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# Development, Validation, and Effectiveness of Android-Based Learning Material in Statistics

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**ABSTRACT:** In this 21st century, students are more compelled towards the use of a mobile phone for every purpose. This study aimed to develop, validate, and test the effectiveness of an android-based learning material in Statistics. The technological profile, technology acceptance in terms of perceived use and perceived ease of use, relationship between the technological profile and technological acceptance, performance of respondents with or without the use, effectiveness, and validity of the android-based learning material were investigated in this study. The study utilized descriptive, developmental, and quasi-experimental research design. Two sections of Grade 10 were considered in the study; one section used the learning material, while the other section did not. Pre-test and post-test were conducted on the two groups. Data gathered were analyzed, tabulated, and presented using frequency count, percentage, mean, standard deviation, paired sample t-test, and simple correlational analysis. It was found out that all respondents have available gadgets; they "often" use technology and "advanced" in terms of technological skills; they strongly agree that the learning material is useful and easy to use; there is a positive relationship between the technology profile and the technology acceptance of the respondents; and the learning material was found to be effective and has very high validity. Hence, it is highly recommended to use the learning material in Statistics. Developing android-based learning material is recommended for other topics in mathematics, and students may be provided with other supplementary materials for greater retention.

**KEYWORDS:** Android-based learning material, technology profile, technology acceptance, perceived use, perceived ease of use

## I. INTRODUCTION

Mathematics deals with logical reasoning, and its development contributed to the expansion of science and technology. It requires critical thinking skills that involve abstraction and analysis. Mathematics has been widely used to improve society through research. The role of mathematics is inevitable; hence, it must be mastered.

Many things must come together for learning to be effective. These elements often result from teachers, students, teaching and learning media or resources, and the learning environment. The development of advanced hardware, software, and other technologies in the computer industry has led to advancements that could be used to address the problem. The development of the student's practical and theoretical knowledge would be greatly enhanced by exploring the potent capabilities of multimedia and implementing it in teaching and learning processes by creating learning materials and products like e-books, Android learning applications, and computer-assisted instruction, among others.

In addition, electronic learning, or e-learning as it is more commonly called, includes mobile learning interaction with information, enabling effective learning without spatial constraints. A source that can be accessed from anywhere, mobile learning is a blend of cloud computing and online learning. Cell phones will make it simpler and more convenient for students to access educational resources without being restricted by time and space.

Mobile technology is an extremely fast-growing industry intrinsically tied to our work and daily life. In this 21st century, students are more compelled to use a mobile phone for every purpose. The world is at the fingertips, and a student can access any information from anywhere. A mobile phone, hence, can be used for several such purposes. Mobile applications make the information easily available. Every mobile app has a unique feature that offers its own set of services.

According to Raphael (2017), learning via mobile applications creates a more interesting, interactive experience for students. Students learn differently; not all can absorb and retain information by reading books. He added that hands-on tools such as videos and illustrations keep students engaged. They can utilize games, activities, and flashcards, helping them retain the information

later. Learning via mobile apps allows teachers to gain immediate feedback on what a student is or is not understanding and can intervene quickly.

Students' success in all learning disciplines is important in generating the best quality of learners who can achieve and compete worldwide. Their performances could demonstrate the effectiveness of the curriculum, which encompasses every aspect of instruction, such as learning resources and teaching pedagogy.

Thus, this study aims to develop an interactive learning mobile application in Statistics. This provided learning resources in teaching and learning Statistics (Measures of Position – Ungrouped Data).

A. Objectives of the Study

This study aimed to develop an android-based learning material in Statistics.

Specifically, the study sought to answer the following:

1. What is the technology profile of the respondents in terms of:
•availability of gadget/s;
•level of technology use; and
•level of technological skills?
2. What is the level of technology acceptance of the developed Android-based learning material in terms of:
•perceived use; and
•perceived ease of use?
3. Is there a significant relationship between the technology profile of the respondents and the technology acceptance of the developed Android-based learning material in Statistics?
4. What is the level of performance of the two groups of respondents:
•with the use of Android-based learning material; and
•without the use of Android-based learning material?
5. Is there a significant difference between the group's performance with or without using Android-based learning material?
6. What is the level of validity of the developed android-based learning material in terms of:
•content quality;
•instructional quality; and
•technical quality?

