triștiu, I., Iantoc, A., Poștovei, D., Bulac, C., & Arhip, M. (2019). Theoretical analysis of voltage instability conditions in distribution networks. *54th International Universities Power Engineering Conference (UPEC)*. Bucharest, Romania.
- 46) Williams, E. A., Okpo, E. E., & Nkan, I. E. (2023). Performance evaluation of induction motor behaviour on conventional and PV system sources. *International Journal of Multidisciplinary Research and Analysis*, 6(12), 5500-5511.
- 47) Zhang, W., Fu, S., Diao, Y., Sheng, W., & Jia, D. (2018). A Situation Awareness and Early Warning Method for Voltage Instability Risk. *China International Conference on Electricity Distribution (CICED)*. Tianjin, China.



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The Effect of Three Depths of Mechanical Seed Drill (Gaspardo SC-250) on the Performance of *Vicia Faba* L. Bean for Yield Characteristics and Components



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ABSTRACT: Current study was conducted on a farm in two sites: the center of Kirkuk Governorate and Hawija District, during the 2022–2023 agricultural season. It focused on two factors: the seeding depths of the Gaspardo SC-250 machine (at 2, 3, and 6 cm) and three varieties (local, Yildiz, and Aquadulce). The land was divided according to a randomized complete block design (RCBD) according to a split-plot system with three replicates. The study allocated the sowing depth factor to the main panels and the variety factor to the secondary panels. The findings showed a notable improvement in yield characteristics and components when sowing depths were increased at both sites. It was observed that the total yield of dry seeds was significantly influenced by sowing depths at both sites, with D3 showing superior results, producing 2074.91 kg/ha and 7854.71 kg/ha, respectively. We observed that the Aquadulce variety had the highest yield rate, producing 5503.64 kg/ha and 7441.37 kg/ha, respectively. There was a significant impact of sowing depths and varieties on this trait at both sites. Specifically, at the Kirkuk site, the Aquadulce variety had the highest yield at depth D1, with 8413.83 kg/ha. At the Hawija site, the Aquadulce variety outperformed the other varieties at depth D3, yielding 9863.83 kg/ha. This superior performance was attributed to the quality of its components, resulting in a significant increase in the final yield.

KEYWORDS: Gaspardo, randomized complete block design, Aquadulce, split-plot system, variety factor

I. INTRODUCTION

Broad bean (*Vicia faba* L.) is an important crop in the leguminous family because its seeds contain a high percentage of protein, ranging between 23 and 45% (Stan, 1997). These seeds are used as fodder for animals, either as plant remains after harvest or as dried seeds in concentrated diets to provide protein. (Al-Fakhry, 1981). In addition, it plays an important role in improving the properties of the soil by fixing atmospheric nitrogen through the root nodule bacteria that coexist with it, and it contains quantities of sugars, starches, and some vitamins. (FAO, 2003) (Matloub et al., 1989). Several studies indicate that the Mediterranean is the origin of the bean (Sumerfield and Roberts, 1985). China is one of the largest countries when it comes to production and consumption, followed by Ethiopia. China produces 2.7 million tons of beans per year, which is 65% of global production, followed by Ethiopia at 9% and Egypt at 262,000 tons per year. In these countries, beans are consumed as a staple food for the poor (FAO, 2003). In Iraq, the production rates are low per unit area. In 2020, the total cultivated area was 12,510 acres, and the production included 10,876 tons of dry pods and 144,300 tons of green pods. The average productivity for dry pods was 869.2 kg per acre. (Central Bureau of Statistics: 2020).

Studies have indicated that depths of sowing directly affect the height and fall of the plant, as they vary according to the genetic composition of the cultivated varieties (Hasan and Abdullah, 2021). The diameter and length of the internodes in a given variety may allow for an increase in nodes and will be less affected by increased vegetation cover. Attiya et al. (1983) reported that the yield per plant decreases as sowing depths increase. Numerous studies have been carried out in this field, such as the research conducted by Kakahy et al. (2012), which examined the impact of different sowing depths on bean yield under a drip irrigation system using three varieties: Spanish, Turkish, and local. The study also looked at three planting distances of 20, 25, and 30 cm. The Spanish variety showed the highest average number of seeds per pod (3.12 seeds/pod). Yucel (2013) mentioned in his study the depths of sowing for the production of local bean varieties, and he used four local varieties and four distances of 5, 10, 15,

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and 20 cm. Since a depth of 10–12 cm was shown to be optimal for crop length under such circumstances, there were no discernible variations between types with respect to yield parameters or some of their components. The impact of different planting depths on bean yield and its components was also discovered by Derogar and Mojaddam (2014). Their investigation used three different depths: 8, 12, and 16 plants/m². The findings demonstrated that compared to other types, the Barekat cultivar produced much more seeds when planted at a depth of 12 plants/m². The 100 seeds weighed more and the plant produced more pods as a result of this depth. Over the course of two growing seasons, researchers from the College of Agriculture at Sudan University of Science and Technology (Osman et al., 2013) examined four distinct bean cultivars. Neither the yield nor the pod density per plant varied much between the two locations. Nevertheless, there were notable variations in the amount of seeds produced per plant and the weight of 100 seeds; the Selaim variety stood out from the others in this respect.

Abbas et al. (2014) pointed out when they studied some new genetic compositions in the growth of beans and the differences in sowing depths in Egypt, where they used the varieties Assiut-159, Assiut-125, Assiut-215, Roomy-3, and Roomy-8, and their results showed that the Assiut-125 variety was superior in terms of dry seed weight, 2.1 tons/acre, whereas the Roomy-3 variety was superior in terms of the highest green yield, 10.5 tons/acre. Accordingly, this study aims at investigating the effect of three depths of mechanical seeding drill (Gaspardo SC-250) on the performance of Vicia faba L. legume varieties for yield characteristics and components.

II. MATERIALS AND METHODS

This study was conducted at two sites: the center of Kirkuk Governorate in one of the citizens' farms and Hawija district, Mahooz village, for the agricultural season 2022-2023. The study included two factors: the first was the depths of the mechanical seeding drill (Gaspardo SC-250), which were used (2–4–6 cm) and were denoted (D1, D2, and D3), respectively. The second factor is the range of varieties (local, Yildiz, and Aquadulce). The land was prepared by plowing in two perpendicular plows, then the soil was smoothed to prepare a suitable bed for the seeds, and superphosphate fertilizer was added to the soil before sowing at a rate of 70 kg. Ha⁻¹ Al-Mayouf (1982). The land was divided into experimental units according to the randomized complete block design (RCBD) according to the split plot system with three replicates. The factor of sowing depths was distributed on the main panels and the varieties on the secondary panels, so that the number of experimental units was (9) ones. The experimental unit included 3 screws with a length of 3 m. 2-3 seeds were placed in each hole, and the distance between each hole was 25–30 cm. After the seedlings appeared, the reducing process was carried out so that each hole had one plant. Weeds were manually controlled twice during the season for both sites, and the plants were fertilized directly with urea fertilizer (44 kg/ha) in two batches: the first was after germination and the second was at the beginning of the blooming stage. (Boras et al. 2006). The irrigation process was carried out according to the plant's needs, and the following characteristics were studied: the number of pods per plant, the number of seeds per pod, the weight of 100 seeds, and the total yield of dry seeds (kg/ha) (Hasan and Abdullah, 2021).

III. STATISTICAL ANALYSIS

The data was analyzed statistically using the ready-made statistical program (SAS) to investigate the effect of sowing depths, bean varieties, and the interactions between them on the studied qualities. The least significant difference test was also used to compare the means by using the same program (SAS). (Abdullah and Hasan, 2021).

Results and discussion:

Number of pods in the plant

Table 1 shows that the number of pods in the plant at the Hawija site was not significantly affected by the sowing depths, with depth D2 reaching the highest number of pods (7.87 pods) and depth D3 having the lowest number of pods (6.77 pods). As for the Kirkuk site, the depth of sowing had a significant effect on the number of pods in the plant, as depth D3 was the highest with 15.61 pods, whereas depth D1 was the lowest depth in terms of the number of pods in the plant with 9.42 pods. The reason for this may be attributed to the ease of movement of insects and the occurrence of pollination at small depths rather than at greater depths, due to the speed of plant growth, which limits the movement of insects. Consequently, the pollination rate, particularly cross-pollination, in this crop is reduced by 42–36%. There is also competition for environmental resources among plants at the depths studied for cultivation. (Kambal, 1969) and (Younis et al., 2022) The results align with Al-Jubouri and Ali's findings in 2012, indicating that the interaction between sowing depths and varieties significantly affected the number of seeds per pod at both sites. In Kirkuk, the Aquadulce variety performed best at depth D3, producing 9.16 seeds per pod, while the

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Yildiz variety had the lowest yield at the same depth, with 5.06 seeds per pod. Meanwhile, at the Hawija site, the Yildiz variety at depth D3 had the highest yield with 14.86 seeds per pod, whereas the Yildiz variety at depth D1 had the lowest yield with 7.5 seeds per pod.

Table 1: Number of seeds in the pod

The depths of the seeding machine Varieties	Kirkuk				Hawija					
	D1	D2	D3	Rate of varieties	D1	D2	D3	Rate of varieties		
Local	7.16	7.28	6.1	6.84	8.53	11.1	17.23	12.28		
Yildiz	6.66	8.23	5.06	6.65	7.5	9.56	14.86	10.64		
Aquadulce	8.63	8.1	9.16	8.63	12.24	12.98	14.76	13.32		
Rate of depth	7.48	7.87	6.77		9.42	11.21	15.61			
L.S.D varieties 1.395=	interaction L.S.D 2.245=		sowing L.S.D 0.915=depths		L.S.D interaction 0.695=		L.S.D sowing depths 0.283=		varieties L.S.D 0.404=	

Table (2) shows that sowing depths and varieties did not have a significant effect on the number of seeds per pod at the Kirkuk site. On the other hand, the Hawija site had the best D2 distance (7.11 seeds/pod) and the worst D1 depth (6.87 seeds/pod). In contrast, in the Hawija site, the pods with the most seeds per pod were found at the D3 depth (15.61), while the pods with the fewest seeds per pod were found at the D1 level (9.42). Aquadulce variants had 8.63 seeds per pod at one location and 13.32 seeds per pod at the other, demonstrating a significant variation in this attribute across the types. At both locations, the Yildiz cultivar had the fewest seeds per pod, measuring 6.65 and 10.64, respectively. This might be because this characteristic is generally fixed genetically, and it varies from variation to variety. Dahmardeh and Ramroodi (2010), Bakry et al. (2011), Hasan and Abdullah (2020), Hasan et al. (2022), Muhammad et al. (2021), and Younis et al. (2022) all agree with these findings, although Al-Jubouri (2016) disagrees.

Table 2: Weight 100 seeds/g

The depths of the seeding machine Varieties	Kirkuk				Hawija					
	D1	D2	D3	Rate of varieties	D1	D2	D3	Rate of varieties		
Local	6.83	6.97	5.25	6.35	6	5.74	4.96	5.56		
Yildiz	7.34	6.68	7.27	7.09	5.23	6.32	4.97	5.50		
Aquadulce	6.29	7.68	8.11	7.36	5.21	5.87	5.77	5.61		
Rate of depth	6.82	7.11	6.87		5.48	5.97	5.23			
L.S.D varieties =0.142	L.S.D sowing depth=0.097		L.S.D interaction =0.265		L.S.D varieties =0.187		L.S.D sowing depths =0.154		L.S.D interaction =0.312	

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The interaction between sowing depths and varieties significantly affected the number of seeds per pod at both sites. At the Kirkuk site, the Aquadulce variety had the highest number of seeds per pod at depth D3, with 8.11 seeds per pod, while the local variety at the same depth had the lowest at 5.25 seeds per pod. At the Hawija site, the Yildiz variety at depth D1 had the highest number of seeds per pod at 6.32, whereas the Aquadulce variety had the lowest at 5.21 seeds per pod at the same depth.

Table (2) The effect of sowing depths, varieties, and the interaction between them on the number of seeds per pod in the two sites.

It is revealed from the results in Table (3) that increasing sowing depths did not significantly affect the weight of 100 seeds at the Kirkuk site. However, at the Hawija site, sowing depths were significantly affected, as Depth D3 had the highest weight for the 100 seeds, reaching 105.49 grams, while Depth 2D had the lowest values at 97.38 grams. Also, the Aquadulce type did far better at both locations; its average weight was 109.16 grammes at the first site and 110.38 grammes at the second. Out of the two locations, the Yildiz variety had the lightest 100-seed weight at 93.83 g, 109.16 g, and 99.38 g, respectively.

The reason for this may be attributed to the small number of plants due to uneven growth as a result of the great depth, which leads to reducing competition for food by the farmers, causing a high deposition of nutrients in the seeds. Moreover, increasing the depth among plants leads to reducing the efficiency of light interception of sunlight and increasing the efficiency of photosynthesis (Thalji, 2006; Abdullah and Hasan, 2021). It is also noted that the interaction between sowing depths and varieties was significant in terms of seed weight for both sites. At the Kirkuk site, the local variety at depth D1 had the highest rate, amounting to 115.5 g, whereas the local variety was the lowest at depth D2, as it had 84.83 g. At the Hawija site, the local variety at depth D3 had the highest average weight of 100 seeds, which amounted to 125.83 grams. On the other hand, the Yildiz variety was the lowest at depth D1, weighing 84.5 grams. The result agrees with Hasan and Abdullah (2020), Hasan et al. (2022), Muhammad et al. (2021), and Younis et al. (2022).

Table (3) The effect of sowing depths, varieties, and the interaction between them on the weight of (100) seeds/g of dry seeds in the two study sites.

Table 3: Total yield (kg/ha)

The depths of the seeding machine Varieties	Kirkuk				Hawija				
	D1	D2	D3	Rate of varieties	D1	D2	D3	Rate of varieties	
Local	115.5	84.83	110.83	103.72	103.83	99.83	125.83	109.83	
Yildiz	89.5	98.83	93.16	93.83	84.5	113.83	99.83	99.38	
Aquadulce	106.5	108.5	112.5	109.16	119.16	104.16	107.83	110.38	
Rate of depth	103.83	97.38	105.49		102.49	105.94	111.16		
L.S.D varieties =2.125	L.S.D interaction =3.512		L.S.D sowing depths =1.421		L.S.D interaction =3.426		L.S.D sowing depths=1.382		L.S.D varieties =1.943

Table (4) shows that the total yield of dry seeds was significantly affected by the sowing depths. In both sites, the depth D3 exceeded the total yield of dry seeds (kg/ha), as it had (2074.91 kg/ha) and (7854.71 kg/ha), respectively. The depth D2, on the other hand, had the lowest rate at (4401.83 kg/ha) and (4547.35 kg/ha), respectively. There might be a correlation between the number of branches per unit area and the increase in the total yield at short distances. This helps in producing more pods, which reflects positively on the yield, especially if the nutrients are sufficiently available to the plant. (Chaieb et al., 2011).

It is noted from Table (4) that the average total yield of dry seeds varies according to the varieties studied. The differences among the varieties were significant, with the Aquadulce variety giving the highest rate of 5503.64 kg/ha and 7441.37 kg/ha, respectively. However, the Yildiz variety had the lowest rates of 3595.78 kg/ha and 4972.29 kg/ha, respectively. The reason for this discrepancy among varieties is attributed to their various genetic structures. Table 4 also shows a significant effect of the interaction of sowing depths and varieties on the average of this characteristic in both sites. It is noted at the Kirkuk site that the Aquadulce variety had the highest rate of this characteristic at depth D1, amounting to 8413.83 kg/ha, whereas the local variety at depth D3 had the lowest rate of total dry seed yield, amounting to 1417.13 kg/ha. As for the Hawija site, the Aquadulce

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variety outperformed the rest of the varieties in this characteristic at depth D3, reaching (9863.83 kg/ha), whereas the Yildiz variety was the lowest in this average at depth D2, reaching (3812.16 kg/ha).

