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Implementation of Special Mathematics Education in Narvacan National Central High School

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ABSTRACT: The study assessed the implementation of Special Mathematics Education (SME) at Narvacan National Central High School, focusing on teacher profiles, policy, instructional materials, and performance, identifying challenges and relationships among variables. The study utilized a mixed method and explanatory sequential research design, involving 15 teachers and 128 learners, and collected data through a survey questionnaire and one-on-one interviews, analyzing frequency, percentage, mean, and correlation. The study found that most respondents were female mathematics teachers aged 26-30, with a master's degree and school-based training. Most students received outstanding grades for the 2022-2023 school year. The Special Mathematics Education curriculum was highly implemented, and teachers' profiles showed a significant relationship with instructional materials and learners' performance. Solutions included technology integration, Open Education Resources, active learning techniques, and personalized learning plans. Teachers should pursue postgraduate education, enhance student performance through materials, sustain special mathematics education, enrich their knowledge through LAC sessions, seminars, and trainings, identify and solve teaching problems, and continue to provide meaningful and productive activities for learners, ensuring outstanding performance and continuous improvement.

KEYWORDS: Profile, Instructional Materials, Implementation, Curriculum

I. INTRODUCTION

Students in the United States outperformed the OECD average in reading and science, but below in mathematics, with a nearly 4 percentage point increase in reading performance between 2009 and 2018.

In the Philippines, Department of Education (DepEd) is working to enhance the literacy and numeracy skills of Filipino learners through various policies, including DepEd Order No. 55 s 2010 and DepEd Order No. 46 s 2012, which focus on science and mathematics education at the secondary level. Malipot (2022) reports that the Department of Education plans to launch a national initiative to enhance numeracy and mathematics achievement in schools through a Steering Committee and Technical Working Group.

Policies have allowed schools to implement Special Science and Mathematics Classes, like those at Narvacan National Central High School in Ilocos Sur. However, their implementation status remains unassessed, requiring a study. The Special Mathematics Education (SME) curriculum was introduced to strengthen mathematics programs in the Philippines.

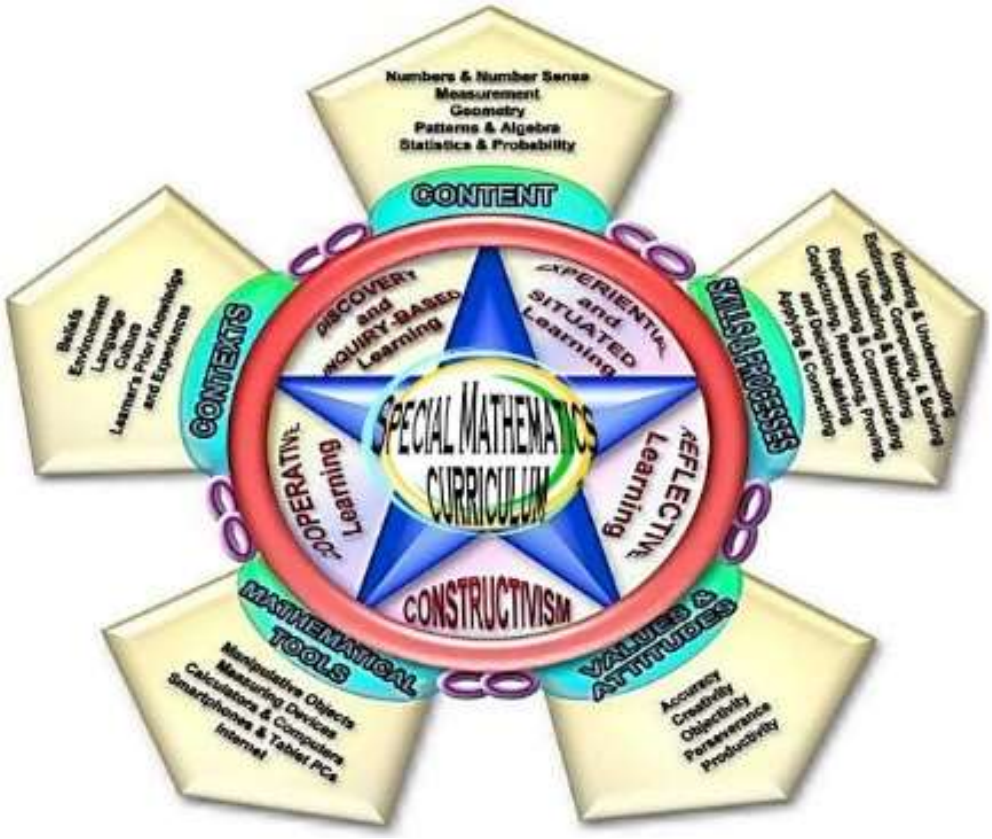
The purpose of issuing this Order is to encourage schools to strengthen Science and Mathematics Education at the secondary level in the country. Under this Order, the Department offered funding allocation for both types of A and B schools as reflected in an enclosure. Such initiative is really made to encourage schools to offer Special Science and Mathematics Education. As an effect, many schools submitted pertinent documents for validation and approval.

The Order requires schools offering Special Science and Math Classes to meet specific requirements before approval, allowing schools to operate. However, these schools continue to offer these classes for improved student performance.