## II. REVIEW OF LITERATURE

**Technological Profile of the Respondents.** According to Lai and Hong's (2015) research, while students spent a lot of time on digital technologies, the variety of digital technologies they employed could have been more extensive. This study also identified no practical generational differences in technology use patterns or learning characteristics. According to the findings of this study, generation is neither a determining factor in students' usage of digital tools for learning nor has it had a significant impact on the learning qualities of higher education students.

**Availability of Gadgets.** The availability of online gadgets significantly influences their functionality, showing that online facilitation thrives on online gadgets. As a result, the importance of online devices in guaranteeing successful online facilitation must be considered. Individual students participating in remote education must make the necessary efforts to acquire these critical online tools/gadgets, such as Android phones, laptops, and desktop computers, among others, to participate in online facilitation. This could be a problem for students because some distance learners need outside assistance to pay their school fees. Thus, the expense of acquiring internet gadgets has become a necessary supplementary cost to their education whether they choose or are compelled to participate in the intended fully online study. (Segbenya et al., 2022).

**Technology Skills.** Rodrigues et al., (2021) found that the respondents emphasized "adapt my searching strategy to find the most appropriate information and content in digital environments," "share information and content using a variety of digital tools," "manipulate information for easier organization, storage, and retrieval," and "use and select appropriate digital technologies to interact" as skills they felt they had developed more in higher education. Less developed technological skills were those related to security, such as "applying copyright and license rules," "using safety and security measures," "choosing solutions to protect the environment from the impact of digital technologies," and "solving problem situations in digital environments." In addition, the text editor, learning platforms, presentations, WhatsApp, and Instagram were the programs or software utilized by most respondents in their personal, social, academic/professional, and teaching/learning lives. "Search engine navigation and searches," "send messages and use email," "perform academic work," and "use social networks" were the most developed digital technology activities. Students generally saw technology abilities as critical in the future digital world and labor market. Technology is helpful at the organizational level for time management, knowledge dissemination and promotion, and problem-solving, and it allows for

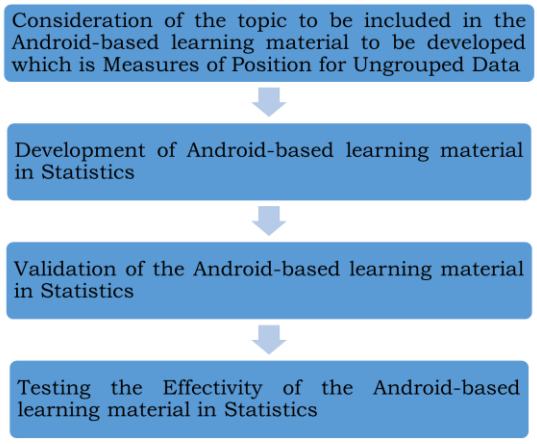
increased efficiency, excellent connectivity and communication, information management, distance work, and adaptation to a constantly changing world.

**Development and Validation of Android-based Material.** Yunus and Francisco (2021) concluded that the learning media product—android-based learning media—was the basis for the validation analysis. Four-D models were used with research and development techniques to create the instructional materials. After the learning media was finished, the validation process was conducted. The average validity rating on the frequency distribution diagram is 96.8%, which is Very Valid. This conclusion was reached after evaluating five specialists, including media and content experts. The analysis and validation results support the usage of this android-based learning resource for entrepreneurship classes at the Padang Vocational School's Tourism Department.