Table 4: Sowing depths, varieties, and the interaction between them for the total yield (kg/ha) of seeds in the two sites

The depths of the seeding machine Varieties	Kirkuk				Hawija				
	D1	D2	D3	Rate of varieties	D1	D2	D3	Rate of varieties	
Local	5617.16	5275.83	1417.13	4103.37	4121.5	4022.7	7075.16	5073.12	
Yildiz	6147.16	2820.83	1819.36	3595.78	3812.16	4479.56	6625.16	4972.29	
Aquadulce	8413.83	5108.83	2988.26	5503.64	7320.5	5139.8	9863.83	7441.37	
Rate of depth	6726.05	4401.83	2074.91		5084.72	4547.35	7854.71		
L.S.D varieties =122.301	L.S.D interaction =211.830		L.S.D sowing depths=86.478		L.S.D interaction =666.084		L.S.D sowing depths =271.927		L.S.D varieties 384.563

IV. CONCLUSIONS

According to the results revealed, it was shown that D3 and the Aquadulce variety were superior in all the studied characteristics in comparison to other varieties for both sites. After conducting numerous studies in different locations and seasons, it is possible to benefit from this genetic composition because Aquadulce possesses the majority of the studied characteristics. This genetic composition can then be used in hybridization programs with other varieties in order to transfer desirable genes to other varieties. Additionally, a number of genetic tests were carried out on this variety to ascertain the degree of its resistance to various environmental conditions.

REFERENCES

- 1) Abbas, H. S., A. G. Haridy and M. S. S. Abdel-Rahman, (2014). Testing of New Genotypes of Faba Bean Grown at Different plant Densities .Asian Journal of crop Science .
- 2) Abdullah, R. M., Hasan, S.A. (2021). Estimation of components of genetic variance using Jinks-Hayman method analysis on the crop of faba bean (Vicia faba L.) . Int. J. Agricult. Stat. Sci. 16(1); pp. 1897-1903 .
- 3) Al-Fakhri, A, Q. (1981). Dry farming, its foundations and elements of its investment. Dar Al-Kutub for Printing and Publishing - University of Mosul: 388 pages.
- 4) Al-Jubouri, R, M,. A. (2016). Genetic analysis and evaluation of some promising genotypes and the synthetic variety derived from them for salt tolerance in beans (Vicia faba L.), PhD thesis, College of Agriculture - Tikrit University.
- 5) Attiya, H. J., R. J. Field and G. D. Hill.(1983). Effect of PP333 and TIBA growth regulators on development and yield component of spring sown field beans (vicia faba L.) proceedings Agronomy Society of N.Z.13 P81-86.
- 6) Bakry, B.A., T.A. Elewa, M.F. El karamany, M.S. Zeidan and M.M. Tawfik. (2011). Effect of row spacing on yield and its components of some faba bean varieties under newly reclaimed sandy soil condition. World J. Agric. Sci. 7 (1): 68-72.
- 7) Central Bureau of Statistics (2020). Production of crops and vegetables. Directorate of Agricultural Statistics, Planning Authority - Council of Ministers - Republic of Iraq.
- 8) Chaieb, N.; M. Bouslama and M. Mars (2011). Growth and yield parameters variability among faba bean (Vicia faba L.) genotypes , J. nat. prod. Plant resour., 1(2):81-90.
- 9) Dahmardeh, M., Ramroodi, M. (2010). Effect of plant density and cultivars on growth, yield and yield components of faba bean (Vicia faba L.). African Journal of Biotechnology. 9(50): 8643-8647.
- 10) Derogar, N , Mojaddam, M(2014). Effect of plant density on grain yield and yield components in faba bean . International Journal of Plant, Animal and Environmental Sciences.4(2):92-96.
- 11) FAO.(2003). Data base: Rome, Italy.
- 12) Hasan, S.A., Abdullah, R.M.. (2020) Estimating the performance and gene action of a number of individual genotypes and hybrids on the crop of faba bean (Vicia faba L.) . Plant Archives Volume 20 No. 2, pp. 8981-8988.

The Effect of Three Depths of Mechanical Seed Drill (Gaspardo SC-250) on the Performance of Vicia Faba L. Bean for Yield Characteristics and Components

- 13) Hasan, S.A., Abdullah, R.M.. (2021) Characterization of Genetic Variability Through The use of Rapsds Markers, of A Group of Native and Commercial Genotypes of Bean Species. International Journal of Agricultural and Statistical Sciences. this link is disabled, 2021, 17, pp. 1141–1147
- 14) Hasan, SA Abdullah, RM Hanoon, MB. (2022) Effect of foliar application with proline on growth, yield, and quality of faba bean (*Vicia Faba L.*) (A review) . European Journal of Agricultural and Rural Education (EJARE). Vol. 3 No. 3, March 2022 ISSN: 2660-5643.
- 15) Kakahy, Amer N. N. Ahmad D. and Abdullahi A. S.(2012). The effect of planting distance on yield of beans (*Vicia faba L.*) under drip irrigation system . African Journal of Agricultural Research Vol. 7(46), pp. 6110-6114.
- 16) Kambal, A. E (1969). Components of yield in field bean (*Vicia faba L.*) J.Agric.Sci.Camb.,72:359-363.
- 17) Muhammad, NI. Humada, YH. Abdullah, RM . (2021) . Using phenotypic and molecular indicators RAPD-PCR to evaluate the performance and genetic dimension of a number of genotypes and their individual hybrids in the chickpea plant *Cicer arietinum L.* . NVEO-NATURAL VOLATILES & ESSENTIAL OILS Journal| NVEO . Nat. Volatiles & Essent. Oils, 2021; 8(4): 11786-11810.
- 18) Osman,A,A,M. Abdel Aziz,A,H. Gailani,M,B.(2013). Correlation between Seed Yield and Yield Components in Faba Bean (*Vicia faba L.*). Advances in Environmental Biology, 7(1): 82-85.,
- 19) Salih, F. A. ; Sarra, AA, and Salih. S. H. (1993) Performance of faba bean genotypes in the Jebel marra area. Fabis Newsletter No, 33: 3-7 .
- 20) Stan, B. (1997). Alberta update –PMAPC(1997). Manitoba Agric. And Food:1-15.
- 21) Summerfield, Rg. and E. H. Roberts (1985). Grain legume crops. Collins print.pp.199-266
- 22) Thalji, T. (2006). Impact of row spacing on faba bean , growth under Mediterranean rainfed conditions . Journal of Agronomy 5(3):527-532.
- 23) Matloub, Adnan Nasser, Izz al-Din Sultan Muhammad, and Karim Saleh Abdul (1989). Vegetable production (Part Two). Ministry of Higher Education and Scientific Research, University of Mosul.
- 24) Younis, H. S. Abdul Sattar, A. A. and Amer K. Z. Abdullah, R.M. Hassan, A. S. (2022) Effect of biological and cultivar control to Ear- Cockle Nematode disease caused by the nematode (*Anguina tritici*) on different genotypes of bread wheat (*Triticum aestivum L.*) Annuals of Forest Research .65(1): 916-930, 2022.
- 25) Younis, H.S., Abdullah, R.M., Hasan, S.A., Abdul-Sattar, A.A. (2022) Systemic resistance Indicators Study and Seed gall nematode disease Caused by Angina Tritice Affecting of Biological and Varietal treatments on bread wheat (*Tritium aestlvum L.*) , International Journal of Agricultural and Statistical Sciences. This link is disabled, 2022, 18(1), pp. 289–296 .
- 26) Yucel DO (2013). Optimal intra-row spacing for production of local faba bean (*Vicia faba L.*Major) cultivars in the Mediterranean conditions. Pak. J. Bot., 45(6):1933-1938.



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Global Diversity Character Habituation Profil Pelajar Pancasila in Islamic-Based Schools from the Perspective of Pierre Bourdieu and Clifford Geertz



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ABSTRACT: This research is based on the phenomenon of conflict with a background of differences. Indonesia, as a multicultural country that has the ideology of Pancasila and Bhinneka Tunggal Ika, in fact still often experiences discrimination, domination, and other problems that end in conflict and violence. Indonesia's cultural wealth in the form of local wisdom is now starting to be eroded due to the influence of globalization. Society began to focus on Western cultures. This research aims to describe the process of habituating the character of global diversity in the younger generation, especially students through educational institutions. Based on the theory of Pierre Bourdieu and Clifford Geertz, the researcher tries to describe the implementation of strengthening the global diversity character of the Profil Pelajar Pancasila in Islamic-based schools in the city of Surakarta. This research is research with a descriptive qualitative approach. The results of this research explain that Profil Pelajar Pancasila is a competent lifelong learner, has character, and behaves according to Pancasila's values. In connection with Pierre Bourdieu's theory, educational institutions are referred to as arenas (fields). Furthermore, global diversity includes openness and tolerance towards foreign cultural diversity while still respecting culture. This concept is by Clifford Geertz's theory that culture is a symbolic system, so cultural processes must be read, translated, and interpreted. The success of characterizing global diversity is influenced by family socialization and teacher example, both of which, according to Pierre Bourdieu, are structural actors/agents and are influenced by social heterogeneity which becomes social capital.

KEYWORDS: Profil Pelajar Pancasila, Global Diversity

I. INTRODUCTION

The development of the study of culture examines socio-political, religious, ethnic, gender, literary, and cultural issues themselves into an interrelated text. Sociocultural researchers such as Pierre Bourdieu and Clifford Geertz used this study as a criticism of scientific positivism in the modern era which upholds specialization. Bourdieu's thinking was influenced by various scientific disciplines including history, sociology, law, and criminology. Bourdieu's theory expresses "human practice" by combining actor/agent-centered theory and theory that emphasizes the structural dimensions that form society's social life or objectivism theory (Farid, 2021).

Bourdieu identified four elements forming social praxis, namely habitus, arena, symbolic violence, capital, and strategy. These four elements are epistemologically developed as tools for comprehensive analysis of socio-cultural phenomena in certain societal environments. The core of Bourdieu's thinking lies in the concepts of habitus and arena and the dialectical relationship between the two. Habitus is in the mind of the actor/agent while the arena is outside their mind (Lubis, 2014).

In connection with Bourdieu's thinking, Clifford Geertz also studied symbols. Geertz contributed many socio-cultural theories and had a major influence in changing the concept of anthropology to a concern within the framework of the meaning that humans live outside of their lives. In general, Geertz stated that humans and society are formed with certain symbols. Symbols include objects, events, qualities, actions, or everything related to conception, meaning that conception is a symbol (Geertz, 1993).

Geertz (Ramli, 2012) found that culture is closely related to symbols or emblems. It is with these symbols that humans convey thoughts, and feelings and communicate with each other. Culture does not occur with habits, but is based on a society's interpretation or interpretation of an experience. Geertz saw culture as a text so that interpretation needed to be carried out to

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capture the meaning contained in that culture. He sees culture as a network of symbolic meanings whose interpretation requires an in-depth description.

The brief review above will lead researchers to examine the basic differences between Habitus and Culture from the perspective of Pierre Bourdieu and Clifford Geertz. The concept of habitus and culture will be the basis for the author to study issues of discrimination, conflict, and violence against a background of diversity. The diversity of ethnicity, race, religion, language, and life values in Indonesia often results in various conflicts. The conflicts that have occurred in various regions of Indonesia show how fragile the sense of togetherness that is built to realize integration is. Indonesian society is still steeped in prejudice between groups and a low level of mutual respect or tolerance.

One of Indonesia's diversity that contains potential threats to the unity of the country is religion. The study (Yunus, 2014) stated that there were several major cases of religious conflict such as the Poso case in Ambon, Sunni cases in East Java, GKI Yasmin in Bogor, and so on. A study conducted by the Institute of Peace and Islamic Studies in big cities such as Jakarta, Bogor, Depok, Tangerang, and Bekasi found that almost 50% of 993 students committed violence in the name of religion (Kurniawan, 2018). Racial conflicts also often occur in several cities in Indonesia. Surakarta, which is currently ranked in the top 10 most tolerant cities, also has a dark history of racial conflict, namely between ethnic Chinese and native Javanese in Surakarta in 1998 (Istiqomah & Widiyanto, 2020). These threats of conflict are an encouragement to build public awareness to instill a fair attitude in responding to diversity. In the context of religion, to avoid conflict and disharmony it is necessary to foster a moderate, inclusive way of religion or an open religious attitude.

Efforts to build public awareness to be fair in diversity is a process of habituation that involves all aspects of the ideology of Pancasila and Bhinneka Tunggal Ika which have become entrenched in every generation, but Indonesia must not be careless in strengthening these values amidst the influence of globalization and westernization. Indonesian society is encouraged to have global diversity competencies from an early age. Global diversity is the future of Indonesian society with an open character, able to accept and utilize global diversity, experiences, and different cultural values in the world, without losing its unique characteristics (Yumaroh & Suranto, 2024).

One of the processes of habituation to global diversity is through educational institutions, both formal, informal, and non-formal. In Indonesia, an independent curriculum is currently running, known as the independent curriculum, through a transformational approach to learning values, namely the Profil Pelajar Pancasila (Aziz & Abdulkarim, 2023). Indicators of success in forming the Pancasila student character refer to Minister of Education and Culture Regulation Number 22 of 2020 concerning the Strategic Plan of the Ministry of Education and Culture for 2020-2024. Pancasila students are the embodiment of Indonesian students as lifelong learners who have global competence and behave according to Pancasila values, with six main characteristics, namely faith, devotion to God Almighty, noble character, global diversity, cooperation, independence, critical reasoning, and creativity.

Global diversity is one of the dimensions of Profil Pelajar Pancasila as a form of effort to preserve noble culture, identity, and locality and develop an open attitude in interaction with other cultures, able to instill an attitude of tolerance and not violate the noble culture of the Indonesian nation. Global diversity is the ability to develop an attitude of tolerance for diversity and mutual respect for all existing differences (Nurgiansah, 2022). Global diversity can encourage students' life orientation not only limited to tolerance but also love of traditions and traditional culture from various regions and can create sustainability of traditions and traditional culture itself (Ghozali, 2020). Based on the above explanation, the researcher focused the study on the process of forming a globally diverse character, the Profil Pelajar Pancasila at an Islamic-based school in the city of Surakarta, namely at Madrasah Aliyah Negeri 2 Surakarta.

II. METHOD

This research uses a qualitative approach. Qualitative research is a research process to understand human or social phenomena by creating a comprehensive and complex picture that can be presented in words, reporting detailed views obtained from informant sources, and carried out in a natural setting. This research then uses descriptive research. Descriptive research is research that explains the results of problem-solving based on data presentation, analysis, and interpretation (Fadli, 2021).

We call the subjects of this research informant or people who will provide information about the data that researchers want. We obtained these informants using a purposive sampling technique with the criteria that the informants were people who understood the concept and implementation of Profil Pelajar Pancasila character learning at Madrasah Aliyah Negeri 2 Surakarta, which included the Madrasah Head, Teachers, Students, and Student Guardians. Researchers will ask for permission first before digging up information by contacting informants either via official letters or via telecommunications media.

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Data source according to (Rahmadi, 2011) is defined as an object or person where the researcher observes, reads, or asks about certain information related to the research problem. This research uses primary and secondary data. Primary data is data obtained or collected by researchers directly from the data source. Secondary data is data obtained or collected by researchers from various existing sources (researchers as second hand) (Siyoto & Sodik, 2015).

This research uses data collection methods which include interviews, observation, and documentation. The researcher chose an in-depth interview technique using intense questions and answers to obtain explanations and gather in-depth information. Observation is used to observe the learning process to strengthen the character of the Profil Pelajar Pancasila. Researchers used participatory observation techniques by being directly involved in the learning process. This research will also use data collection methods in the form of documentation to investigate written documents such as learning documents such as teaching journals, teaching modules, grade recapitulation, and technical guidelines for implementing learning to strengthen the Profil Pelajar Pancasila. Furthermore, the data collection tools used by researchers are interview guidelines, observation guidelines, and document checklists.