The implementation of Special Science and Mathematics Education is still in effect. Thus, with the abovementioned scenarios and policies, there is really a need to investigate the present status of implementation of the Special Mathematics Classes in the Schools Division of Ilocos Sur which is the focus of this study. This could lead to the better understanding on the implementation of the program especially on instruction.

II. FRAMEWORK OF THE STUDY

To provide a clearer understanding, the following concepts and theories which are closely related to the subject of the study are highlighted.



The K-12 curriculum uses various educational learning theories. In fact, the curriculum framework establishes a clear picture on the relationship between content standard and performance standard. Thus, teachers should be fully aware of these theories so that they will be guide as they prepare and execute their lessons.

To see a clearer view of how the study was conducted, the research paradigm is shown below.

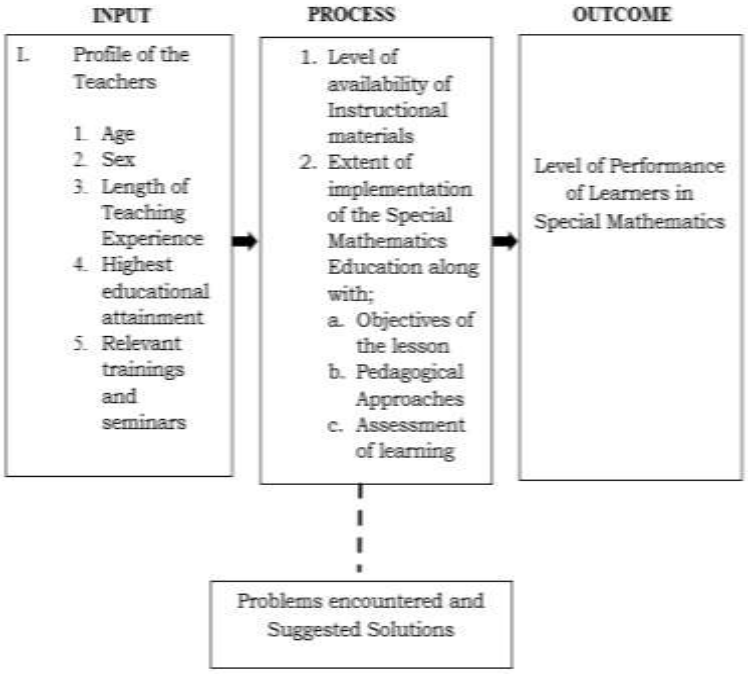


Figure 1. The Research Paradigm

The paradigm of the study as shown in Figure 1 presents the Input-Process-Outcome model.
The input encapsulates the profile of the respondents such as age, sex, length of teaching service, educational attainment, relevant trainings and seminars.
The process emphasizes the level of availability of instructional materials, the extent of implementation of the Special Mathematics Education along objectives of the lessons, teaching pedagogies, and assessment of learning. The problems encountered by the respondents and the suggested solutions are also presented. The outcome of the study includes the performance of learners in Special Mathematics Education.

III. METHODOLOGY

A. Research Design

This study used a mixed method design. Bhandari (2020) defined quantitative research as the process of collecting and analyzing numerical data and can be used to find patterns and averages, make predictions, test causal relationships, and generalize results to wider populations.
This study uses a correlational research design to examine the relationship between respondents' profile and the implementation of the Special Mathematics Program.
The study utilized a qualitative research method to identify respondents' problems, utilizing non-numerical data to gain in-depth insights and generate new research ideas.

B. Population and Locale of the Study

This study was conducted at Narvacan National Central High School, Paratong, Narvacan, Ilocos Sur for school year 2022 – 2023.
The study employed purposive sampling, a non-probability method where units are chosen based on their necessary characteristics for the sample.
More specifically, this study utilized total population sampling. Total population sampling is a type of **purposive sampling technique** that involves examining the **entire population** (i.e., the **total population**) that have a particular set of **characteristics** (e.g., specific attributes/traits, experience, knowledge, skills, exposure to an event, etc.) *(Ibid.).*
The researcher utilized the fifteen (15) teachers who are handling mathematics at Narvacan National Central High School. Additionally, one hundred twenty-eight (128) learners in Grades 7-10 were also utilized.

IV. RESULTS AND DISCUSSIONS

Profile of the Respondents

The following figure present the profile of the teacher-respondents along age, sex, length of service, educational attainment and relevant trainings and seminars attended.

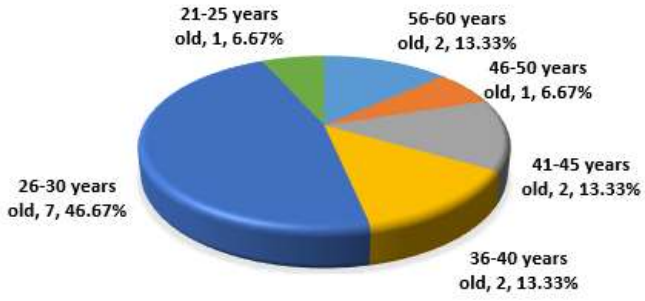


Figure 2.