**Mathematics performance**. The study by Peteros et al. (2019) finds that 52 or 28.42 percent of respondents had satisfactory performance in mathematics, whereas 97 or 53.01 percent of respondents had a performance that was fairly satisfactory. Only twenty, or 10.93%, had very satisfactory performance, while only thirteen, or 7.10%, had outstanding performance. Furthermore, the statistics indicate room for improvement in the respondents' performance. Learning difficulties in the topic must be addressed to improve students' performance, mainly because their work has already been graded for three grading periods.

## III. METHODOLOGY

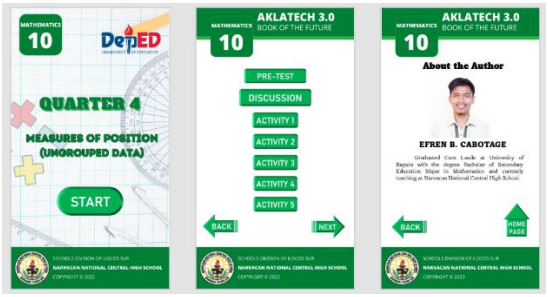
This study utilized descriptive and quasi-experimental research design employing correlational and developmental approaches to determine the validity, effectiveness, and technology acceptance of the android-based learning material. The descriptive research was chosen to determine the technological profile of the respondents in terms of availability of gadgets, level of technology use, level of technological skills, level of technology acceptance in terms of perceived use and perceived ease of use, level of performance, and level of validity of the learning material. Moreover, the study used correlational methods to determine the relationship between the technology profile and the technology acceptance of the learning material. Meanwhile, developmental research design was considered in developing the android-based learning material, which was validated by experts. The study was conducted among two sections of Grade 10 students of Narvacan National Central High School during the SY 2022-2023. One section used the android-based learning material, composed of 40 learners, and the other did not use the android-based learning material and, composed of 39 learners. The following flowchart was followed throughout the study.




In developing the Android-based learning material, the activities and discussions were made using Lumi software and saved into HTML files. The graphics were made using Microsoft PowerPoint and Canva. Using Adobe XD, HTML files were exported into one folder. Also, the interface and prototype of the Android-based learning material were made using Adobe XD. Finally, using Website 2 APK Android App Builder, the HTML files were converted into an APK (Android Package Kit) format. The APK file was distributed to the students using Bluetooth, SHAREit, and Facebook Messenger and installed on their Android phones.

The process illustrates the development of the android-based learning material.


The figure below shows the interface of the android-based learning material.




To treat and analyze the data gathered, the following statistical tools were utilized:

Frequency count and percentage were used to describe respondents' technology profile regarding gadgets' availability.

Mean was utilized to determine the level of technology use, level of technological skills, level of technology acceptance of the android-based learning application in Statistics, and level of validity of the android-based learning application. Mean and standard deviation were also used to determine the student's performance level with or without using Android-based learning material.

Simple correlation analysis was used to determine the significant relationship between the technology profile of the respondents and the level of technology acceptance of the android-based learning application in Statistics.

A paired sample T-test was used to determine the significant difference between the group's performance with or without using Android-based learning material.

## IV. RESULTS AND DISCUSSIONS

**Table 1. AVAILABLE GADGET/S of the RESPONDENTS**

| Gadget | f | % |
|---|---|---|
| Laptop | 31 | 77.50 |
| Desktop | 4 | 10.00 |
| Tablet/iPad | 9 | 22.50 |
| Smartphone | 40 | 100.00 |

Table 1 shows all the respondents have smartphones, while only 4 (10%) have desktop computers. This means that all of them have available gadgets to use in learning. In the study of Asio et al. (2021), the smartphone ranks first on the list of learning devices available to learners. Because these devices are popular among students, they are among the greatest tools for educational institutions to use (AlTameemy, 2017).