Data analysis is the process of systematically searching and compiling data obtained from interviews, field notes, and documentation, by organizing data into categories, describing it into units, synthesizing it, arranging it into patterns, and choosing what is important and what is important. what will be studied, and make conclusions so that they are easily understood by yourself and others (Sugiyono, 2017). Data analysis takes place simultaneously with the data collection process with the flow of Miles and Huberman's stages. The data obtained is written in the form of a report or detailed data, then reduced, summarized, and important things are selected. The data obtained is categorized according to the main problem and is made in matrix form, making it easier to see patterns of relationship between one data and other data. Conclusion activities are a further step from data reduction and presentation activities. At this stage, the data will be temporarily concluded and then verified (Miles & Huberman, 2014).

III. RESULT AND DISCUSSION

Pierre Bourdieu's Concept Of Habitus

Pierre Bourdieu, whose full name is Pierre Felix Bourdieu, was born in the village of Denguin (Pyrenees Atlantiques District) on August 1, 1930. Bourdieu underwent his high school education (Lycee) in Pau as a brilliant student and was famous at his school as a rugby star. Bourdieu then moved to the Lycee Louis-le-Grand in Paris. Bourdieu attended college in the 1950s and received a diploma from the French Teachers' Institute Ecole Normale Superieure.

Bourdieu gave birth to the Theory of Agents and Structure, where his views are structuralist without losing his attention to actors/agents. The dialectical relationship between objective structures and subjective phenomena is the center of his attention. Bourdieu in the theory of agency and structure places the core of his thinking on the concepts of habitus and arena, as well as the dialectical relationship between the two. Habitus is in the mind of the actor/agent who is still conscious, while the arena is outside the mind of the actor/agent who constructs the actor's mind (Adib, 2012).

Habitus can be interpreted as an actor's tastes, habits, or tendencies that are embedded in their subconscious because of their experience in a particular cultural environment. An individual's habits are acquired through his life experiences (Ritzer & Douglas, 2004). This experience then has a certain function in the history of the social world where the habit occurs. The individual's life experience obtained from the results of this history is then internalized within him, then used to realize, feel, and understand the social world. Through these patterns, an individual produces actions and also evaluates them. Habitus also describes a series of tendencies that encourage social actors or actors to act and react in certain ways. The essence of Bourdieu's thinking about habitus is all types of cultural activities which include perception, production, and evaluation of daily life practices (Lubis, 2014).

Habitus has a dynamic nature because it experiences cultural reproduction by actors or agents so that it becomes active (Farid, 2021). Habitus has two basic concepts, namely: First, habitus animates the collective actions of social and individual actors. The actors in question are individuals who have the same role in a field and carry out similar practices or actions. Second, habitus has a role in maintaining a hierarchy that considers something natural, legitimate, and unavoidable. Habitus has principles that are the basis for actors in making choices and choosing strategies to be used in social life so that actors act reasonably. Actors/agents have feelings when acting, there is a logic to why they act, this is what is called action logic (Bourdieu, 1990).

Kleden in (Adib, 2012) draws seven important elements of habitus which include: (1) historical products, as a set of dispositions that last a long time and are acquired through repeated activities; (2) born from certain social conditions so that it becomes a structure formed by the social conditions in which it is produced; (3) this structured disposition also functions as a

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framework that gives birth and gives shape to a person's perceptions, representations and actions so that they can become structuring structures; (4) although habitus is born in certain social conditions, it can be transferred to other social conditions and is therefore transposable; (5) is pre-conscious because it is not the result of reflection or rational consideration; (6) is regular and patterned, but is not subject to certain regulations; (7) habitus can be directed towards certain goals and results of actions, but without awareness of achieving these results and also without mastering special skills to achieve them.

Clifford Geertz's Concept Of Culture

On August 23, 1926, Clifford Geertz was born, precisely in the city of San Francisco. In 1950, Geertz earned a BA from Ohio University's Antioch College in philosophy. Geertz then continued studying Anthropology at Harvard University. Geertz gave rise to the idea of the concept of culture which was written in his book entitled *Interpretation of Culture*. Geertz saw that culture is not only a concrete pattern of behavior but also a text whose meaning needs to be interpreted (Nasruddin, 2011).

Geertz tried to understand culture by looking at culture as a text so that interpretation needed to be carried out to capture the meaning contained in it. Culture is seen by Geertz as a network of symbolic meanings whose interpretation requires a thick description or an in-depth description. Geertz defines culture as a structured system of meanings and symbols (Kuper, 1999). This understanding means that individuals define their world, express their feelings, and provide judgments in a pattern of meaning that is transmitted historically and translated into symbolic forms. The transmission process is carried out through means by which people communicate, perpetuate, and develop their knowledge and attitudes towards life to form a collection of symbolic equipment to regulate behavior and extra somatic sources of information. Culture is a symbolic system, so cultural processes must be read, translated, and interpreted.

According to Geertz, the existing building of human knowledge is not a broad collection of feelings but a structure of facts which are symbols and laws that have been given meaning. Geertz thought that human actions could be read for meaning, as when we treat written texts. The concept of culture focuses on cultural values that guide society to act in dealing with various life problems. In the end, the concept of culture is interpreted as a guide for assessing symptoms that are understood by the cultural actor. Culture does not make meaning individually but publicly when the meaning system becomes the collective property of a group of people (Geertz, 1993).

Culture has three forms, the first is an abstract idea and its place is in the minds of every citizen who supports the culture in question so that it cannot be touched or photographed. The manifestation of culture in the form of a system of ideas is also usually called a cultural value system. Second, concrete behavior can be seen and documented. Third are cultural objects that are concrete and can be touched and photographed. Culture in this concrete form is called physical culture (Syakhrani & Kamil., 2022).

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Indonesia has diverse diversity, including various ethnicities, languages, religions, cultures, and social statuses. Diversity can be an integration force that binds society, but it can be the cause of conflict between religions, cultures, races, ethnicities, and living ideologies. As a plural country, Indonesia has two important modalities in forming a multicultural character, namely democracy and local wisdom, one of which is through the implementation of strengthening the character of Profil Pelajar Pancasila in educational institutions.

Profil Pelajar Pancasila

Indonesian students are competent lifelong learners, have character, and behave according to Pancasila values. The Profil Pelajar Pancasila is designed to answer one big question, namely students with what kind of profile (competency) the Indonesian education system wants to produce. In this context, Profil Pelajar Pancasila has a competency formulation that complements the focus on achieving Graduate Competency Standards at each level of the educational unit in terms of cultivating character through Pancasila values. Profil Pelajar Pancasila's competencies pay attention to internal factors related to the identity, ideology, and ideals of the Indonesian nation, as well as external factors related to the context of life and challenges of the Indonesian nation in the 21st century which is facing the industrial revolution 4.0 (Satria, Adiprima, Wulan, & Harjatanaya, 2021).

The Profil Pelajar Pancasila has various competencies which are formulated into six key dimensions. The six are interrelated and strengthen each other so that efforts to realize a complete Profil Pelajar Pancasila require the development of all these dimensions simultaneously. The six dimensions are: 1) Faith, devotion to God Almighty, and noble character, 2) Global diversity, 3) Working together, 4) Independence, 5) Critical reasoning, and 6) Creativity. These dimensions show that Profil Pelajar Pancasila does not only focus on cognitive abilities but also attitudes and behavior by their identity as Indonesians and global citizens.

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Decree of the Director General of Islamic Education No. 3811 of 2022 concerning madrasas implementing the Independent Curriculum, it is listed that Madrasah Aliyah Negeri 2 Surakarta is one of the pilot projects Madrasah that has implemented the Independent Curriculum starting in the 2022/2023 academic year. Based on these regulations, Madrasah Aliyah Negeri 2 Surakarta has carried out the Strengthening Profil Pelajar Pancasila Project activities for 2 academic years, namely in the 2022/2023 and 2023/2024 academic years. Educational institutions, in this case, schools/madrasahs, according to Bourdieu's concept, are referred to as arenas (fields).

Implementation of the Strengthening Profil Pelajar Pancasila project activities at Madrasah Aliyah Negeri 2 Surakarta was carried out in the middle of the semester and at the end of the semester. Students must complete 3 themes this academic year, with a time allocation of 2 weeks. The themes taken refer to the Profil Pelajar Pancasila and the selection of themes is determined by the teacher. This is intended to make assessment easier. Implementation of the project is a collaboration between several subjects but with different assessments and types of projects for each subject.

The flow/stages of project implementation for each subject are as follows: 1) Determining the theme of the Profil Pelajar Pancasila project for each subject is carried out during classroom learning; 2) Each class determines the theme to be chosen accompanied by the subject teacher of each class; 3) Subject teachers coordinate with each other to determine suitable collaborators; 4) The subject group then designs a project that fits the chosen theme; 5) The subject teacher then designs the grid, materials and project assessment along with the WorkSheet.

Profil Pelajar Pancasila's project activities are carried out concerning the project-based learning model (PJBL). Steps for this project-based learning activity include: 1) Picking a topic that suits reality by determining basic questions to start the project; 2) Designing project implementation; 3) Develop a project schedule; 4) monitor students and project progress; 5) Testing Results; 6) Evaluate the experience that students have gained.

The implementation of this activity is accompanied by subject teachers, supervisors, and homeroom teachers while still involving parents both directly and indirectly. The school carries out monitoring regarding the project activities. The Project Theme Selection Procedure is carried out as follows: 1) Selection of one of the Profil Pelajar Pancasila project themes that will be carried out in a particular class and semester, 2) Each subject in the Subject group carries out an analysis of the suitability of the main material (based on Learning Outcomes) by project theme, 3) If most of the subjects have appropriate subject matter then the project theme can be carried out in the specified class and semester, 4) If many subjects are not suitable, you can choose another theme, 5) Subjects-subjects If appropriate, you can form groups of several subjects to develop sub-themes, 6) Each subject develops indicators to be achieved, 7) Each subject determines the results that must be achieved, and 8) Each subject designs student activity sheets.

Table 1: Project Themes for Strengthening the Profil Pelajar Pancasila for the 2023/2024 Academic Year

No	Class	P5RA Theme	Topics Developed
1	Phase (Grade X)	E Bhinneka Tunggal Ika	The Beauty of Diversity and the Importance of Tolerance
2	Phase (Grade X)	E Engineering and technology to build the Republic of Indonesia	Simple, Appropriate Technology Engineering
3	Phase (Grade X)	E Local wisdom	Tracing the Cultural Heritage of Central Java
4	Phase F (Grade XI)	Build your body and soul	Mental Health of Children and Adolescents
5	Phase F (Grade XI)	Voice of Democracy	Actualization and the Role of Youth in Democracy

Source: curriculum documentation

Implementation guidelines The Profil Pelajar Pancasila Strengthening Project above becomes a guideline in learning, behaving, and behaving in global diversity that can be interpreted as culture according to Clifford Geertz's concept

Global Diversity Character

Global Diversity Character is one of the six dimensions of the Profil Pelajar Pancasila. Global diversity is a sense of respect for differences or tolerance of diversity, respecting one's culture of origin but not closing oneself off from outside cultures

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(Agustina, Nuvitalia, Listyarini, & Hanum, 2023). Global diversity also includes openness and tolerance towards foreign cultural diversity while still respecting culture. The concepts of global diversity are emphasized by the existence of four elements, namely: 1) recognizing and appreciating culture, 2) interaction between cultures, 3) reflection and responsibility for experiences of diversity, and 4) social justice (Satria, Adiprima, Wulan, & Harjatanaya, 2021).

First, knowing and appreciating culture has sub-elements, namely exploring culture and cultural identity, exploring and comparing cultural knowledge, beliefs, and practices, and fostering a sense of respect for cultural diversity. Second, intercultural communication and interaction include the subelements of intercultural communication and considering and cultivating various perspectives. Third, reflection and responsibility for the experience of diversity have subelements, namely reflection on the experience of diversity, eliminating stereotypes and prejudices, and harmonizing cultural differences. Finally, social justice has active subelements in building an inclusive, just, and sustainable society, participating in collective decision-making processes, and understanding the role of individuals in democracy. The explanation of the concepts of global diversity of character is in line with this thinking Geertz stated that culture is a symbolic system, so the cultural process must be read, translated, and interpreted.

Driving Factors For The Formation Of Global Diversity Character Profil Pelajar Pancasila

The character of global diversity is a habituation that is instilled in the family environment, school to social society. The family environment is the first group a child encounters and becomes the first medium for socialization. Research data, from interviews with six students at Madrasah Aliyah Negeri 2 Surakarta, shows that family socialization includes habituation of attitudes towards differences, behavior that respects differences, good ethics towards everyone, caring for everyone, behaving by religious norms, laws, Morality, and civility have a significant influence on the formation of a character of global diversity. Parents are family socialization actors in the formation of the global diversity of character so according to Pierre Bourdieu's theory they are structural actors/agents.

The family environment is not the only center for forming children's behavior, it is also formed in the school environment. Schools play a role in educating, educating students, and developing all aspects of behavior, including the development of sociomoral and emotional aspects. Teachers are the spearhead in the success of education in schools. The term teacher is used and imitated as a strong encouragement so that teachers can become role models for their students so that they can develop good character values. Teachers should be able to be examples, role models, examples, and reflections of true character. Teachers must have skills according to their field, broad insight to be transferred to their students, and an attitude and personality that is by the values and norms of society so that they are worthy of being role models (Sutisna, Indraswati, & Sobri, 2019).

The teacher's example includes the example of respecting other people's opinions, respecting other people's work, respecting other people's physical differences, respecting other people's different origins, believing in human equality, behaving fairly towards anyone, behaving in a way that does not discriminate against others, behaving without favoritism, and can listen to suggestions from others. The results of observations on several teachers who were facilitators of the Strengthening Profil Pelajar Pancasila Project activities found that they were able to convey ideas without affiliating or overly idealizing someone's religious beliefs. On the theme of the Bhinneka Tunggal Ika project, several teachers were seen facilitating students to raise the topic of religious moderation in the city of Surakarta, then on the theme of local wisdom, students were facilitated to get to know various cultures in Indonesia, especially in Central Java Province. The example given by teachers in the school environment shows that structural actors/agents have a big influence in shaping individual behavior. This is very much in line with Pierre Bourdieu's agentic and structural theory.

The family and school environment are very important in forming a child's character, but the social environment of society is also no less important. Society acts as a place for developing students' self-potential so they must provide support for student activities in efforts to self-actualize in character formation. The diversity or heterogeneity of social relationships certainly contributes to the influence on the formation of children's character. Heterogeneity is a horizontal grouping based on differences in ethnicity, race, and religion and based on differences in work and family structure (Saragih, Tabrani, Putri, Yohan, & Ivanna, 2023). The heterogeneity of social interactions encourages increased cooperation in various fields, both social, economic, and cultural. Diverse people living together can be good neighbors and will learn to respect differences (Gultom, Gandarum, & Ischak, 2015).

Madrasah Aliyah Negeri 2 Surakarta students are grouped into students living in dormitories, boarding houses, and with family or parents. Based on the results of interviews with three students who each live in different residences, show that students who live in dormitories and boarding houses have high social heterogeneity. The conclusion is that students who have

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social heterogeneity will have social capital that influences the improvement of the character of global diversity. This is demonstrated by students' ability to be willing to know the culture, respect culture, interact with other cultures, be able to reflect and be responsible for experiences of diversity and be able to behave fairly. Students who have a very high level of global diversity character show behavior including socializing in environments that are diverse intellectually/intelligently, morally, habitually/culturally, physically, religiously, economically, ethnically, and linguistically.

Social heterogeneity is social capital in the formation of a globally diverse character. This is relevant to Pierre Bourdieu's thinking regarding social capital theory. Pierre Bourdieu (1986) defines social capital as the totality of both actual and potential resources associated with the ownership of a permanent network of institutional relationships based on mutual acquaintance and mutual recognition. An individual can gain support from collectively owned capital by becoming a member of a group. The amount of social capital that a member of a group has depends on the quantity and quality of the network of relationships he can create, as well as how large the volume of economic, cultural, and social capital is owned by each person in his network of relationships (Bourdieu, 1990).