Distribution of the Profile of Respondents in terms of Age

Figure 2 shows that the majority (46.67%) of the respondents were 26-30 years old. Six of them shared a total of 39.99% with ages 36-40 years old, 41-45 years old, and 56-60 years old respectively. Two of them shared a total of 13.34% with ages 21-25 years old, and 46-50 years old. The result further means that the teaching force of the Math department was dominated by teachers who have been trained or equipped with 21st-century teaching skills. The findings of the study are similar to that of Funtanilla (2022) where majority of the respondents were under the ages of 26-30.

Moreover, according to Alufohai and Ibhafidon (2015), students' academic achievement is significantly influenced by teachers' age. Relatively, the findings of the study of Russo et. al (2023) suggested that teacher enjoyment of teaching mathematics in the early primary years has important implications for both the quality and quantity of mathematics instruction students receive.

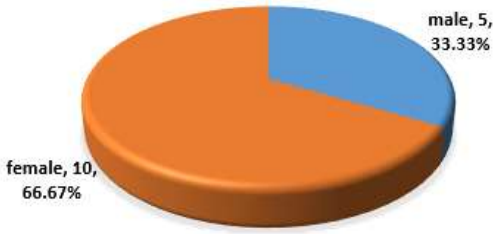


Figure 3.

Distribution of the Profile of the Respondents in terms of Sex

Figure 3 shows that the majority (66.67%) of the respondents were females, followed by males at 33.33%. The result further shows that the teaching force of the mathematics department of the school was dominated by female teachers.

Sex plays a vital role in different job performance whether in offices, teaching, or in field works. Various researches provided results how males and females vary in terms of their performance. Women were found to score higher than men on the interpersonal dimension (Stone et. al.,2009). These findings support this study that there are more female teachers than male teachers.

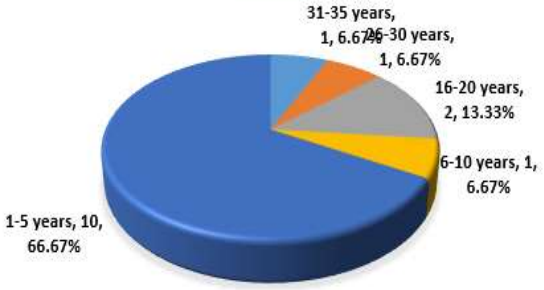


Figure 4. Distribution of the Profile of the Respondents in terms of Length of Service

Figure 4 shows that the majority (66.67%) of the respondents started teaching between 1-5 years. Two or 13.33% of them have a length of service between 16-20 years in the government service, and three of them shared a total of 20.01% with a length of service of 6-10 years, 26-30 years, and 31-35 years respectively. The result means that the teaching force of the Mathematics Department of the school was dominated by newer and younger teachers.

According to Kini and Podolsky (2016), they found that more experienced teachers confer benefits to their colleagues, their students, and to the school as a whole.

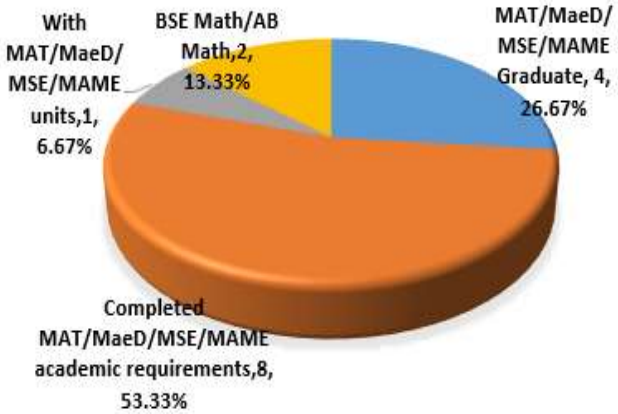


Figure 5. Distribution of the Profile of the Respondents in terms of Educational Attainment

Implementation of Special Mathematics Education in Narvacan National Central High School

The majority of respondents (53.33%) have completed academic requirements for a Master's degree, with 26.67% graduating with a Master of Arts in Teaching, Education, Science, or Mathematics Education. The data reveals a positive trend in the educational landscape, with graduates actively pursuing advanced degrees, demonstrating commitment to lifelong learning and staying updated with the latest methodologies and research in the education sector.

The result is in line with the study of Ferrer (2017), with the advent of globalization and competition, this young generation of teachers is more aware of the need to grow professionally, thus, they pursue graduate studies.

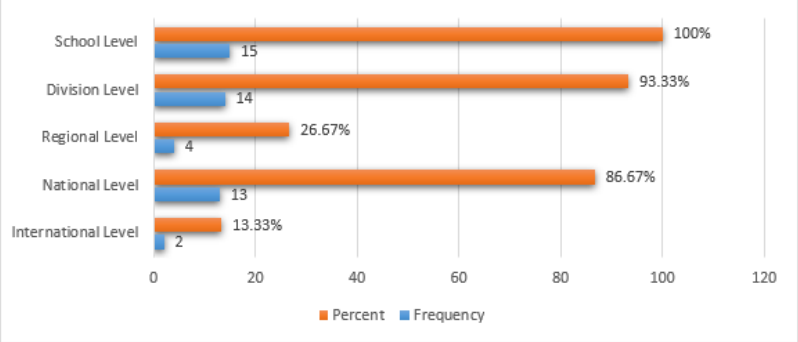


Figure 6. Distribution of the Profile of the Respondents in terms of Seminars and Training Attended

The study reveals that all respondents have attended school-based mathematics training and seminars, with 93.33% participating in sponsored training. The majority of teachers have adequate knowledge and skills through various levels of training and seminars. Nabayra & Nabayra (2021) revealed that mathematics teachers personified the culture of excellence in mathematics education by integrating different strategies in teaching mathematics, being passionate and dedicated, and by pursuing continuous professional growth.