**Table 2. Level of Technology Use of the Respondents**

| **Indicators** | **Mean** | **DR** |
|---|---|---|
| 1. I use technology while working in teams with other students. | 3.95 | Often |
| 2. I learned how to use new technology tools this school year. | 3.80 | Often |
| 3. I take quizzes or tests on the computer/ laptop/ smartphone. | 3.88 | Often |
| 4. I use technology to search for information for school assignments. | 4.23 | Very Often |
| 5. I use technology to create products for school (posters, presentations, projects, etc.) | 4.23 | Very Often |
| 6. I use technology to present information to others (class presentations, demonstrations, etc.) | 4.10 | Often |
| 7. I use technology to communicate with teachers or students at my school about schoolwork (email, instant message, Facebook/messenger, etc.) | 4.38 | Very Often |
| 8. I use technology to solve complex, real-life situations and problems. | 3.85 | Often |
| OVERALL | 4.05 | Often |

Table 2 indicates that the respondents use technology Very Often (mean=4.05) when they search for information for school assignments, create products for school (posters, presentations, projects, etc.), and communicate with teachers or students

about schoolwork. In general, the respondents use technology Often in their learning process. It implies that the use of technology is helpful in the learning process of the respondents. According to the study by Thompson (2013), it is crucial for instructors to critically evaluate claims regarding digital natives' technological proficiency and to establish accurate assessments of their students' technological proficiency.

The study of Rashid et al. (2016) revealed that students' involvement and self-directed learning are directly related to their use of technology. However, there is no substantial direct association between technology use and academic performance. The results indicate a complicated linkage between student technology use, self-directed learning, and academic success.

**Table 3. Level of Technological Skills of the Respondents**

| Indicators | Mean | DR |
|---|---|---|
| 1. Create and format reports or documents (Microsoft Word, etc.). | 3.78 | Advanced |
| 2. Create and format spreadsheets (Microsoft Excel, etc.). | 4.20 | Advanced |
| 3. Create presentations (PowerPoint, etc.). | 3.73 | Advanced |
| 4. Create multimedia products (combining pictures, sounds, writing, etc.). | 4.03 | Advanced |
| 5. Create graphs and charts (Microsoft Excel, Microsoft Word, etc.). | 3.65 | Advanced |
| 6. Solve mathematical problems using a graphing calculator or mathematical software. | 3.80 | Advanced |
| 7. Upload and edit digital media (pictures, video, audio, etc.). | 4.18 | Advanced |
| 8. Find information on the internet using search engines (Google, Microsoft Edge, Mozilla Firefox, etc.). | 4.35 | Expert |
| 9. Send and receive email messages. | 4.18 | Advanced |
| 10. Work with others online (Google Docs, wikis, discussion boards, etc.). | 4.15 | Advanced |
| OVERALL | 4.00 | Advanced |

Table 3 shows the respondents' level of technological skills. The respondents are Experts (mean = 4.00) in finding information on the internet using search engines. In general, the respondents are advanced in their technological skills. It implies that the respondents can use technology in their learning process. In the study of Thompson (2013), if early technology immersion affects development and thinking in the way many famous press authors suggest, then this collection of "digital learner" qualities may be present in the subset of the digital native population that uses a wide range of technologies regularly.

**Level of Technology Acceptance of the Developed Android-Based Learning Material in Statistics**

**Table 4. Level of Technology Acceptance in Terms of Perceived Use**

| Indicators | Mean | DR |
|---|---|---|
| 1. Using the Android-based learning material would enable me to accomplish tasks more quickly. | 4.53 | Strongly Agree |
| 2. Using the Android-based learning material would improve my academic performance. | 4.43 | Strongly Agree |
| 3. Using the Android-based learning material increases my efficiency in studying statistics. | 4.25 | Strongly Agree |
| 4. Using the Android-based learning material would enhance my effectiveness in studying statistics. | 4.30 | Strongly Agree |
| 5. Using the Android-based learning material would make it easier to study statistics | 4.30 | Strongly Agree |
| 6. I would find the Android-based learning material helpful in studying statistics | 4.30 | Strongly Agree |
| **OVERALL** | 4.35 | Strongly Agree |

Table 4 reflects the respondents' level of technological acceptance of the Android-based learning material in terms of perceived usefulness. The respondents Strongly Agree (mean = 4.35) that the android-based learning material is perceived as useful in their learning process. This implies that the respondents perceived the android-based learning material useful in learning Statistics. In

the study of Masrom (2007), according to the findings', perceived usefulness is more relevant than attitude toward utilizing in predicting intention to use. According to TAM, perceived usefulness significantly influences students' intention to use technology.