IV. CONCLUSION

Pierre Bourdieu's habitus can be interpreted as an actor's tastes, habits, or tendencies that are embedded in their subconscious because of their experience in a particular cultural environment. Habitus is different from culture. According to Clifford Geertz's concept, culture is a guide for assessing symptoms that are understood by the cultural actor. Culture does not make meaning individually but publicly when the meaning system becomes the collective property of a group of people.

The concept of habitus Bourdieu and culture Geertz became the basis for researchers' analysis of the habituation of global diversity in the Profil Pelajar Pancasila. Indonesian students are competent lifelong learners, have character, and behave according to Pancasila values. Profil Pelajar Pancasila has various competencies which are formulated into six key dimensions, namely: 1) Faith, devotion to God Almighty, and noble character, 2) Global diversity, 3) Working together, 4) Independence, 5) Critical Reasoning, and 6) Creative. One of the dimensions of Profil Pelajar Pancasila is global diversity, namely a sense of respect for differences or tolerance in diversity, respecting one's culture of origin but not closing oneself off from outside cultures. Educational institutions, namely schools/madrasahs, according to Bourdieu's concept, are referred to as arenas (fields), whereas globally diverse character concepts are relevant to thinking Clifford Geertz stated that culture is a symbolic system, so the cultural process must be read, translated and interpreted.

Factors driving the habituation of globally diverse characters include family socialization, teacher example at school, and social heterogeneity in society. Parents and teachers become structural agents/actors who have a big influence in shaping individual behaviors in Pierre Bourdieu's theory. Heterogeneity Association is social capital in the formation of a character of global diversity.

REFERENCES

- 1) Abdiraiymova, Gulmira, Sofiya Duisenova & Sayat Shayakhmetov. (2012). Reforming of System of the Higher Education in Kazakhstan (Based on Results of Sociological Research). *Procedia - Social and Behavioral Sciences*, 82, 397-403. <https://doi.org/10.1016/j.sbspro.2013.06.282>
- 2) Adib, Mohammad. (2012). *Agen dan Struktur dalam Pandangan Piere Bourdieu*. *Biokultur*, 1(2), 91-110
- 3) Agustina, IM., Nuvitalia, D., Listyarini, I., & hanum, A. (2023). Penguatan Profil Pelajar Pancasila Aspek Berkhebinekaan Global Pada Pelajaran IPAS Materi Kekayaan Budaya Indonesia di Kelas IV SDN Peterongan. *Didaktik : Jurnal Ilmiah PGSD FKIP Universitas Mandiri*, 9(2), 4795 – 4807. <https://doi.org/10.36989/didaktik.v9i2.1121>
- 4) Anggraeni, Fitri Inda. (2019). Young People and Pancasila: The Current Challenges. *Journal of Creativity Student*, 4(1), 1 – 26. <https://doi.org/10.15294/jcs.v4i1.35974>
- 5) Ansani & H. Muhammad Samsir. (2022). Bandura's Modeling Theory. *Jurnal Multidisiplin Madani (MUDIMA)*, 2(7), 3067 – 3080. <https://doi.org/10.55927/mudima.v2i7.692>
- 6) Arikunto, S. (2002). *Prosedur penelitian: Suatu pendekatan praktek*. Edisi revisi. Jakarta: PT Rineka Cipta.
- 7) Ariyanto, Andy & Endang Fauziati. (2022). Pembelajaran Daring di Sekolah Dasar dalam Perspektif Teori Belajar Konektivisme George Siemens. *Jurnal Ilmiah Mitra Swara Ganesha*, 9(2), 144-153.
- 8) Arofad, K. (2022). Pembentukan Karakter Remaja Melalui Pembinaan Remaja Islam Masjid Al-Cholid Singocandi Kudus. *Dinamika Sosial Budaya*, 24(1), 115-119. <http://dx.doi.org/10.26623/jdsb.v24i1.3558>
- 9) Aymerich MDM, Musitu G, Palmero F. (2018). Family Socialization Styles and Hostility in the Adolescent Population. *Sustainability*, 10, 29 – 62. <https://doi.org/10.3390/su10092962>

Global Diversity Character Habituation Profil Pelajar Pancasila in Islamic-Based Schools from the Perspective of Pierre Bourdieu and Clifford Geertz

- 10) Aziz, Thoriq Abdul & Aim Abdulkarim. (2023). Strengthening Global Diversity Values through Profil Pelajar Pancasila in Citizenship Education Learning. Proceeding International Conference on Religion, Science and Education 2, 281-287. <https://sunankalijaga.org/prosiding/index.php/icrse/article/view/922>
- 11) Bandura, Albert. (1977). *Social Learning Theory*. Englewood Cliffs, NJ: Prentice-Hall
- 12) Bastian, Rina, Syur'aini & Ismaniar. (2020). Pengaruh Sosialisasi dalam Keluarga Terhadap Perkembangan Sosial Anak Usia Dini di Masyarakat Desa Koto Lamo Sumatera Barat. *Indonesian Journal of Adult and Community Education*, 2(1), 16 – 25. <https://doi.org/10.17509/ijace.v2i1.28286>
- 13) Baudrillard, J. (2003). *Simulacra and Simulation*. US: The University of Michigan Press
- 14) Bourdieu, P. (1986). The forms of capital. In: Richardson, J., *Handbook of Theory and Research for the Sociology of Education*. New York: Greenwood Press. Received from <https://canvas.harvard.edu>
- 15) Bourdieu, Pierre. (1990). *The Logic of Practice*. California: Stanford University Press.
- 16) Dušan Deák and Ilze Kačane. (2021). The Family as a Site of Social Learning: the Cultural Socialisation of Young People in the Process of Intergenerational Exchange. *Slovenský národopis*, 69(3), 399–415. <https://doi.org/https://doi.org./10.2478/se-2021-0023>
- 17) Fadli, Muhammad Rijal. (2021). Memahami desain metode penelitian kualitatif. *Humanika, Kajian Ilmiah Mata Kuliah Umum*, 21(1), 33-54. DOI: <https://doi.org/10.21831/hum.v21i1.38075>
- 18) Faizah, Silviana Nur, Lia Nur Atiqoh Bela Dina & Ade Eka Anggraini. (2023). Realize Tolerant Students Through Strengthening the Profil Pelajar Pancasila with Global Diversity in Elementary Schools. *QALAMUNA: Jurnal Pendidikan, Sosial, dan Agama*, 15(1), 439-452. DOI: <https://doi.org/10.37680/qalamuna.v15i1.2149>
- 19) Farid, Muhammad. (2021). *Implementasi Teori Bourdieu dalam Upaya Menjaga Warisan Budaya Sunan Muria pada Masyarakat Piji Wetan Desa Lau Kabupaten Kudus*. *Jurnal Penelitian*, 12(2), 279-298. DOI: <http://dx.doi.org/10.21043/jp.v15i2.11305>
- 20) Febria, D., Marsevani, M., Catherine, Sinurat, CP., Tan, Joyce., & Julia. (2022). Upaya Pencegahan Rasisme dan Radikalisme Pada Sekolah Menengah Kejuruan Mahardika. *Providing National Conference for Community Service Project (NaCosPro)*, 4(1), 1699 – 1704. Received from <http://journal.uib.ac.id/index.php/nacospro>
- 21) Geertz, Clifford. (1993). *Religion as a Cultural System the Interpretation of Cultures*. Fontana Press
- 22) Ghozali, Imam. (2011). *Aplikasi Analisis Multivariate dengan Program IBM SPSS 19*. Semarang: Badan Penerbit Universitas Diponegoro
- 23) Ghozali, Solchan. (2020). Pengembangan Karakter KeBhinnekaan Global dalam Membentuk Profil Pelajar Pancasila . *MIYAH Jurnal Studi Islam*, 16(02), 515-524. <https://doi.org/10.33754/miyah.v16i2.566>
- 24) Grümme, Bernhard. (2021). Enlightened Heterogeneity: Religious Education Facing the Challenges of Educational Inequity. *Religions* 2021, 12, 835. <https://doi.org/10.3390/rel12100835>
- 25) Gultom, K., Gandarum, DN., & Ischak, M. (2015). Pengaruh Heterogenitas Sosial, Ekonomi, Budaya Penghuni Terhadap Heterogenitas Desain Fasad Bangunan Sebagai Pembentuk Kualitas Kawasan Perumahan (Studi Kasus: Perumnas Klender, Jakarta). *AGORA, Jurnal Arsitektur*, 15(2), 19 – 38. <https://doi.org/10.25105/agora.v15i2.2025>
- 26) Hastuti, Dwi, Sarwiti, Sarwoprasodjo, & Alfiasari. (2016). An Integration of Family and School on Strengthening the Character of Teenager in Indonesia: It's a Must. *Journal of Child Development Studies*, 1(1), 13 – 27. <https://doi.org/10.29244/jcdis.1.01.13-26>
- 27) Hidayatullah, Furqon. (2010). *Pendidikan Karakter: Membangun Peradaban Bangsa*. Surakarta: UNS Press&Yuma Pustaka.
- 28) Hurlock, E. (1998). *Perkembangan Anak*. (Agus Dharma, Ed) (Jilid 1). Jakarta: PT Gelora Aksara
- 29) Istiqomah, Annisa & Delfiyan Widiyanto. (2020). Resolusi konflik berbasis budaya Tionghoa-Jawa di Surakarta. *Jurnal Civics: Media Kajian Kewarganegaraan*, 17 (1), 40 – 49. DOI: <https://doi.org/10.21831/jc.v17i1.28754>
- 30) Kambo, G. (2022). *Politik Identitas Etnik Sebuah Kajian Konstruktivis dalam Tradisi Interaksi Simbolik*. Makasar: Unhas Press. Received from <http://repository.unhas.ac.id>
- 31) Karso. (2019). Keteladanan Guru dalam Proses Pendidikan di Sekolah. *Prosiding Seminar Nasional Pendidikan Program Pascasarjana Universitas PGRI Palembang 12 Januari 2019*. Received from <https://jurnal.univpgri-palembang.ac.id/index.php/Prosidingpps>
- 32) Kasingku, Juwinner Dedy, Siwu, Feronika Evlita & Sanger, Alan Hubert Frederik. (2023). Menjaga Orang Muda Agar Tetap dalam Pergaulan yang Benar. *Journal on Education*, 5(4), 12368-12376.
- 33) Keputusan Direktur Jendral Pendidikan Islam No. 3811 Tahun 2022 tentang Madrasah Pelaksana Kurikulum Merdeka

Global Diversity Character Habituation Profil Pelajar Pancasila in Islamic-Based Schools from the Perspective of Pierre Bourdieu and Clifford Geertz

- 34) Kuper, Adam. (1999). *Culture*. Cambridge: Harvard University Press.
- 35) Kurniawan, Kevin Nobel. (2018). Tolerance Education in the Hidden Curriculum: A Case Study on Indonesian Public School. *MASYARAKAT Jurnal Sosiologi*, 23(1), 1-31. DOI: <https://doi.org/10.7454/MJS.v23i1.7841>
- 36) Lubis, Ahyar Yusuf. (2014). *Postmodernisme, Teori dan Metode*. Jakarta: Rajagrafindo
- 37) Matthew B. Miles & A. Michael Huberman. (2014). *Analisis Data Kualitatif : Buku Sumber Tentang Metode-Metode Baru*. Jakarta: UI-Press.
- 38) Mead, GH. (1972). *Mind, Self & Society*. Chicago and London: The University of Chicago Press
- 39) Mutohar, Prim Masrokan, Trisnantari, Hikmah Eva & Masduki. (2021). The Effect of Principal Leadership Behavior, Teacher Model, and School Culture on Student' Character in Adapting to the Global Environment. *Asian Social Science and Humanities Research Journal (ASHREJ)*, 3(2), 36 – 44. <https://doi.org/10.37698/ashrej.v3i2.78>
- 40) Napratilora, M., Mardiah, M & Lisa, H. (2021). Peran Guru sebagai Teladan dalam Implementasi Nilai Pendidikan Karakter. *Al-Liqo: Jurnal Pendidikan Islam*, 6(1). <https://doi.org/10.46963/alliqo.v6i1.349>
- 41) Nasruddin. 2011. *Kebudayaan dan Agama Jawa dalam Perspektif Clifford Geertz*. *Religió: Jurnal Studi Agama-agama*, 1(1), 33-46. Retrieved from <https://jurnalfuf.uinsby.ac.id/index.php/religio/article/view/275>
- 42) Noor, Juliansyah. (2014). *Metodologi Penelitian*. Jakarta: Kencana Prenada Media Group
- 43) Nurgiansah, T Heru. (2022). Pendidikan Pancasila sebagai Upaya Membentuk Karakter Religius. *JURNAL BASICEDU*, 6(4), 7310 – 7316. <https://doi.org/10.31004/basicedu.v6i4.3481>
- 44) Oktaviani, Selfi Nur dan Syawaluddin. (2023). Peran Guru Bimbingan Konseling Dalam Menguatkan Karakter Siswa. *EDUCATIVO: Jurnal Pendidikan*, 2(1), 115 – 119. <https://doi.org/10.56248/educativo.v2i1.120>
- 45) Permendikbudristek Nomor 22 Tahun 2020 tentang Rencana Strategis Kementerian Pendidikan dan Kebudayaan Tahun 2020-2024
- 46) Priscilla, YG., Suprpto, Y & Hartono, B. (2022). Radikalisme dan Rasisme. *Providing National Conference for Community Service Project (NaCosPro)*, 4(1), 303 – 309. Received from <https://journal.uib.ac.id/index.php/nacospro>
- 47) Putri, Alifia Meita. (2021). Urgensi Toleransi KeBhinnekaan dalam Kehidupan Berbangsa dan Bernegara (Studi Kasus Diskriminasi dan Rasisme Terhadap Masyarakat Papua). *i-WIN Library: Perpustakaan Internasional Waqaf Illmu Nusantara*.
- 48) Rahmadi. (2011). *Pengantar Metodologi Penelitian*. Banjarmasin: Antasari Press
- 49) Ramli, Yusri Mohamad. (2012). *Agama dalam Tentukur Antropologi Simbolik Geertz*. *International Journal of Islamic Thought*, 1, 62-73. DOI: <https://doi.org/10.24035/ijit.1.2012.008>
- 50) Ridho, Hidayah. (2022). Pendidikan Islam Di Era Globalisasi. *Education Journal*, 1(1), 1 – 10.
- 51) Ritzer, George dan Douglas J. Goodman. (2004). *Teori Sosiologi Modern*. Jakarta: Kencana
- 52) Ruthner, Andreea Rodica. (2012). The status of the German minority within the multi-ethnic educational system of the Banat region – a historical overview focusing on the multicultural character of the region. *Procedia - Social and Behavioral Sciences*, 46, 1435 – 1439. <https://doi.org/10.1016/j.sbspro.2012.05.316>
- 53) Saragih, AN., Tabrani, FR., Putri, FM & Yohan, P. (2023). Harmonisasi Mahasiswa di tengah Adanya Heterogenitas Sosial di Jurusan PPKn FIS UNIMED. *MAHAGURU: Jurnal Pendidikan Sekolah Dasar*, 4(1), 27 – 40. Received from <https://ummaspul.e-journal.id/MGR>
- 54) Satria, R., Adiprima, P., Wulan, KS & Harjatanaya, TY. (2022). Panduan Pengembangan Proyek Penguatan Profil Pelajar Pancasila . *Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, Dan Teknologi Republik Indonesia*. Received from <https://kurikulum.kemdikbud.go.id>
- 55) Sawitri, OE., Imran, I. Ramadhan, I. (2021). Sosialisasi Keluarga Dalam Membentuk Kepribadian Anak (Studi Pada Keluarga Rumah Tangga Guru Ma Islamiyah). *Jurnal Sosialisasi*: 8(2), 10 – 21.
- 56) Siyoto, Sandu & M. Ali Sodik. (2015). *Dasar Metodologi Penelitian*. Karanganyar: Literasi Media Publishing.
- 57) Slamet, Y. (2006). *Metode Penelitian Sosial*. Surakarta: Sebelas Maret University Press
- 58) Sugiyono. (2017). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung : CV. Alfabeta
- 59) Sutisna, D., Indraswati, D., & Sobri, M. (2019). Keteladanan Guru sebagai Sarana Penerapan Pendidikan Karakter Siswa. *Jurnal Pendidikan Dasar Indonesia*, 4(2), 29 – 33. <http://dx.doi.org/10.26737/jpdi.v4i2.1236>
- 60) Suwendri, NM & Sukiani, NK. (2020). Penyimpangan Perilaku Remaja di Perkotaan. *Kulturistik: Jurnal Bahasa dan Budaya*, 4(2), 51 – 59. <https://doi.org/10.22225/kulturistik.4.2.1892>
- 61) Suyahman. (2018). Aktualisasi Keteladanan Guru Sebagai Upaya Mewujudkan Pendidikan Berkarakter di Sekolah Dasar. *PKn Progresif*, 13(1), 91 – 103. <https://doi.org/10.20961/pknp.v13i1.23266>