Availability of Instructional Materials in Teaching Special Mathematics Education in Narvacan National Central High School

Table 1. shows the level of availability of instructional materials.

Available Materials	Mean	SD	DESCRIPTIVE RATING
1. Pictures	4.33	1.23	VMA
2. Diagrams	4.33	1.23	VMA
3. Illustrations	4.47	0.99	VMA
4. Charts	4.47	0.99	VMA
5. Real objects (realia)	4.33	0.98	VMA
6. Recordings (audio and video)	4.00	0.93	*MA*
7. Videos	4.07	0.88	*MA*
8. Slides	4.27	1.03	VMA
9. Interactive Materials	3.80	0.94	*MA*
10. Graphic materials	3.93	0.96	*MA*
11. Printed materials (books, periodicals etc.)	4.67	0.82	VMA
12. Flashcards	3.87	0.92	*MA*
13. Interventions/Enrichment Materials	4.13	0.74	*MA*
14. e-references	4.13	1.06	*MA*
15. posters	3.47	1.25	*MA*
16. Simulations	3.67	0.62	*MA*
17. Games	4.07	0.96	*MA*
OVERALL MEAN	**4.12**	***0.97***	***MA***

Specifically, on the one hand, printed materials (4.67) such as books and periodicals among others, illustrations (4.47) and charts (4.47), pictures (4.33), diagrams (4.33) and real objects (4.33), and slides (4.27) are described “very much available”. On the other hand, interventions, or enrichment materials (4.13) and e-references (4.13), videos (4.07), games (4.07), recordings (4.00), graphic materials (3.93), flashcards (3.87), interactive materials (3.80), simulations (3.67), and posters (3.47) are described “much available”.

The extent of use of available materials has an overall mean of 4.12 which is described as "much available". Thus, the result means that the instructional materials to be used by teachers in implementing Special Mathematics Education (SME) in school are available.

Extent of Implementation of Special Mathematics Education (SME) in Narvacan National Central High School

Table 2. shows the Special Mathematics Education (SME) extent of implementation along objective of the lesson, pedagogical approaches and assessment of learning.

Extent of Implementation of Special Mathematics Education	Mean	SD	DR
Objectives of the lessons			
1. The Learning Objectives (LOs) are aligned with the standards of the K to 12 curriculum.	4.80	0.41	VHI
2. The LOs are specific, measurable, attainable, relevant, and time-bound (SMART).	4.60	0.83	VHI
3. The LOs provide varied learning tasks and activities.	4.80	0.41	VHI
4. The LOs integrate knowledge, skills, and attitude (KSA).	4.73	0.46	VHI
5. The LOs provide available instructional materials to be used.	4.60	0.51	VHI
SUB MEAN	**4.71**	**0.52**	**VHI**
Pedagogical Approaches			
1. Learners are actively involved in the learning process, creating their own meaning and knowledge of the material (constructivist).	4.33	0.90	VHI
2. Multiple learners work together, like in small group instruction, and they all contribute and help each other learn (collaborative).	4.53	0.52	VHI
3. Students address real-world problems, like in project-based learning, by asking questions and doing further research (inquiry-based).	4.27	0.96	VHI
4. Learners engage with cross-curricular material using multiple academic disciplines and common language (integrative).	4.33	0.72	VHI
5. Both teachers and learners reflect on lessons, projects, and assessments to see how to improve them in the future (reflective).	4.40	0.74	VHI
SUB MEAN	**4.37**	**0.77**	**VHI**
Assessment of learning			
1. The assessment tools (ATs) are appropriate to meet the objectives of the desired skills.	4.53	0.64	VHI
2. The ATs contain varied activities to assess different learning skills.	4.53	0.64	VHI
3. The directions in the assessment tool (ATs) are clearly stated.	4.47	0.74	VHI
4. The test questions in the ATs are free from conceptual or content errors.	4.47	0.52	VHI
5. The ATs are suitable for learners' level of understanding.	4.67	0.49	VHI
SUB MEAN	**4.53**	**0.61**	**VHI**
OVERALL MEAN	**4.53**	**0.64**	**VHI**

The Special Mathematics Education (SME) curriculum is categorized into objectives of the lesson, pedagogical approaches, and assessment of learning. Respondents rated the objectives as aligned with K to 12 standards, specific, measurable, attainable, relevant, time-bound, integrating knowledge, skills, and attitude.

The respondents rated pedagogical approaches as highly implemented, including multiple learners working together, reflection on lessons, active participation in the learning process, cross-curricular engagement, and real-world problem-solving through project-based learning, as well as the use of multiple academic disciplines and common language.

The respondents rated the Assessment Tools (ATs) as suitable for learners' understanding, meeting desired skill objectives, having varied activities, clearly stated directions, and free from conceptual errors, indicating that Special Mathematics Education (SME) is highly implemented in schools, ensuring its continuation in accordance with existing policies.