**Table 4. Level of Technology Acceptance in Terms of Perceived Ease of Use**

| Indicators | Mean | DR |
|---|---|---|
| 1. Learning to use the Android-based learning material would be easy for me. | 4.50 | Strongly Agree |
| 2. I would find it easy to get the Android-based learning material to do what I want it to do. | 4.33 | Strongly Agree |
| 3. My interaction with the Android-based learning material would be clear and understandable. | 4.33 | Strongly Agree |
| 4. I would find the Android-based learning material clear and understandable. | 4.28 | Strongly Agree |
| 5. It would be easy for me to become skillful at using the Android-based learning material. | 4.30 | Strongly Agree |
| 6. I would find the Android-based learning material easy to use. | 4.23 | Strongly Agree |
| OVERALL | 4.32 | Strongly Agree |

Table 5 reflects the respondents' level of technology acceptance regarding the perceived ease of use of the Android-based learning material. The respondents Strongly Agree (mean = 4.32) that the android-based learning material is perceived as easy to use and could help them learn. This implies that the Android-based learning material is easy to use and useful in mastering statistics skills. In the study conducted by Dart et al. (2020), one of the most common themes in student replies was that WEVs' (Worked Example Videos) vocal explanations improved their understanding of the subject. Students used this understanding to improve their course achievement. Previous studies have indicated this is a common belief among the student population, with about 90% believing that WEVs improve technical topic understanding.

**Table 5. Relationship between the Level of Technology Use and Technology Acceptance**

| Level of Technology Use | Perceived Use | | Perceived Ease of Use | |
|---|---|---|---|---|
| | Computed r | p-value | Computed r | p-value |
| 1. I use technology while working in teams with other students. | -.153 | .344 | .049 | .765 |
| 2. I learned how to use new technology tools this school year. | .143 | .380 | .064 | .697 |
| 3. I take quizzes or tests on the computer/ laptop/ smartphone. | .243 | .130 | .245 | .128 |
| 4. I use technology to search for information for school assignments. | .050 | .758 | .339* | .032 |
| 5. I use technology to create products for school (posters, presentations, projects, etc.) | .247 | .125 | .160 | .325 |
| 6. I use technology to present information to others (class presentations, demonstrations, etc.) | .150 | .356 | .037 | .822 |
| 7. I use technology to communicate with teachers or students at my school about schoolwork (email, instant message, Facebook/messenger, etc.) | .239 | .138 | .139 | .392 |
| 8. I use technology to solve complex, real-life situations and problems. | .140 | .388 | .148 | .363 |

*Correlation is significant at the 0.05 level (2-tailed).

Table 6 shows a positive relationship between using technology to search for information for school assignments and the perceived ease of use of the Android-based learning material in statistics (r=.339, p-value=.032). Hussein (2017) found that perceived ease of use and usefulness were not significant indicators of E-learning intention to use. This could be because most students already know about E-learning and believe that the technology is convenient and has satisfied them.

Moreover, Hussein (2017) states that attitude is vital in motivating students to use E-learning. Subjective norm (SN), Experience (EXP), and Enjoyment (ENJOY) are found to have a positive and significant influence on students' perceived usefulness (PU) of e-learning.