Global Diversity Character Habituation Profil Pelajar Pancasila in Islamic-Based Schools from the Perspective of Pierre Bourdieu and Clifford Geertz

- 62) Syakhrani, Abdul Wahab & Muhammad Luthfi Kamil. (2022). Budaya Dan Kebudayaan: Tinjauan Dari Berbagai Pakar, Wujud-Wujud Kebudayaan, 7 Unsur Kebudayaan Yang Bersifat Universal. *Cross-border*, 5(1), 782-791. Retrieved from <https://journal.iaisambas.ac.id/index.php/Cross-Border/article/view/1161/916>
- 63) Wahyuni, Nurul & Wahidah Fitriani. (2022). Relevansi Teori Belajar Sosial Albert Bandura dan Metode Pendidikan Keluarga dalam Islam. *Qalam: Jurnal Ilmu Kependidikan*, 11(2), 60 – 66. <https://doi.org/10.33506/jq.v11i2.2060>
- 64) Wijayanti, DN & Muthali'in, A. (2023). Penguatan Dimensi Berkebinekaan Global Profil Pelajar Pancasila melalui Pembelajaran Pendidikan Pancasila dan Kewarganegaraan. *Educatio: Jurnal Ilmu Kependidikan*, 18(1), 172 – 184. <https://doi.org/10.29408/edc.v18i1.12518>
- 65) Wirakusuma, Zuhana Ade, Ardhana Januar Mahardhani, Hadi CahyonO, Ambiro Puji, Asmaroini & Dwi Hatmoko. (2023). Global Diversity Character Development Strategy at the Center for Indonesian Citizenship Education Klang Malaysia. *Al-Ishlah: Jurnal Pendidikan*, 15(4), 5234-5242. DOI: <https://doi.org/10.35445/alishlah.v15i4.3510>
- 66) Yumaroh, Siti & Suranto. (2024). Implementation of Global Diversity Values in Vocational High School Students. *Didaktika: Jurnal Kependidikan*, 13(1), 185-198. DOI: <https://doi.org/10.58230/27454312.407>
- 67) Yunus, Firdaus M. (2014). *Konflik Agama di Indonesia Problem dan Solusi Pemecahannya*. *Substantia*, 16(2), 217-228. DOI: <http://dx.doi.org/10.22373/substantia.v16i2.4930>
- 68) Zakso, A., Agung, I., Susanto, AB., & Capnary, MC. (2021). The Effect of Strengthening Character Education on Tolerance Increasing and Development of Pancasila Students in Border Area: Case of West Kalimantan Province. *Academic Journal of Interdisciplinary Studies*, 10(5), 232 – 248. <https://doi.org/10.36941/ajis-2021-0136>



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Proposed Web-Based Goods Recording Information System in the Warehouse of PT Bahana Unindo Teknik Plant Plastics Injection



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ABSTRACT: PT Bahana Unindo Teknik Plant Plastics Injection is a company engaged in manufacturing. In the company's warehouse there is a problem, namely the absence of an integrated goods recording system, this is an obstacle because the recording is still done using stock cards and Microsoft Excel. Recording with this method affects the level of speed in the activity of recording goods in the warehouse, recording time takes an average of 10 minutes depending on the variation in the number of items. The proposal given is an information system for recording goods to support activities in the warehouse. System development is carried out using Unified Modeling Language (UML) modeling and creating an information system interface design. The use of an information system for recording goods is expected to shorten the time for recording and provide flexibility in data sharing capabilities in the warehouse of PT Bahana Unindo Teknik Plant Plastics Injection.

KEYWORDS: Recording, Unified Modelling Language, Information System

1. INTRODUCTION

Industry 4.0 transformation supports warehousing activities, one of which is the administrative process. The use of information systems can simplify the flow of work and it has an impact on worker productivity in carrying out inbound and outbound records. With a warehouse information system, companies can monitor warehouse activities and get information on goods quickly. Furthermore, by using an information system, companies can maintain stability and monitor stock availability, thereby minimizing stock shortages in warehouses.

Warehouse is an important component of the supply chain, including sourcing, production and distribution of goods. A warehouse is a place for temporary storage and retrieval of inventory used for further process activities or for distribution to consumers. The warehouse is described as a part of the logistics system in the company with the function of storing products and providing information including the status and condition of supplies/materials stored in the warehouse, so that the information is in accordance with updated actuals and can be accessed by people with the interests in the course of warehouse activities. The absence of a warehousing information system in a company may cause goods to be damaged in storage, damaged during the handling process, incorrect storage of goods, stock discrepancies and so on that can impact the company's losses both physically and financially.

An information system is an arrangement of people, data, processes and information technology that interact with each other to provide, store, process and collect as output information that users need to support an organization. An information system is a framework that coordinates both human and computer resources, to convert input (input) into output (information) that is useful for achieving company targets.

The administration process at the PT Bahana Unindo Teknik warehouse still uses two methods, namely manual recording and using Excel. The use of manual methods in recording goods with an impact on the time of the goods recording process, where warehouse staff need quite long time to write and calculate data on incoming and outgoing goods on stock cards manually.

Based on the description of the problems that occur repeatedly, PT Bahana Unindo Teknik Plant Plastic Injection requires an appropriate goods recording information system, so as to provide efficiency in carrying out administrative activities and make it easier to control the inbound and outbound processes. The solution that can be provided is implementing an information system

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with the features according to the needs of goods recording activities in the company's warehouse. Based on this background, the research focuses on the proposed use of an information system for recording goods that can later be implemented at PT Bahana Unindo Teknik Plant Plastic Injection.

There are limitations used to limit the scope of the research as follows:

The research location was carried out at PT Bahana Unindo Teknik Plant Plastics Injection; The research period started in November 2022 – May 2023; The research topic was a proposed web-based goods recording information system.

It is expected that the proposed research carried out may provide benefits to: PT Bahana Unindo Teknik, and can serve as a reference and evaluation for the Company to implement the proposed goods recording information system in warehousing activities, especially in increasing the stability and speed of goods recording so it can continue to maintain optimal business activities.

2. RESEARCH METHODOLOGY

The availability and accuracy of stock of goods was determined by the goods recording system in the warehouse. Apart from that, the speed and ease of obtaining goods information was one of the factors determining the performance of warehousing activities. The research was conducted with the purpose of increasing the company efficiency and making it easier to retrieve information in recording incoming and outgoing goods at the company's warehouse. Proposed improvements that can be made in the form of a web-based goods recording information system were expected to help companies increase efficiency in recording activities for both incoming and outgoing goods.

The research was conducted using qualitative data. The data used comes from primary data. Primary data were obtained from interviews with related parties. Not only primary data, the secondary data were also used in this research. The secondary data used were SOP documents and work instructions in the warehouse. SOP and IK were used as a reference for receiving and sending goods.

The preparation of improvement proposals in this research was carried out in three stages, it started from the needs analysis stage and proposed system flow, framework design and system programming, and system interface design. The stages of the proposed information system for recording goods at the PT Bahana Unindo Teknik Plant Plastics Injection warehouse are as follows.

1. Need analysis

Based on the production flow, there are 4 main inventories at PT Bahana Unindo Teknik Plant Plastics Injection, including supplies of raw materials, child parts & components, work in process (WIP) goods and finished goods. These goods are stored first in the warehouse before entering the next process, so they require fast and accurate recording. During the recording goods process in the warehouse, companies need an integrated system so that it provides flexibility in its use and can make it easier for users when using the system.

2. Proposed information system flow

At this stage, figure out the flow of the proposed information system to meet the Company' need and provide user flexibility and be able to overcome the problems experienced. The following is a needs analysis of the proposed information system:

- a. Login
- b. System start page
- c. Warehouse Information
- d. Transactions
- e. Goods Master Data
- F. Inbound/Outbound Report

System design started with creating a system development framework. In making this framework through a design process using Unified Modeling Language (UML). Unified Modeling Language is a modeling language for systems or software with an "object-oriented" paradigm. Modeling was actually used to simplify complex problems so that they were easier to study and understand. There are types of UML that can be used, including use case diagrams, activity diagrams, and class diagrams. There are several UML models that can be used, including using Use Case Diagrams, Activity Diagrams, and Class Diagrams.

1. Use Case Diagram

Use case diagram is used to visualize or describe interactions between systems and external systems or users. A use case can represent a single goal for the system and describe a series of activities and user interactions to achieve the goal. At the analysis

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stage, use case diagram play very important role in finding system requirements and understanding how the system should work. In a model it is possible to have one or several use case diagrams.

2. Activity Diagram

Activity diagrams illustrate the flow of activities in a system that is in the development process, each flow begins, the decisions that may occur and how they end. Activity diagrams can visualize parallel processes that may occur in several executions.

3. Class Diagram

Class diagram is modeling in UML that describe the system structure in terms of defining the classes that will be created to build the system. Class diagram has attributes and methods or operations

The warehouse information system interface is created using the Laravel framework to make it easier for users to use or access the system. There are six main displays in the system, including the login menu display, dashboard, account management, master data, transactions and reports.

3. RESULTS AND DISCUSSION

The information system used was a web platform. System user analysis was to find out the actors or users that were involved in running the information system. Models used in designing information systems consisted of Use Case Diagrams, Activity Diagrams, and Class Diagrams. An explanation of the modeling used was as follows.

1. Use Case Diagram

Use Case Diagram is modeling in UML that function to explain requirements from the user perspective. Use case diagrams represent the relationship or behavior between users and the system through a simple scheme with the purpose of make ease for users to read information on the functional requirements of the system. The warehouse information system use case diagram was created based on an analysis of the company's system requirements and the information system proposal flow that was created above. The following is a use case diagram along with an explanation.

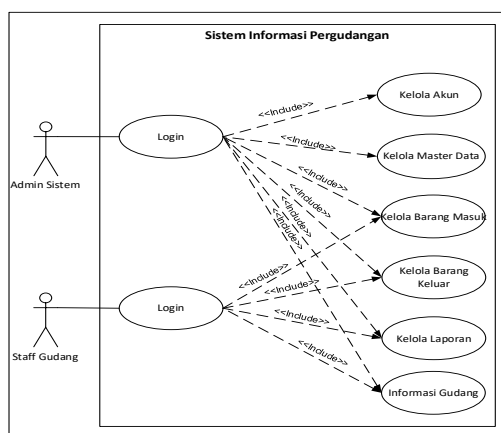


Figure 1. Use Diagram

In Figure 1 , it is explained that there were two types of actors in the warehouse information system use case diagram, namely system admin and warehouse staff, each actor had their own use case needs. There were six use cases in the warehouse information system, including the login use cases, manage accounts, manage master data, view warehouse information, manage incoming goods, manage outgoing goods, and manage reports. System Admin actors can access all use cases in the warehouse information system through use case login using email and password first, while warehouse staff log in using email and password that have been registered first to be able to access warehouse information, manage incoming goods, manage goods log out, and manage reports. Each actor is required to log in to the initial web display first in order to access each use case.

2. Activity Diagram

Activity diagram is modeling in UML that have the function of illustrating the flow of activities in the system. This diagram represents the development of a use case diagram that has a flow of activities. The activity flow can be in the form of a series of menus or business processes that describe the actions that need to be carried out by the actor. The following is an activity diagram for each use case development in a warehouse information system.

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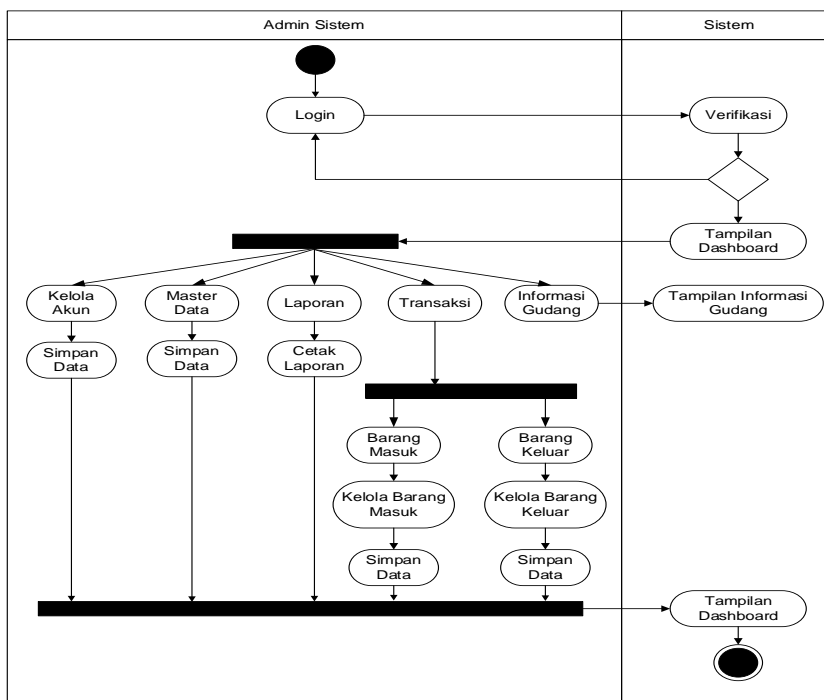


Figure 2. Activity Diagram

3. Class Diagram

Class Diagram is modeling in UML (Unified Modeling Language) that is used to describe the structure of objects in the system. Class Diagrams describe the relationship between one class and another and the attributes and operations that exist in each class in a system. In a warehouse information system there are interconnected classes as well as attributes and operations that are the basis for system development. The following is the class diagram used.