Elsayed and Nasef (2020) found that there are statistically significant differences between the scores of the academic achievement motivation and the creative thinking in favor of the post- applications at (0.01) level and this showed that the program has positive

effects in developing the academic achievement motivation and the creative thinking in Mathematics among Prince Sattam Bin Abdulaziz University Students.

Level of Mathematics Performance of the Learners in Narvacan National Central High School

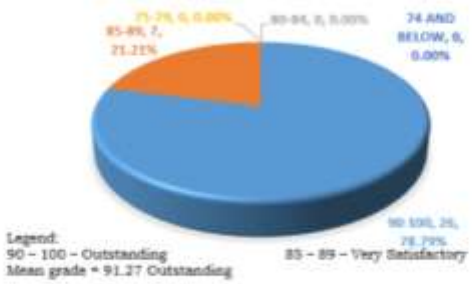


Figure 7.

Performance of the Grade 7 Learners in Mathematics

Figure 7 shows the performance of the Grade 7 learners in Mathematics for the school year 2022-2023. More specifically, twenty-six or 78.79% obtained a grade ranging from 90-100 (outstanding), and seven or 21.21% obtained a grade ranging from 85-89 (very satisfactory). The result means that the learners excel in the subjects offered in this grade level.

The findings of the study are similar to Guro (2018) in her study where student's self-efficacy was rated very well. This means that they have the capability to do homework, schoolwork, as well as to study their algebra and pass the test.

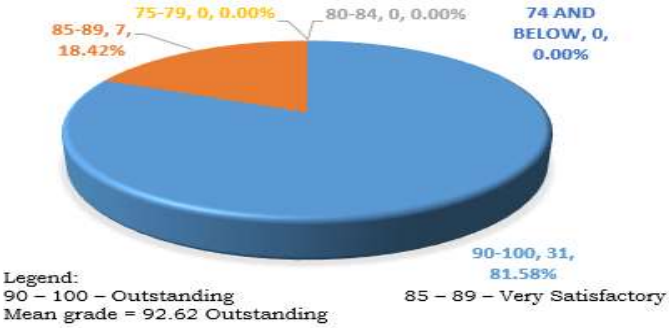


Figure 8.

Performance of the Grade 8 Learners in Mathematics

Figure 8 shows the performance of the Grade 8 learners in Mathematics for the school year 2022-2023. More specifically, thirty-one or 81.58% obtained a grade ranging from 90-100 (outstanding), and seven or 18.42% obtained a grade ranging from 85-89 (very satisfactory). The result means that the learners excel in the subjects offered in this grade level.

Teachers try to explore the educational research which expended time and energy trying to unravel the possible. Although the goal of Intervention is not necessarily to make Mathematics fun, by varying the learning tasks and making the instruction engaging the intervention teacher has the opportunity to reach more students and build success (Sundling, 2012)

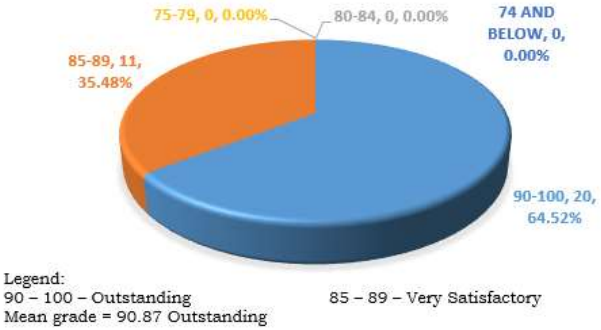


Figure 9.

Performance of the Grade 9 Learners in Mathematics

Figure 9 shows the performance of the Grade 9 learners in Mathematics for the school year 2022-2023. More specifically, twenty, or 64.52% obtained a grade ranging from 90-100 (outstanding), and eleven, or 35.48% obtained a grade ranging from 85-89 (very satisfactory). The result means that the learners excel in the subjects offered in this grade level.

The findings of the study of Ngcobo (2021), revealed that the development programme for teachers must be continuous, to ensure that they are up to date with the current status of mathematics, so that they will implement the current knowledge for teaching.

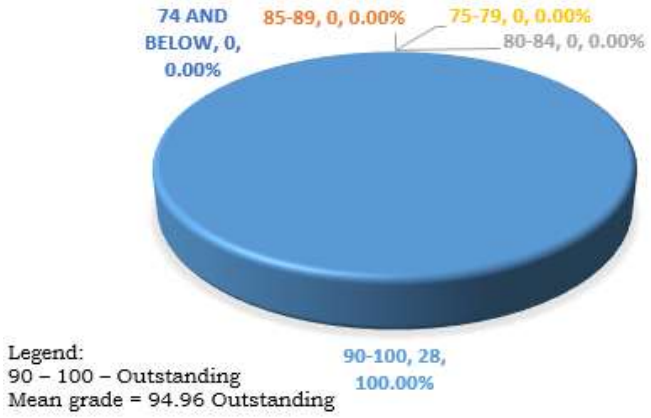


Figure 10.

Performance of the Grade 10 Learners in Mathematics

Figure 10 shows the performance of the Grade 10 learners in Mathematics for the school year 2022-2023. More specifically, twenty-eight or 100% obtained a grade ranging from 90-100 (outstanding), The result means that the learners excel in the subjects offered in this grade level.