**Table 6. Relationship between the Level of Technological Skill and Technology Acceptance**

| Level of Technological Skills | Perceived Use | | Perceived Ease of Use | |
|---|---|---|---|---|
| | Computed r | p-value | Computed r | p-value |
| 1. Create and format reports or documents (Microsoft Word, etc.). | .104 | .523 | .031 | .849 |
| 2. Create and format spreadsheets (Microsoft Excel, etc.). | -.100 | .541 | -.126 | .439 |
| 3. Create presentations (PowerPoint, etc.). | .165 | .310 | .279 | .081 |
| 4. Create multimedia products (combining pictures, sounds, writing, etc.). | .158 | .329 | .129 | .428 |
| 5. Create graphs and charts (Microsoft Excel, Microsoft Word, etc.). | .115 | .480 | .068 | .678 |
| 6. Solve mathematical problems using a graphing calculator or mathematical software. | .187 | .248 | .168 | .299 |
| 7. Upload and edit digital media (pictures, video, audio, etc.). | .064 | .696 | .382* | .015 |
| 8. Find information on the internet using search engines (Google, Microsoft Edge, Mozilla Firefox, etc.). | .132 | .416 | .327* | .040 |
| 9. Send and receive email messages. | .112 | .492 | .419** | .007 |
| 10. Work with others online (Google Docs, wikis, discussion boards, etc.). | .109 | .505 | .193 | .232 |

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 7 shows a positive relationship between uploading and editing digital media and the perceived ease of use of the developed android-based learning material, r = .382, p-value = .015. In addition, there is also a positive relationship, r=.327, p-value = .040, between finding information on the internet using search engines such as Google, Microsoft Edge, and Mozilla Firefox and perceived ease of use of the developed Android-based learning material. Also, there is a relationship of 0.01 significance between sending and receiving email messages and the perceived ease of use of the developed Android-based learning material. It implies an association between the level of technological skill and technological acceptance of the android-based learning material. The positive relationship between uploading and editing digital media and the perceived ease of use of the developed Android-based learning material suggests that students who engage in multimedia creation and manipulation find the material more user-friendly. This alignment can enhance their learning experience by allowing them to interact with content in diverse ways. It indicates that students who are adept at online research may navigate the material more effectively. Access to relevant online resources can contribute to a smoother learning process.

According to Ajibade (2018), the ability of staff members to effectively use technology is influenced by their level of IT proficiency and experience. On the other hand, factors such as a company's rules, policies, and IT guidelines can influence an

individual's acceptance and intention to use technology in the workplace. Additionally, personal, or professional goals, as well as the desire for promotion, can also impact one's attitude towards using IT to perform better, which can subsequently increase their intention to use technology more effectively. Employees' effectiveness or self-efficacy has a positive effect on the ease of use and perceived usefulness of a system, Ding & Er (2018) as cited by Abijade (2018). The external variable that may influence the acceptance of technology has already been discussed, and not simply perceived ease of use as suggested by the TAM (Joo, So & Kim, 2018; le Roux & Bresshears, 2016).

**Table 8. Performance of the Respondents with or without the use of Android-based learning material (ABLM)**

| | Mean Score | Standard Deviation | Descriptive Rating |
|---|---|---|---|
| With the Use of ABLM | | | |
| PRE-TEST | 6.98 | 1.2547 | Satisfactory |
| POST-TEST | 13.63 | 0.7644 | Outstanding |
| Without the Use of ABLM | | | |
| PRE-TEST | 6.97 | 1.3679 | Satisfactory |
| POST-TEST | 10.77 | 0.9990 | Very Satisfactory |

Table 8 shows that the respondents who used and did not used the android-based learning material had a satisfactory performance with a mean score of 6.98 and 6.97, respectively, in the pre-test. It was shown that the respondents who used the ABLM had an Outstanding performance with a mean score of 13.63 in the post-test. Meanwhile, the students who did not use the ABLM had a Very Satisfactory performance with a mean score of 10.77. It implies that using ABLM as a supplementary material greatly affected the respondents' performance. The ABLM significantly contributes to student achievement, leading to outstanding post-test results.

In the study of Ghavifekr and Rosdy (2015), findings show that ICT integration is highly effective for both teachers and students. The findings show that teachers' well-preparedness with ICT tools and facilities is one of the most important variables in the effectiveness of technology-based teaching and learning.