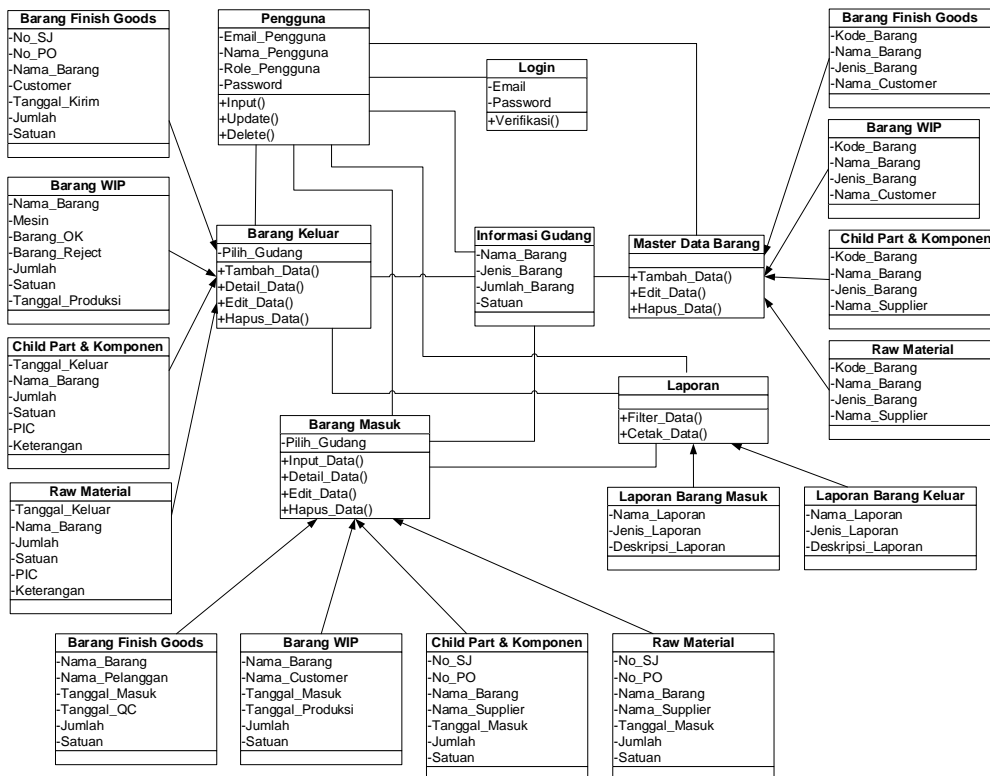


Figure 3. Class Diagram

In Figure 3 above, it can be explained that the activity diagram contains the User class that was a class used to represent users of the system. Then the Login class was a class that was related to users being able to access the features contained in the system.

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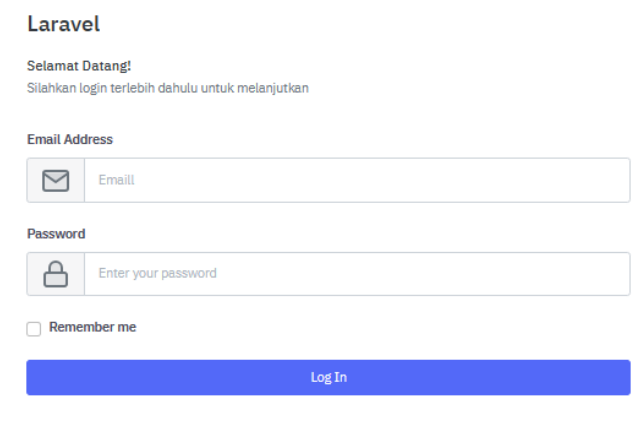
Then the Master Data class was a class that represents a list of items contained in the system. Then the Warehouse Information class functions to display information on the stock of goods in the warehouse. Then the Incoming Goods class had the function of representing incoming goods in the warehouse information system. Then the Outgoing Goods class had a function to represent outgoing goods in the warehouse information system. The Report class was a class that describes the Incoming Goods and Outgoing Goods class reports.

DEVELOPMENT OF WAREHOUSE INFORMATION SYSTEM

An information system that can be developed to manage data on incoming and outgoing goods at PT Bahana Unindo Teknik Plant Plastic Injection. The following is a display of the interface for information system development. An information system that can be developed to manage data on incoming and outgoing good at PT Bahana Unindo Teknik Plant Plastic Injection. The following is a display of the interface for information system development

1. Login Display

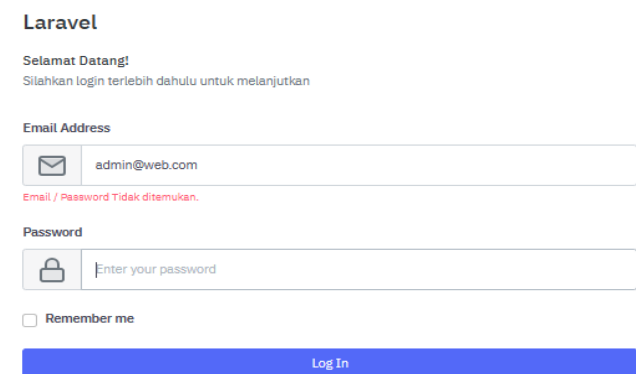
Login is the initial process to enter a system. The login display on the system is a user interface that allows the user to input access information such as username and password.



The screenshot shows a Laravel login page. At the top, it says "Laravel" and "Selamat Datang!" followed by the instruction "Silahkan login terlebih dahulu untuk melanjutkan". Below this are two input fields: "Email Address" with a placeholder "Email" and "Password" with a placeholder "Enter your password". There is a "Remember me" checkbox and a blue "Log In" button at the bottom.

Figure 4. Login Menu Display

In Figure 4 above is the login display on the system. In the login menu, users are required to enter their email and password. Apart from that, there are login and remember me buttons that are used to store user access data. If the email and password are correct, a dashboard display will appear. If the email and password entered are incorrect, a notification will appear as shown in the figure below.



This screenshot shows the same Laravel login page as Figure 4, but with an error message. The "Email Address" field now contains "admin@web.com". Below the field, a red error message reads "Email / Password Tidak ditemukan.". The "Password" field and "Remember me" checkbox remain the same, and the "Log In" button is still present at the bottom.

Figure 5. Wrong Password Display

2. Dashboard Display

The dashboard display on the system is a user interface used to view information quickly and effectively. Generally, dashboards display information in the form of graphs, tables or diagrams that can help users understand the data more easily

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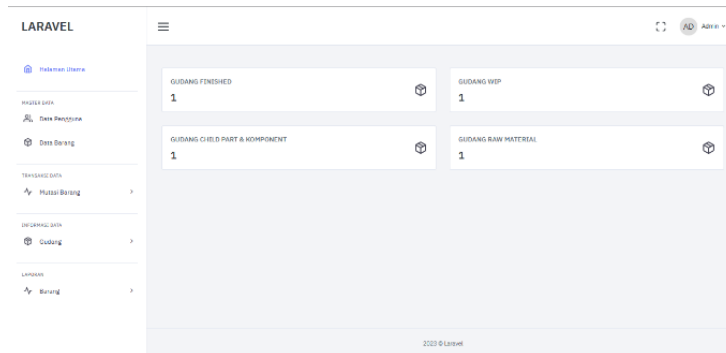


Figure 6. Dashboard Menu Display

In Figure 6 above is a dashboard display in the information system, displaying information on the number of goods in the warehouse. Apart from that, it displays the menu functions found in the system that are located on the left. At the top right there is a full screen function and a menu to log out of the system.

3. Manage Accounts Display

The account management view on the system is a user interface that allows users to manage accounts on the system. This display generally consists of several options for changing information such as passwords and privacy preferences.

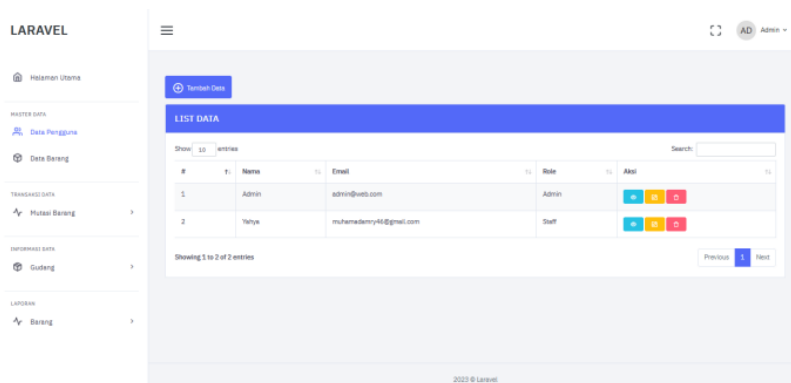


Figure 7. Manage Accounts Display

In Figure 7 above is the account management display, there is a list of accounts registered in the system along with their roles. There are functions to add account data, view detailed information, edit account information, and delete account data. If the user chooses to add account data, the system will display an add account form.

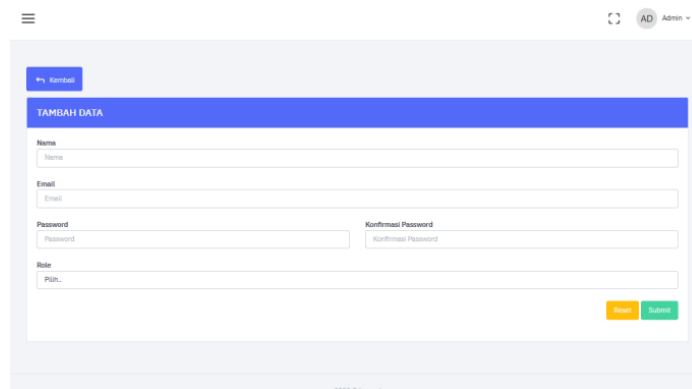


Figure 8. Add Account Form Display

In Figure 8, there is the display of the add account form, there is data that must be filled in by the user, including name, email, password, password confirmation, and role. There is a button that functions as a back button, reset data, and save data

4. Master Data Display

The master data display functions to provide control over item data in the system and to organize the required information easily.

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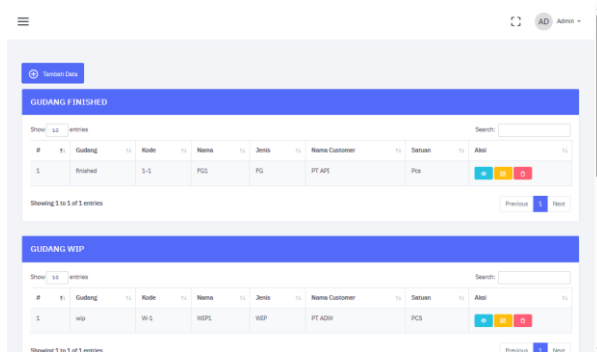


Figure 9. Master Data Menu Display

In Figure 9 above is the master data menu display, in this display there are 4 warehouse lists displayed. In each warehouse list there are buttons to view detailed information, edit data, and delete data. Apart from that, there is a button that is used to add new item data. If the user selects the add data button, the add item data form will appear.

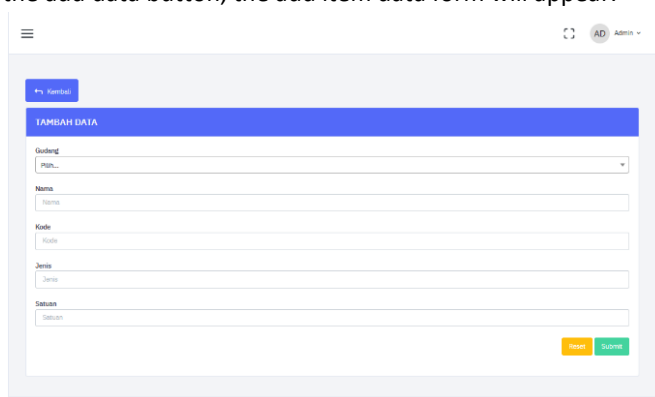


Figure 10. The Add Item Data Form

Figure 10 describes form for adding item data, this display contains data that must be filled in by the user, apart from that there are buttons that are used to return, reset data and save data.

5. Display of Incoming Goods Transactions

The display of incoming goods transactions in the system functions to make it easier for users to record goods entering the warehouse. The display generally makes it easier to record and manage stock of goods, apart from that, the incoming goods display is usually used to view the history of incoming goods transactions carried out previously.

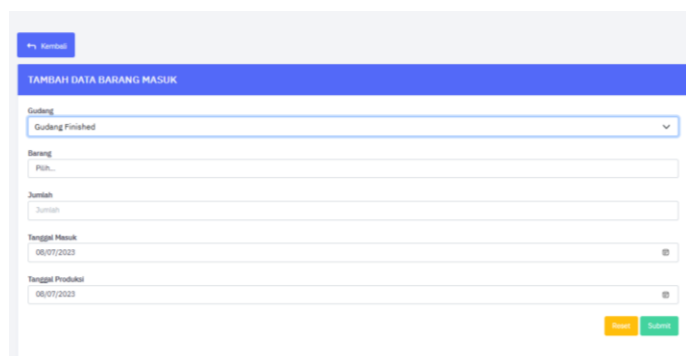


Figure 11. Incoming Goods Report Menu Display

Figure 11 is a display of incoming goods transactions. In this display there is a historical list of incoming goods, there are buttons to view detailed data information, edit data and delete data. To change the list page, there is a previous button that is used to change the previous page and a next button is used to change the next page. To add data there is an add data button, if the user selects this button a form to add data for incoming goods will appear.

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Figure 12. Incoming Goods Form Display

Figure 12 above is a display of the incoming goods form, in this form there are data that needs to be input by the user. Apart from that, there are buttons that are used to go back, reset data, and save data.

6. Outgoing Goods Transaction Display

The display of outgoing goods transactions in the system functions to make it easier for users to record goods entering the warehouse. This display generally makes it easier to record and manage stock of goods. Apart from that, usually the incoming goods display is used to view the history of incoming goods transactions that have been carried out previously.

Figure 13. Outgoing Goods Menu Display

Figure 13 above is a display of the outgoing goods menu, the same as the incoming goods menu display. This menu displays a list of outgoing items. There is a button that is used to add data to display data, if the user selects this menu the add data form will appear. Apart from that, there are buttons to view detailed data information, edit data, and delete data.

Figure 14. Display the Add Out Data Form

Figure 14 is a display of the add out data form. In this form there are data that must be filled in by the user, apart from that there are buttons to return, reset data and save data.

7. Display of Good Report

The item report display in the system functions to determine the location of the warehouse, goods and the amount of stock available as well as customers.

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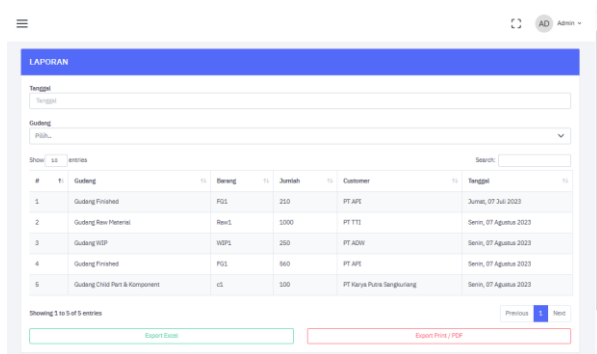


Figure 15. Incoming Goods Report Menu Display

Figure 15 displays the incoming goods report menu. This display displays a list of periodic reports and there is a feature to select the report date range. Apart from that, there is a button that is used to print reports into Excel or PDF files.

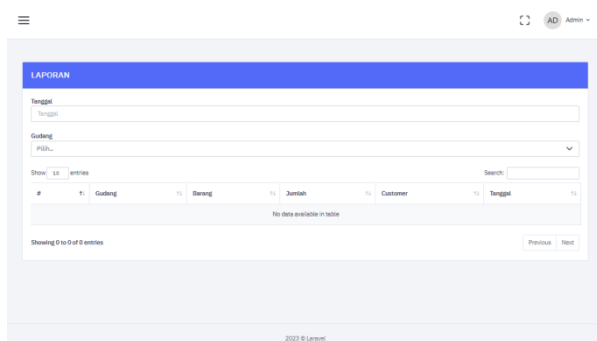


Figure 16. Outgoing Goods Report Menu Display

Figure 16 is a display of the outgoing goods report. Just like the incoming goods report, this display displays a list of periodic reports and there is a feature to select the report date range. Apart from that, there is a button that is used to print reports into Excel or PDF files.

8. Warehouse Information Display

The warehouse information display functions to find out the list of stock items available in the warehouse. Apart from that, there are previous and next buttons that functions to display the previous and next pages.

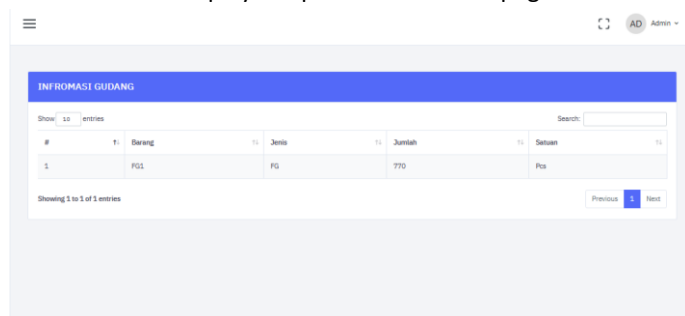


Figure 17. Warehouse Information Menu Display

Figure 17 shows the display of the warehouse information menu. In this display there is a list of stock items available in the warehouse, apart from that there are previous and next buttons that function to display the previous and next pages.