The findings of this study negate and in fact, surpassed the results of the study of Hebres (2022) where the students belonged to satisfactory performance meaning their performance is not bad but average performance. Derrac (2019), academic performance is greatly affected by Mathematics self-concept. This means that students who perform well in academic performance also possess high self-concept in Mathematics and vice versa. This only shows that to become a good performer in Mathematics, one must be able to improve his or her Mathematics self-concept since they are significantly correlated.

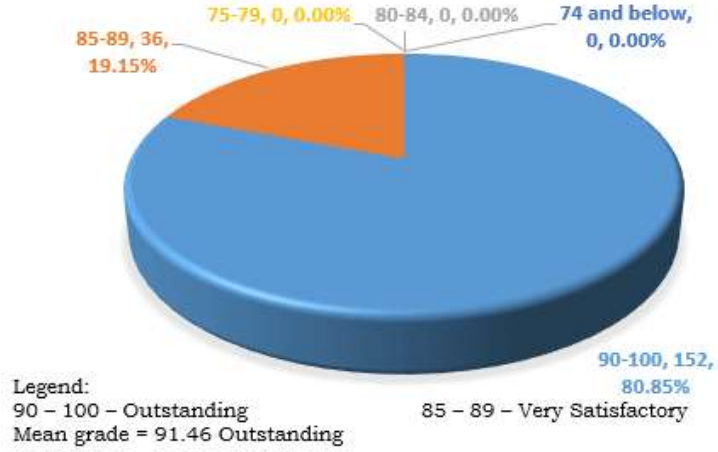


Figure 11.

Overall Performance of the Learners in Mathematics

Figure 11 shows the overall performance of the learners from grades 7-10.

As shown in the chart, one hundred fifty-two, or 80.85% attained a grade ranging from 90-100 (outstanding), and thirty-six, or 19.15% attained a grade ranging from 85-89 (very satisfactory). Thus, the result means that the learners are excelling in mathematics.

The finding of the study is similar to Guinocor et al. (2020) where they found out that there is a significant positive high correlation between the study orientations of the students considering their academic performance in terms of their Graded Point Average (GPA) in Mathematics subjects.

Relationship between the Profile of the Respondents and the Level of Use of Available Instructional Materials

Table 3. presents the profile of the teacher-respondents and the use of available instructional materials.

Profile Of Teachers	Use of Available Instructional Materials	
	Computed r	p-value
1. Age	0.165	0.557
2. Sex	-0.230	0.410
3. Length of Service	0.011	0.970
4.Educational Attainment	-0.112	0.691
5.International Level	0.592*	0.020
6. National Level	0.501	0.057
7. Regional Level	0.350	0.201
8. Division Level	0.501	0.057
9. School Level	0.435	0.106

It can be seen in Table 4 that the profile of the respondents such as age, sex, length of service, educational attainment, and seminars and training attended at regional levels, division level, and school level post no relationship. This implies that they do not affect their instruction in Mathematics.

Considering the fact that teachers are aware of the significance of providing their learners accurate information about what they teach, they enrich themselves by attending seminars and trainings at different levels. Kapur (2022) stressed in his study that Seminars and workshops are organized with the primary aim of imparting information in terms of a particular subject or concept. Furthermore, the students are provided with the opportunities to present their papers and hone communication, presentation and public-speaking skills. These are useful in augmenting knowledge, competencies and abilities among students.

The study found a significant relationship between respondents' participation in international seminars and trainings and their use of available instructional materials, indicating that these activities have enriched their skills and knowledge.

Cempron (2021) concluded in his study that despite being categorized as traditional and common respectively, whiteboard, text and workbooks, newspapers, and computers are frequently utilized and quite perceived as essential instructional materials in the teaching of Social Studies correlating to the nature of its content that is expected to be transferred well to the learners no less that almost everything is already embedded in the computer e.g. virtual whiteboard, even in the time of online classes.

Relationship between the Profile of the Respondents and the Extent of Implementation of Special Mathematics Education (SME)

Table 4 presents the profile of the teacher-respondents and the implementation of Special Mathematics Education (SME).

Profile of Teachers	Objectives of the Lesson		Pedagogical Approaches		Assessment of learning	
	Computed r	P-value	Computed r	P-value	Computed r	P-value
1. Age	-0.164	0.558	-0.315	0.252	-0.222	0.426
2. Sex	0.227	0.415	0.401	0.138	0.272	0.327
3. Length of Service	0.035	0.901	-0.110	0.697	-0.302	0.275
4. Educational Attainment	0.126	0.655	0.138	0.624	0.229	0.412
5. International Level	0.388	0.153	0.464	0.082	0.424	0.115
6. National Level	-0.121	0.667	-0.093	0.742	0.118	0.676
7. Regional Level	0.093	0.741	0.321	0.244	0.253	0.362
8. Division Level	-0.121	0.667	-0.093	0.742	0.118	0.676
9. School Level	-0.265	0.341	-0.316	0.251	0.449	0.093

As revealed in Table 5, the profile of the respondents and the implementation of Special Mathematics Education along three core areas such as the objectives of the lesson, pedagogical approaches, and assessment of learning post no relationship. This implies that the teachers are capable of teaching mathematics regardless of the variables in their profile considering that they are qualified. Thus, the null hypothesis is accepted.