Furthermore, Cabuquin and Abocejo (2023) conclude that mathematics performance and academic achievement are inextricably linked, and gender does not affect students' ability to excel in mathematics. Teachers must help students understand how to solve problems and think critically, expose them to real-world applications, and instill the confidence and motivation to succeed academically.

**Table 9. Significant difference Between the Performance of the Respondents with or without the use of Android-based learning material**

| | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| PRE-TEST | .02564 | 1.99324 | .31917 | -.62049 | .67177 | .080 | 38 | .936 |
| POST-TEST | -2.84615 | 1.20391 | .19278 | -3.23642 | -2.45589 | -14.764 | 38 | .000 |

A total of 79 students were respondents in this study, using android-based learning material, n = 40, and without using android-based learning material, n = 39. As shown in Table 9, the pre-test of the respondents with or without the use of ABLM, t = .080, p-value = .936, has no significant difference, while the post-test of the respondents with or without the use of ABLM, t = -14.764, p-value=.000, has a significant difference. It implies that the android-based learning material is effective as a supplementary learning material in studying statistics. A similar study by Wahid (2020) found that android-based learning material affects student achievement in basic mathematical concepts. Moreover, Wahid (2020) found that using Android-based learning material about basic mathematical principles can result in feelings of pleasure and a rapid understanding of the subject matter.

Furthermore, using Android-based learning media increases students' enthusiasm for acquiring numeracy information in mathematics fundamental concepts courses. Android-based learning media, particularly math material, has improved student learning achievement. Finally, Sunarto et al. (2020) found that the difference in average pre-test and post-test scores in the MoLearn (Mobile Learning Application) class is more significant than in the non-MoLearn class. It suggests that adopting MoLearn (Mobile Learning Application) for learning has increased student achievement.

**Table 10. Validity of the Developed Android-based Learning Material in Terms of Content Quality, Instructional Quality, and Technical Quality**

| Indicators | Mean | DR |
|---|---|---|
| **CONTENT QUALITY** | | |
| 1. Content is consistent with topics/skills found in the DepED Learning Competencies for the subject and grade/year level it was intended. | 5.00 | VHV |
| 2. Concepts developed contribute to enrichment, reinforcement, or mastery of the identified learning objectives. | 4.67 | VHV |
| 3. Content is accurate. | 5.00 | VHV |
| 4. Content is up to date. | 5.00 | VHV |
| 5. Content is logically developed and organized. | 5.00 | VHV |
| 6. Content is free from cultural, gender, racial, or ethnic bias. | 4.67 | VHV |
| 7. Content stimulates and promotes critical thinking. | 5.00 | VHV |
| 8. Content is relevant to real-life situations. | 5.00 | VHV |
| 9. Language (including vocabulary) is appropriate to the target user level. | 4.67 | VHV |
| 10. Content promotes positive values that support formative growth. | 4.67 | VHV |
| **MEAN SCORE** | **4.87** | **VHV** |
| **INSTRUCTIONAL QUALITY** | | |
| 1. Purpose of the material is well defined. | 4.33 | VHV |
| 2. Material achieves its defined purpose. | 4.67 | VHV |
| 3. Learning objectives are clearly stated and measurable. | 4.33 | VHV |
| 4. Level of difficulty is appropriate for the intended target user. | 4.33 | VHV |
| 5. Graphics/colors/sounds are used for appropriate instructional reasons. | 4.67 | VHV |
| 6. Material is enjoyable, stimulating, challenging, and engaging. | 4.67 | VHV |
| 7. Material effectively stimulates creativity of target user. | 4.67 | VHV |
| 8. Feedback on target user's responses is effectively employed. | 4.67 | VHV |
| 9. Target users can control the presentation and review rate and sequence. | 4.67 | VHV |
| 10. Instruction is integrated with target user's previous experience. | 5.00 | VHV |
| **MEAN SCORE** | **4.60** | **VHV** |
| **TECHNICAL QUALITY** | | |
| 1. Audio enhances understanding of the concept, if any. | 4.00 | HV |
| 2. Speech and narration (correct pacing, intonation, and pronunciation) are clear and can be easily understood, if any. | 4.00 | HV |
| 3. There is complete synchronization of audio with the visuals, if any. | 4.00 | HV |
| 4. Music and sound effects are appropriate and effective for instructional purposes, if any. | 4.00 | HV |
| 5. Screen displays (text) are uncluttered, easy to read, and aesthetically pleasing. | 4.00 | HV |
| 6. Visual presentations (non-text) are clear and easy to interpret. | 4.33 | VHV |