COMPARISON OF OLD SYSTEM WITH INFORMATION SYSTEMS

Based on the results, there was a comparison between the warehouse information system and the old system that had been used by the company. The comparison used 5 parameters, including system media, recording of goods transactions, recording time, flexibility, and ability to view information or data. The following are the results of the comparison of the information system with the old system.

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Table 1. Comparison of old systems with information systems

Parameter	Sistem Lama	Sistem Informasi
Media Sistem	Kartu stok dan Microsoft Excel	Situs Website
Pencatatan Transaksi Barang	Dilakukan secara manual dengan menggunakan kartu stok dan memindahkan ke Excel	Pencatatan langsung menggunakan sistem dan perhitungan otomatis secara real time
Waktu Pencatatan	8 menit untuk melakukan pencatatan barang masuk	2 menit untuk melakukan pencatatan barang masuk
Fleksibilitas	Kartu stok hanya dapat digunakan satu orang dan tidak dapat berbagi pada waktu yang sama	Dapat diakses pada waktu yang sama oleh pihak yang memiliki hak akses
Kemampuan Melihat Data	Harus melihat kartu stok dan mencari data informasi yang diinginkan terlebih dahulu secara manual	Dapat melihat langsung secara real time dengan mengakses fitur informasi gudang pada sistem

4. CONCLUSION

Based on analysis and observation of the problems experienced by PT Bahana Unindo Teknik Plan Plastic Injection in the activity of recording, incoming and outgoing goods that was carried out using manual methods, namely with stock cards and Microsoft Excel. This results in decreased efficiency in goods recording activities. So the proposal given was a web-based goods recording information system. It considers efficiency and flexibility of use according to user requests. The features contained in the warehouse information system include account management, master data, goods transactions, warehouse information, and reports. This information system can be used by companies to support recording and reporting activities.

The proposals given are expected to support warehousing activities in the recording of incoming and outgoing goods with the purpose of increasing the efficiency and performance of warehousing activities. So warehouse staff can more easily record incoming and outgoing goods.

REFERENCES

- Zaroni. (2017). Panduan Eksekusi Strategi Logistics & Supply Chain. Jakarta: Prasetiya Mulya Publishing.
- Prasetyo, H. A., Priyambadha, B., & Arwan, A. (2018). Pembangunan Aplikasi Sistem Informasi Pergudangan pada Rumah Sakit Umum Daerah Dr. Murjani Sampit Kabupaten Kotawaringin. *Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer*, 2789-2800.
- Martono, R. V. (2018). Manajemen Logistik. Jakarta: PT Gramedia Pustaka Utama.
- Pandiangan, S. (2017). Operasional Manajemen Pergudangan. Jakarta: Mitra Wacana Media.
- Alfarizi, S., Mulyawan, A. R., & Basri, H. (2018). Rancang Bangun Sistem Informasi Penjualan Berbasis Web Dengan Pemanfaatan UML (Unified Modelling Language) Pada CV Harum Catering Karawang. *Indonesian Journal on Networking and Security*.
- Heriyanto, Y. (2018). Perancangan Sistem Informasi Rental Mobil Berbasis Web Pada PT.Apm Rent Car. *Jurnal Intra-Tech*, 64-77.
- Kurniawan, T. (2020). Perancangan sistem aplikasi pemesanan makanan dan minuman pada cafetaria no caffe di Tanjung Balai Karimun menggunakan bahasa pemograman PHP Dan MySQL. *Jurnal Tikar*, 192-206.
- Whitten, J., Bentley, L., & Ditman, K. (2004). Metode Desain dan Analisis Sistem. Yogyakarta: CV. Andi Offset.
- Mcleod, R. (2006). Sistem Informasi Manajemen Edisi Revisi. Jakarta: PT Prenhallindo.
- Kadir, A. (2014). Pengenalan Sistem Informasi Edisi Revisi. Yogyakarta: Andi Yogyakarta.



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Enhancement of Critical Thinking Skills of Grade X Students at SMKN 2 Singosari in History Learning: The Process of Islam's Entry and Development in the Archipelago through Project-Based Learning



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ABSTRACT: This research aims to investigate the improvement of critical thinking skills among grade X students at SMKN 2 Singosari in history learning, particularly regarding the process of Islam's entry and development in the archipelago, through the implementation of project-based learning. The research method employed is classroom action research. Data were collected through tests to measure students' critical thinking skills and their learning outcomes. The analysis results indicate a significant improvement in students' critical thinking skills from pre-cycle to cycle I, and from cycle I to cycle II. At the indicator level, there is a consistent improvement in the ability to ask questions, skills in presenting arguments and ideas, skills in validating data relevant to the problem, and skills in formulating conclusions and solutions with proper reasoning. Furthermore, students' learning outcomes also show a significant improvement from pre-cycle to cycle I, and from cycle I to cycle II, both in terms of average learning outcomes and the level of learning completeness. These findings suggest that the implementation of project-based learning can positively contribute to the enhancement of critical thinking skills and learning outcomes of students in history learning.

KEYWORDS: critical thinking skills, project-based learning, improvement in learning outcomes

INTRODUCTION

Critical thinking skills are crucial aspects of education that not only produce intelligent learners but also foster creative and analytical thinkers. In the context of history learning, developing critical thinking skills becomes crucial, especially for grade X students at SMKN 2 Singosari Malang, the focus of this research, utilizing the Project-Based Learning (PBL) model. PBL offers a learning approach that emphasizes the application of knowledge in real projects, thereby enhancing students' critical thinking skills. Through this approach, this research aims to explore and analyze students' critical thinking skills in understanding the material on the Process of Islam's Entry and Development in the Archipelago. This effort aligns with the views of Muslikhah and Umar (2023), emphasizing the importance of a deep understanding of the history of Islam in the Nusantara region. This is particularly relevant as Islam in Indonesia is undergoing significant events and transformations. One notable development is the emergence of several Islamic schools, which exhibit differences in beliefs and religious practices among these sects. Additionally, there is a process of modernization within Islam in Indonesia, characterized by changes in thinking patterns, practices, and relationships. This modernization is influenced by various factors, including globalization, technological advancements, and social-political changes (Hidayat, Afif, & Dahlan, 2024). Therefore, a profound understanding of this material can result in better critical thinking.

In this context, this research refers to recent findings highlighting the urgent need to enhance students' critical thinking skills (Sundari, Subali, & Marwoto, 2020). All three indicate that a lack of critical thinking skills can hinder students' intellectual development. Thus, this research holds significant relevance in efforts to improve the quality of history education at SMKN 2 Singosari Malang, especially in the history of Islam's entry and development in the archipelago. Meanwhile, previous studies, as

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reported by Ekawati, Dantes, and Marhaeni (2019); Riskayanti (2021); Karomatunnisa, Sholih, Hanifah, and Prihantini (2022); Fuldijatman and Ekaputra (2023); as well as Nurjanah, Harini, and Muflikah (2023), show that project-based learning can result in improvements in cognitive skills and problem-solving. Therefore, this research seeks to explore the potential of PBL in enhancing students' critical thinking skills, particularly in the context of the history of Islam in Indonesia. By reviewing literature and previous research findings, it is hoped that this research can contribute to the development of more effective learning strategies at the secondary education level.

Through a deep understanding of the material, it is expected that students can actively engage in the learning process and produce project work that not only demonstrates conceptual understanding but also good critical thinking skills. Thus, this research is expected to make a real contribution to improving the quality of history education at SMKN 2 Singosari Malang through the implementation of the Project-Based Learning model.

To achieve this goal, this research will investigate the positive impact of the Project-Based Learning model on students' critical thinking skills. Through real projects, students are expected to develop analytical, evaluative, and synthesis skills, along with a deep understanding of the history of Islam's entry and development in the archipelago. Thus, this research not only evaluates students' conceptual abilities but also focuses on developing critical thinking skills as core competencies of the 21st century. The approach used is a qualitative and quantitative approach to gain a deep understanding of students' experiences in applying the Project-Based Learning model. By exploring various aspects of learning, it is hoped that this research can provide a comprehensive overview of how students' critical thinking skills can be enhanced through this innovative learning model.

LITERATURE REVIEW

History learning in schools plays a crucial role in developing students' understanding of past events, one of which is the process of Islam's entry and development in the Archipelago. Focusing on the critical thinking skills of grade X students at SMKN 2 Singosari Malang makes the Project-Based Learning (PjBL) model an interesting approach to consider. This is because critical thinking skills have been recognized as crucial intellectual skills in understanding and interpreting history (Brookfield, 2012:45). Higher-order thinking skills include skills such as critical thinking, creativity, analysis, problem-solving, and visualization (Ramos, Dolipas & Villamor, 2013 as cited in Rahardhian, 2022:91). Beers (2011) as cited in Rahardhian (2022:91), states that to connect concepts with material, students need to use analysis, logical thinking skills, creativity, and critical thinking to understand and solve problems. From this perspective, critical thinking skills include one's ability to analyze ideas systematically to solve problems.

Critical thinking is a form of reasonable and reflective thinking focused on making decisions about what to believe or do (Ennis, 2011). Critical thinking skills involve the ability to access, analyze, and synthesize learnable, trainable, and masterable information (Redecker, et al., 2011). According to Lai (2011), critical thinking includes skills such as analyzing arguments, making inferences using inductive or deductive reasoning, evaluating, and making decisions or solving problems. In line with this, Bailin (2002) describes critical thinking as a form of thinking with certain qualities, essentially characterizing good thinking that meets established sufficiency and accuracy criteria or standards (Zakiah & Lestari, 2019:3).

From a philosophical perspective, the critical thinking framework highlights aspects such as the nature, attitude, and quality of critical thinking. The discussion also focuses on the critical thinking attitude. The components of critical thinking can be seen in Figure 1 below.



Figure 1: Components of Critical Thinking Skills

Critical thinking is the ability to contemplate thoughts and solve problems. This ability can be developed by combining several habits, including curiosity, humility, scepticisms, rationality or logic, creativity, and empathy (Rahardhian, 2022:92-3).

It can be said that critical thinking skills are an intellectual process because one intentionally evaluates the quality of their thinking. In critical thinking, one uses reflective, independent, clear, and rational thinking. Critical thinking skills involve the ability to interpret and evaluate observations, information, and arguments. The model of critical thinking encompasses aspects

related to any object, substance, or issue, allowing thinkers to enhance the quality of their thinking by skilfully addressing the inherent structures in thinking and applying their intellectual standards. According to Paul and Elder (2006:27), critical thinking skills include

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analysis, evaluation, and rational decision-making. Furthermore, Paul and Elder (2013) state that individuals with good critical thinking skills reach levels of proficiency as shown in Table 1 (Rios, et al., 2015:8), as follows.

Table 1. Level of Critical Thinking Skills

Level	Criteria
1	Raise important questions and problems, expressing them with clarity and precision
2	Collect and evaluate information that is relevant to the situation
3	Interpret information effectively
4	Come to well-reasoned conclusions and solutions
5	Contrast the solution against relevant criteria and standards
6	Think open-mindedly
7	Recognize and assess their assumptions, implications and practical consequences
8	Communicate effectively with others in figuring out solutions to complex problems

The eight levels by Paul & Elder have been condensed into five levels of critical thinking skills for the purpose of this research, as shown in the following Table 2.

Table 2. Level of Critical Thinking Skills

Level	Criteria
1	Stating important questions about the issue
2	Gathering and evaluating relevant facts
3	Communicating effectively and efficiently in problem-solving
4	Thinking with an open-minded attitude
5	Formulating conclusions and solutions with appropriate logic

On the other hand, history learning often tends to focus on memorizing facts without providing space for students to develop critical thinking skills. Project-Based Learning as an alternative learning model offers an approach that emphasizes collaborative projects and the application of knowledge in real-life contexts (Thomas, 2000:12). Project-Based Learning can provide deep and meaningful learning experiences, allowing students to actively engage in understanding historical material. Ennis' research (1989:14) highlights that critical thinking ability has a positive correlation with academic achievement. In the context of history learning, students who are able to think critically tend to have a deeper understanding of the material. When understanding the history of the Archipelago, M.C. Ricklefs' research (1991:78) provides insight into the process of Islam's entry into this region. This process involves complex cultural interactions and has had a significant impact on social and cultural development in the Archipelago.

According to the Buck Institute for Education, a leading institution in project-based learning, ProjectBased Learning can be defined as a teaching method where students develop knowledge and skills by engaging in a long-term project aimed at investigating and responding to complex questions, problems, or challenges. Students involved in these projects conduct research, exploration, testing, or even creation related to artworks, questions, phenomena, controversies, or real-world events. Although each project has its own characteristics, they all have one thing in common: providing intense learning experiences. Like other collaborative learning approaches, project-based learning helps build deep conceptual understanding and prepares students to meet the demands of life, citizenship, and the workforce (Rios, et al., 2015:26). The Buck Institute for Education also identifies several essential elements inherent in project-based learning (Rios, et al., 2015:26-7), as follows.

1. *Significant Content*: The project focuses on delivering essential knowledge and skills to students, sourced from standards and key concepts in the academic field.
2. *21st Century Skills*: Students develop skills relevant to the current world's needs, such as problemsolving, critical thinking, collaboration, communication, and innovation, which are taught and evaluated.
3. *In-Depth Investigation*: Students engage in a rigorous and detailed process to inquire, use resources, and seek answers to existing questions.
4. *Driving Questions*: The project is directed by open-ended questions explored by students or reflecting tasks they undertake.

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5. *Need to Know*: Students recognize the importance of acquiring knowledge, understanding concepts, and applying skills to answer driving questions and produce project products, starting from an initial event that sparks interest and curiosity.
6. *Freedom to Choose*: Students are given the freedom to make several choices regarding the products they will create, how they work, and their use of time, guided by teachers and in accordance with their age and experience levels in project-based learning.
7. *Revision and Reflection*: The project includes a process for students to use feedback to consider improvements and changes that can enhance the quality of their products, as well as to reflect on what they have learned and how they have learned.
8. *Public Audience*: Students present their work results to a wider audience, beyond their classroom environment and teachers.

It can be said that Project-Based Learning is a learning model that places students at its center, as students actively participate in conducting in-depth investigations into a topic. Student participation in this model depends on their individual roles. The question is, how can project-based learning implementation be carried out in the classroom? The approach to implementing project-based learning in the classroom is very similar to the Socratic Seminar model because students have an active role and are mostly responsible for their learning process. In the book "Teachers as Classroom Coaches" by Andi Stix & Frank Hrbek, nine steps are identified for implementing project-based learning.

1. Educators as guides prepare the situation by providing concrete examples of the projects that students will undertake.
2. Students take on the role of project designers, possibly by forming forums for exhibitions or competitions.
3. Students actively engage in discussing and gathering background information needed to design their projects.
4. Educators and students together determine the criteria for evaluating the projects.
5. Students collect the materials needed for the project.
6. Students independently create their projects.
7. Students prepare themselves to present their projects.
8. Students present their projects.
9. Students reflect on the learning process and evaluate their projects based on the criteria established in Step 4 (Rios, et al., 2015:28).

Based on the project-based learning steps formulated by Andi Stix & Frank Hrbek, the syntax of the project-based learning model (PjBL) is presented as shown in Table 3.