However, Kaufman et. al (2019) emphasized that, it has been documented in numerous studies, use of rigorous, standards-aligned curricula is challenging for teachers and for students, which might result in more-variable use of standards-aligned curricula, even compared with other curricula. In addition, states and school systems might have been focused primarily on adopting standards-aligned curricula over the past several decades, and further suggested that states and districts must now work to support teachers' use of curriculum.

Relationship between the Level of Use of Available Materials and Learners' Performance

Table 5 presents the relationship between the use of available instructional materials and learners' performance.

Relationship between the Level of use of Available Materials and Learners' Performance		
	Computed r	p-value
1. Pictures	0.11	0.14
2. Diagrams	0.11	0.14
3. Illustrations	0.11	0.12
4. Charts	0.11	0.14
5. Real objects (realia)	0.08	0.26
6. Recordings	-0.463**	0.00
7. Videos	-0.418**	0.00
8. Slides	0.08	0.26
9. Interactive materials	0.253**	0.00
10. Graphic materials	0.351**	0.00
11. Printed Materials (books, periodicals etc.)	0.11	0.12
12. Flashcards	0.08	0.26
13. Interventions/Enrichment Materials	0.11	0.14
14. E-reference	0.11	0.14
15. Posters	0.387**	0.00
16. Simulations	0.418**	0.00
17. Games	-0.1	0.19
Mean of the Extent of Available Materials	**0.190****	**0.009**

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

The study found no significant relationship between variables like pictures, diagrams, illustrations, charts, real objects, slides, printed materials, flashcards, and games with learners' performance. Traditional teaching methods, such as personal interactions and communication, can enhance students' learning experiences and social skills, as they help build interpersonal relationships with teachers and peers.

The study found a significant relationship between audio-visual materials, such as recordings, videos, interactive materials, graphic materials, interventions/enrichment materials, and e-references, and students' performance.

Relationship between the Learners' Performance and the Extent of Implementation of Special Mathematics Education (SME)

Table 6 shows the relationship between the extent of implementation of Special Mathematics Education (SME) and the Learners' Performance.

Relationship between the Extent of implementation and Learners Performance		
	Computed r	P-value
Objectives of the lessons		
The Learning Objectives (LOs) are aligned with the standards of the K to 12 curriculum.	0.351**	0.000
The LOs are specific, measurable, attainable, relevant, and time-bound (SMART).	0.351**	0.000
The LOs provide varied learning tasks and activities.	0.418**	0.000
The LOs integrate knowledge, skills, and attitude (KSA).	0.050	0.540
The LOs provide available instructional materials to be used.	0.418**	0.000

Mean of objective of the lesson	**0.425****	**0.000**
Pedagogical Approaches		
Learners are actively involved in the learning process, creating their own meaning and knowledge of the material (constructivist).	0.463**	0.000
Multiple learners work together, like in small group instruction, and they all contribute and help each other learn (collaborative).	0.418**	0.000
Students address real-world problems, like in project-based learning, by asking questions and doing further research (inquiry-based).	0.401**	0.000
Learners engage with cross-curricular material using multiple academic disciplines and common language (integrative).	0.351**	0.000
Both teachers and learners reflect on lessons, projects, and assessments to see how to improve them in the future (reflective).	0.418**	0.000
Mean of Pedagogical Approaches	**0.476****	**0.000**
Assessment of learning		
The assessment tools (ATs) are appropriate to meet the objectives of the desired skills.	0.418**	0.000
The ATs contain varied activities to assess different learning skills.	0.418**	0.000
The directions in the assessment tool (ATs) are clearly stated.	0.401**	0.000
The test questions in the AT's are free from conceptual or content errors.	.[b]	
The ATs are suitable for learners' level of understanding.	.[b]	
Mean of Assessment of Learning	**0.476****	**0.000**

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

b. Cannot be computed because at least one of the variables is constant.

As observed in table 6, the variable 4 under objectives of the lessons which is "the learning objectives integrate knowledge, skills and attitude (KSA)" (r=0.050, p-value=0.540) has no significant relationship with the learners' performance. The result implies that the learners are unique and therefore, have different levels of understanding toward the mathematics subject offered to them.

The learning objectives of lessons, including alignment with K to 12 curriculum standards, specificity, measurableness, relevance, and time-boundness, varied tasks, and available instructional materials, significantly impact learners' performance, indicating that teacher construction affects learning outcomes.

The study by Kissi et al. (2023) found that the way teachers construct tests directly affects learners' performance. Factors such as active learning, collaboration, real-world problem-solving, cross-curricular use, and reflection on lessons and assessments are significantly related to learners' performance. Teachers perceived more competence in ensuring content validity, test item assembling, and handling options. The study provides unique evidence on teachers' perceived test construction competence.

The assessment of learning is influenced by factors such as appropriate tools, varied activities, and clearly stated directions. Teachers are well aware of the Special Mathematics Education (SME) curriculum, but students have a negative attitude towards mathematics and an ineffective curriculum in secondary schools. Primary school teachers lack potential and competence, leading to poor performance. Secondary school teachers are positive, good quality, performing, and fully qualified in teaching mathematics.