| | | |
|---|---|---|
| 7. Visuals sustain interest and do not distract the user's attention. | 4.67 | VHV |
| 8. Visuals provide an accurate representation of the concept discussed. | 4.67 | VHV |
| 9. The user support materials (if any) are effective. | 4.33 | VHV |
| 10. The design allows the target user to navigate freely through the material. | 4.67 | VHV |
| 11. The material can easily and independently be used. | 4.67 | VHV |
| 12. The material will run using minimum system requirements. | 4.67 | VHV |
| 13. The program is free from technical problems. | 4.00 | HV |
| **MEAN SCORE** | **4.31** | **VHV** |
| **OVERALL** | **4.59** | **VHV** |

* VHV - Very Highly Valid, HV - Highly Valid

As shown in Table 10, the android-based learning material is Very Highly Valid with a mean of 4.87 in terms of Content Quality, Very Highly Valid with a mean of 4.60 in terms of Instructional Quality, and Very Highly Valid with a mean of 4.31 in terms of Technical Quality. Overall, the android-based learning material is Very Highly Valid with a mean of 4.59. The result of the validity implies that the android-based learning material is appropriate and valid. It also suggests that the material effectively covers relevant and valuable educational content. Furthermore, it implies that the instructional design and delivery contribute positively to the learning experience. This indicates that the technical aspects usability, functionality, and reliability are well-executed. In the study of Pantaleon (2022), the overall mean score of "Very Valid" implies that the generated Basic Calculus educational material can help students improve their Basic Calculus ability. Likewise, in Garcia's study (2022), the researcher-created strategic intervention material was assessed as highly valid and reliable in assisting students in developing proficiency in various learning abilities. Prasetyo's (2019) study concluded that the creation of Android-based mobile learning media products is suitable for use in Physical Education, Sports, and Health (PJOK) learning processes. The study also found that the developed product effectively enhanced students' learning outcomes.

## V. CONCLUSION

The following are the conclusions reached after rigorous examination and interpretation of the findings.

1. All respondents have available gadgets such as smartphones. The respondents often use technology and Advanced regarding technological skills.
2. The respondents strongly Agree on the technological acceptance of the android-based learning material in terms of its perceived use and ease of use.
3. There is a positive relationship between the technology profile and the respondents' acceptance, specifically on the perceived ease of use of the Android-based learning material.
4. The respondents who used android-based learning material showed an outstanding performance; meanwhile, the respondents who did not use android-based learning material manifested a Very Satisfactory performance.
5. There is a significant difference in students' performance with or without using Android-based learning material.
6. The developed android-based learning material has a Very High Validity that can help students develop proficiency in the different learning competencies.

## VI. RECOMMENDATION

Based on the conclusions made, the researcher as a result of this recommends the following:

1. Using the developed android-based learning material in Statistics is highly encouraged in teaching Measures of Position, as evident from the study.
2. Provision of learning gadgets such as tablets and smartphones for those who do not have access to technology from the DepEd Computerization Program.
3. The development of android-based learning material is recommended for other topics in mathematics to achieve greater retention among students.
4. Incorporate more interactive online and offline activities that could sustain the students' interest.

5. Students may be provided with other supplementary materials such as activity sheets, self-learning modules, and strategic intervention materials to achieve the desired learning competencies more significantly.
6. A further study along this line should be conducted to validate and strengthen the results and findings of this study and to consider the interactive aspect of the material they will produce.

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