Table 3. Syntax of Project-Based Learning (PjBL) Model

Fase	Indicator	Activity
I	Start with the big question	Educators initiate the learning process by using guiding questions that spark students' interest and encourage them to engage in specific activities. The selected material should ideally be relevant to real-life situations and commence with thorough exploration to deepen understanding.
II	Design a plan for the project	Educators and students collaborate in planning the project, aiming for students to feel a strong sense of ownership over the project. Planning includes establishing rules, selecting activities that support answers to core questions by integrating various relevant subjects, and providing information about the tools and materials needed to complete the project.
III	Create a schedule	Educators work with students to schedule the activities required to complete the project, setting clear deadlines for its completion. Students are expected to use the available time effectively. Although educators grant students the freedom to explore new things, they still monitor and provide reminders if students' activities deviate from the project's goals. As the project requires a significant amount of time, students are asked to work in groups outside of school hours to complete it. During school hours, students only need to present their project results in front of the class.

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IV	Monitor the students and the progress of the project	Educators have the responsibility to monitor students' activities as they work on the project. Monitoring is done through guidance and support at each stage. Thus, educators act as guides for students' activities, providing guidance on group collaboration. Each student is given the freedom to choose their role without neglecting the overall group interests.
V	Assess the outcome	Assessment is used to help educators assess standard achievement, evaluate individual progress of each student, provide feedback on students' understanding, and design next learning strategies. Product assessment is conducted when each group takes turns presenting their work results to the other groups.
VI	Evaluate the experience	At the end of the learning process, educators and students reflect on the activities and results of the project. Reflection is done individually and in groups, and students are asked to share their feelings and experiences during the project implementation.

Thus, it is hoped that this research can explore how much Project-Based Learning can enhance the critical thinking skills of the 10th-grade students of SMKN 2 Singosari in understanding the history material "The Process of the Entry and Development of Islam in the Archipelago". By summarizing these various perspectives, it is hoped to encourage a deeper understanding of the interplay between history learning, critical thinking skills, and student learning outcomes.

METHOD

This research employs the classroom action research (CAR) approach, adopting the model proposed by Kemmis and McTaggart (1988). This model takes a spiral form and is characterized by its continuous nature. If the results obtained have not reached the set target, the next step is to proceed to the next cycle and McTaggart CAR model is illustrated as seen in Figure 2 below.

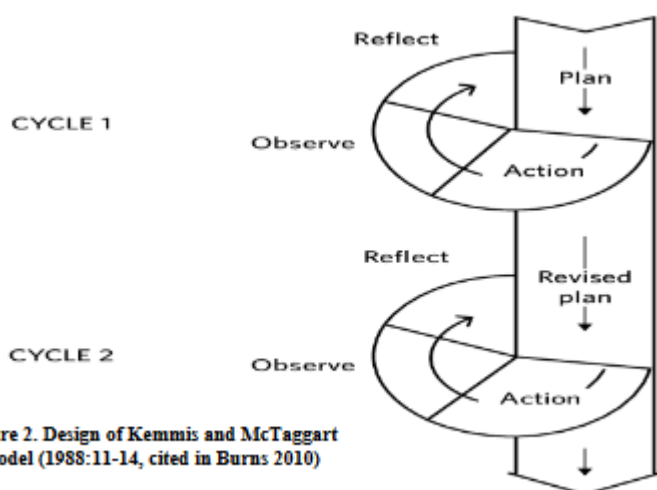


Figure 2. Design of Kemmis and McTaggart Model (1988:11-14, cited in Burns 2010)

This cycle includes planning, implementation, observation, and reflection steps. The design of the Kemmis

The steps taken are: (1) Planning: The planning process involves the preparation of learning tools, including lesson plans (RPP), teaching materials, media, student worksheets (LKPD), as well as observation and evaluation sheet instruments; (2) Implementation: Learning implementation is based on the prepared learning tools and optimized using various media. During the observation phase, assessment of student performance is carried out based on collected data, including learning recordings; (3)

Observation: Observation activities are conducted during the learning process to collect learning outcome data, paying attention to the test scores of evaluation questions; and (4) Reflection: Reflection involves assessing learning outcomes and comparing them with initial data. The researcher evaluates relevant constraints and designs improvement plans or solutions. Achievements or accomplishments attained will be integrated into the subsequent planning. This stage includes conclusions that reflect the entire action research process.

The learning process is implemented through the project-based learning method. Research data are obtained through observations, interviews, and tests. The evaluation of critical thinking skills is done by observing the initial conditions before applying Project-Based Learning, as well as the results of cycle I and cycle II after implementing Project-Based Learning.

This research was conducted at SMKN 2 Singosari Malang in the academic year 2023/2024, with 20 tenth-grade students as subjects in the History subject with the material "The Process of the Introduction and Development of Islam in the Archipelago". The types of data collected include student observations, interviews with class teachers to obtain initial data related to classroom

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conditions and research variables, as well as the results of student evaluation tests. The observation technique is carried out during the learning process using observation instruments prepared by the researcher. The critical thinking skills parameters used as reference in the observation include: (a) the ability to formulate questions, (b) the ability to present arguments and explain reasons, (c) searching for evidence for problems, (d) the ability to draw conclusions and solutions with proper reasoning.

Data collection techniques involve observations, interviews, and tests. Test data are obtained through evaluation questions consisting of 5 essay questions. Evaluation questions are used to assess learning outcomes after implementing the project-based learning method. The research instrument has been validated by experts, namely class teachers, and has been refined based on the feedback provided. The success indicator of this research is the improvement of student learning outcomes after participating in learning with the Project-Based Learning model, if the students' performance reaches results above the Minimum

Completeness Criteria (KKM) ≥ 80 , which is expected to be achieved by 80% of all students.

Data analysis techniques include quantitative and qualitative analysis. Data are processed and analyzed using Ms Excel by calculating the average scores of each, and then these results are described to obtain a more comprehensive picture.

RESULTS AND DISCUSSION

The activities began with the pre-cycle stage aimed at assessing the initial condition of the research object before implementing the project-based learning model in Class X of SMKN 2 Singosari. The pre-cycle involved interviews with class teachers and observations of the learning process as a basis for collecting initial data on students' abilities. The results of the pre-cycle indicated that the critical thinking skills of students were still lacking, consistent with their learning outcomes in the History subject on the topic of "The Process of the Introduction and Development of Islam in the Archipelago". Subsequently, the researcher prepared various learning tools, including RPP, Teaching Materials, LKPD, Learning Media, and Evaluation Instruments to be used in cycle I and cycle II.

Based on the analysis of the percentage of students' critical thinking skills in learning History on the topic of "The Process of the Introduction and Development of Islam in the Archipelago", using the projectbased learning model, and comparing the percentages in the pre-cycle, cycle I, and cycle II, as shown in Table 3. From Table 1, it can be seen that students' critical thinking skills improved from the pre-cycle to cycle I and cycle II. In the "ability to ask questions" indicator, based on the pre-cycle test results, a score of 49% was obtained, increasing to 61% in cycle I, and reaching 82% in cycle II. In the "ability to present arguments/ideas" indicator, based on the pre-cycle test, a score of 50% was obtained, increasing to 63% in cycle I, and increasing to 89% in cycle II. At the level of the "ability to validate data relevant to the problem" indicator, based on the pre-cycle test results, a score of 47% was obtained, increasing to 73% in cycle I, and increasing to 87% in cycle II. Then, in the "ability to formulate conclusions and solutions with proper reasoning" indicator, based on the pre-cycle test results, a score of 47% was obtained, increasing to 75% in cycle I, and increasing to 87% in cycle II.

Table 3. Results of Critical Thinking Skills of Students in Class X of SMKN 2 Singosari in Pre-Cycle, Cycle I & Cycle II

Indicator of CTS	Pre-Cycle	Cycle I	Cycle II
Skills in posing questions	49%	61%	82%
Skills in presenting arguments of ideas/concepts	50%	63%	89%
Skills in validating data relevant to the issue	47%	73%	87%
Skills in formulating conclusions and solutions with appropriate reasoning	47%	75%	87%

Meanwhile, the learning outcomes of the tenth-grade students at SMKN 2 Singosari Malang, as shown in Table 4, indicate that the average learning outcomes in the pre-cycle were 59, in cycle I were 76, and in cycle II were 88, with learning completeness scores of 0 in the pre-cycle, 4 in cycle I, and 20 in cycle II, resulting in percentages of 0% in the pre-cycle, 20% in cycle I, and 100% in cycle II.

Table 4. Learning Outcomes of Tenth-Grade Students at SMKN 2 Singosari in Pre-Cycle, Cycle I & Cycle II

Learning Outcomes	Pre-Cycle	Cycle I	Cycle II
Rerata	59	76	88

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Ketuntasan	0	4	20
Prosentase	0%	20%	100%

The research findings indicate a significant improvement in students' critical thinking skills in History learning by implementing the project-based learning model, especially in the context of the entry and development of Islam in the Indonesian archipelago. From the percentage analysis results of the three learning cycles, it can be observed that there is a consistent improvement in all observed critical thinking skills indicators. This is in line with previous research findings by Rani (2021); Hidayati, Yusnidar & Susanti (2024), which emphasize the effectiveness of the project-based learning model in enhancing students' critical thinking skills in History, including the entry and development of Islam in the Indonesian archipelago.

Other relevant studies to these findings show a similar pattern of improvement in students' critical thinking skills. For example, research results by Nugroho, Pelu & Wahyuni (2018); Kuddu (2021), as well as Mahdalena, Ahmadin & Sulmi (2023), involving the project-based learning model and emphasizing the application of critical reasoning in History learning, also found a significant improvement in students' critical thinking skills. However, it should be noted that these studies may have variations in learning designs and different student populations.

Meanwhile, the learning outcomes of tenth-grade students at SMKN 2 Singosari Malang also demonstrate a significant improvement in the average learning outcomes and the level of learning completeness in the two learning cycles. Although not directly related to measuring critical thinking skills, this improvement in learning outcomes can be considered a positive indicator of the effectiveness of the applied learning model. This finding is consistent with previous research highlighting the relationship between interactive learning models and improved student learning outcomes.

However, despite the significant improvement in learning outcomes, it should be noted that there are differences in the focus of measurement between these studies and studies evaluating critical thinking skills. Therefore, to gain a more comprehensive understanding of the effectiveness of the applied learning model, future research could integrate learning outcome measurements with more detailed measurements of critical thinking skills.

Overall, the research findings provide valuable contributions to understanding the effectiveness of the project-based learning model in enhancing students' critical thinking skills in History learning. Nevertheless, further in-depth and extensive research is needed to strengthen these findings and identify factors that may influence learning outcomes more comprehensively.

CLOSING REMARKS

Based on the research findings, it can be concluded that the implementation of the project-based learning model in the topic of the Entry and Development of Islam in the Indonesian Archipelago has a significant impact on improving students' critical thinking skills.

This improvement can be seen from the percentage analysis of the indicators such as "ability to ask questions", "skills in presenting arguments and ideas", "skills in validating data relevant to the issues", and "skills in formulating conclusions and solutions with appropriate reasoning". From the pre-cycle to cycle I, there was a considerable increase in each indicator, which further increased in cycle II.

Specifically, this improvement is reflected in significant numbers. For example, in the "ability to ask questions" indicator, there was an increase from 49% in the pre-cycle to 82% in cycle II. Similar improvements were observed in other indicators, indicating that the project-based learning model is effective in enhancing students' critical thinking skills in the context of History learning.

REFERENCES

- 1) Arif, H., et al. (2021). *Panduan Pelaksanaan Project-Based Learning*. Batam: Teknik Informatika, Politeknik Negeri Batam.
- 2) Asrori & Rusman. (2020). *Classroom Action Research Pengembangan Kompetensi Guru*. Purwokerto Selatan: Penerbit CV. Pena Persada.
- 3) Brookfield, S. D. (2012). *Teaching for Critical Thinking: Tools and Techniques to Help Students Question Their Assumptions*. Jossey-Bass.
- 4) Changwong, K., Sukkamart, A., & Sisan, B. (2018). Critical thinking skill development: Analysis of a new learning management model for Thai high schools. *Journal of International Studies*, 11(2), 37-48. doi:10.14254/2071-8330.2018/11-2/3.

Enhancement of Critical Thinking Skills of Grade X Students at SMKN 2 Singosari in History Learning: The Process of Islam's Entry and Development in the Archipelago through Project-Based Learning

- 5) Ekawati, N.P.N., Dantes, N., dan Marhaeni, A.A.I.N. (2019). Pengaruh Model Project Based Learning Berbasis 4C terhadap Kemandirian Belajar dan Kemampuan Membaca Pemahaman pada Peserta didik Kelas IV SD Gugus III Kecamatan Kediri Kabupaten Tabanan. *PENDASI: Jurnal Pendidikan Dasar Indonesia*, 3(1), 41-51.
- 6) Ennis, R. H. (1989). Critical Thinking and Subject Specificity: Clarification and Needed Research. *Educational Researcher*, 18(3), 4-10.
- 7) Fuldiaratman & Ekaputra, F. (2023). Analysis of Students' 4C Skills Based on Project Based Learning through Chemo Entrepreneurship Media. *EduLine: Journal of Education and Learning Innovation*, 3(2), 454-459. <https://doi.org/10.35877/454RI.eduline2057>.
- 8) Hidayat, F., Afif, T.R.H., dan Dahlan, Z. (2024). Islam Nusantara: Sejarah Peradaban Islam Kontemporer di Indonesia. *Gudang Jurnal Multidisiplin Ilmu*, 2(1), 92-99. Doi: <https://doi.org/10.59435/gjmi.v2i1.195>.
- 9) Karomatunnisa, A.Z.A., Sholih, J.A.U., Hanifah, N., dan Prihantini. (2022). Meta Analisis Model Pembelajaran Project Based Learning dalam Meningkatkan Kemampuan Keterampilan Abad 21. (*J-PSH*) *Jurnal Pendidikan Sosiologi dan Humaniora*, 13(2), 522-528.
- 10) Muslikhah, N., dan Umar, M.A.C. (2023). Sejarah Pemikiran Islam di Nusantara. *Al Amin: Jurnal Kajian Ilmu dan Budaya Islam*, 6(2), 333-339. <https://doi.org/10.36670/alaman.v6i2>.
- 11) Nurjanah, I.P., Harini, E., Muflikah, I. (2023). Upaya Peningkatan Kreativitas Peserta didik Melalui Model Pembelajaran Project Based Learning (PjBL) di Kelas 4C SD Negeri Glagah Yogyakarta. *Prosiding Seminar Nasional Pendidikan Profesi Guru Universitas Sarjanawiyata Tamanpeserta didik*, 2(2), 1-8.
- 12) Paul, R., & Elder, L. (2006). Critical Thinking: The Nature of Critical and Creative Thought. *Journal of Developmental Education*, 30(2), 2-7.
- 13) Rahardhian, A. (2022). Kajian Kemampuan Berpikir Kritis (Critical Thinking Skill) dari Sudut Pandang Filsafat. *Jurnal Filsafat Indonesia*, 5(2), 87-94.
- 14) Ricklefs, M.C. (1991). *A History of Modern Indonesia since c. 1300*. Stanford University Press.
- 15) Riskayanti, Y. (2021). Peningkatan Keterampilan Berpikir Kritis, Komunikasi, Kolaborasi dan Kreativitas melalui Model Pembelajaran Project Based Learning di SMA Negeri 1 Seteluk. *SECONDARY: Jurnal Inovasi Pendidikan Menengah*, 1(2), 19-26.
- 16) Rios, O.S.L., et al. (2015). *Critical Thinking Toolkit*. Inter-American Teacher Education Network, Organization of American States.
- 17) Sundari, S., Subali, B., & Marwoto, P. (2020). Analisis Berpikir Kritis Peserta Didik pada Materi Gerak Benda dan Makhluk Hidup. *JPPS (Jurnal Penelitian Pendidikan Sains)*, 9(2), 1819–1824. <https://doi.org/10.26740/jpps.v9n2.p1819-1824>.
- 18) Thomas, J. W. (2000). *A Review of Research on Project-Based Learning*. Autodesk Foundation.
- 19) Zakiah, L. & Lestari, I. (2019). *Berpikir Kritis dalam Konteks Pembelajaran*. Bogor: Erzatama Karya Abadi.



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