Problems Encountered by the Respondents in the Implementation of Special Mathematics Education

Table 7. Thematic Analysis on Problems Encountered by the Respondents in the Implementation of Special Mathematics Education

Domain	Category/Sub-category	Frequency Label
Resources	Inadequate Learning Materials for Learners	General
Reinforcement	Low Learning Retention	General

Resources

One of the core challenges by the respondents in the implementation of Special Mathematics Education at present is resources. Respondents identified 1) Inadequate learning materials for learners.

Inadequate Learning Materials for Learners

The Department of Education's learning materials are insufficient for the country's enrollment, and some are outdated and unsuitable for use. Despite this, teachers are resourceful enough to provide necessary materials for their students.

An inadequate number of learning materials prevailed as one of the problems that they encounter during instruction. Participant 4 said, "*Lack of useful material and gadgets by both teachers and learners".* Similarly, participant 10 identified and said, "*lack of learning materials"*. Also, participant 11 responded, "inadequate learning materials". Thus, this seemingly being a problem must be addressed.

This problem affects students and teachers, which in turn can affect the parents of the children. The lack of resources in classrooms can cause extreme distress to the students and teachers. Not only are the students and teachers in distress, but they are unable to learn to their fullest potential because they are not being given the proper resources. Once we realize these problems, we then can investigate solutions for this wicked problem (Mafea, 2020).

Lyons (2012) highlights the complex nature of learning, involving student motivation, physical facilities, teaching resources, and curriculum demands. The availability of TLR enhances school effectiveness, promoting good academic performance through necessary resources.

Reinforcement

Respondents identified reinforcement as one of the fundamental problems in the implementation of Special Mathematics Education at present is resources, thus, low learning retention was identified by the respondents as a factor under this category.

Low Learning Retention

Learning retention is the ability to store new information in one's long-term memory so a person can easily recall it and put that knowledge to use in the future. If the information is not retained, it will remain in the short-term memory and drop out after a certain period (Colman, 2022).

Learners are very unique. They are entirely different in terms of learning styles. Since they are individually different, they cannot be expected nor assumed to have similar ways of understanding each Mathematics lesson to be taught in class. Moreover, their grades differ from each other. As a consequence, they vary in terms of performance.

Low retention of the lessons is one of the problems the respondents experienced during instruction. Participant 3 said, "*Students have low retention of the discussed competencies".* Supporting the same response, participant 12 said, "*Retention is low, and connection to real life and application is difficult".* Even participant 14 said, "*Low retention, special math class has 9 to t10 subjects, and learners are overloaded".* Thus, this must also be given attention.

In order to achieve school's goal, schools need to work with each one of these students. Special education students deserve to develop to their maximum potential in mathematics, especially since it is one of the main focuses in the school curriculum. On a larger scale, the education system needs to be working towards creating a better educated and prepared generation in numeracy, so it can function efficiently and effectively in the future. Very few careers do not require basic mathematics skills, and the job market has ever-increasing demand for technical skills (Noel-Levitz, 2015).

Suggested Solutions to Address the Problems

Table 8. Thematic Analysis on Suggested Solutions by the Respondents in the Implementation of Special Mathematics Education

Domain	Category/Sub-category	Frequency Label
Resources	Technology Integration	General
	Open Education Resources (OER)	General
	Active Learning Techniques	General
Reinforcement	Personalized Learning Plans	Genaral

Resources

According to the respondents, they often suggest resources as one of the solutions to address the problems in the implementation of special mathematics education. Hence, respondents identified two factors: 1) technology integration, and 2) open education resources.

Technology Integration

This refers to the incorporation of various technological tools and resources to enhance the teaching and learning of mathematics. The integration of technology aims to make math more engaging, accessible, and relevant to students, fostering a deeper understanding of mathematical concepts. As technology continues to advance, educations have the opportunity to leverage a wide range of tools to create dynamic and interactive learning experiences in the math classroom. Participant 3 stated that, *"Investing in educational technology and software that supports diverse learning needs. Ensure that teachers are trained to effectively integrate technology intro their teaching methods, providing students with interactive and engaging learning materials."* Added by participant 5, *"It is with great help to the learners having the E- tulay in tv broadcasting as one of the sources of their learning."* E- tulay is a free online tutorial platform for learners given by excellent and inspiring educators, who assume the role of a facilitator and guide the students to another level of learning experience.

In the study of Eshet (2014), the tasks required in a context include for example reading instructions from graphical displays in user interfaces; utilizing digital reproduction to create new, meaningful materials from existing ones; constructing knowledge from a nonlinear, hypertextual navigation; evaluating the quality and validity of information; and have a mature and realistic understanding of the rules that prevail in the cyberspace. The newly emerging concept of technological literacy may be utilized as a measure of the quality of learners' work in technological environments, and provide scholars and developers with a more effective means of communication in designing better user-oriented environments.

Open Education Resources (OER)

This is to freely access, openly licensed educational materials that can be used for teaching, learning, and research. These resources are made available to the public with the intention of removing barriers to education, promoting collaboration, and fostering the sharing of knowledge. OER can include a wide range of materials such as textbooks, lesson plans, multimedia content, and interactive tools. Participant 2 said that, *"it is time to promote the use and creation of Open Education Resources, which are freely accessible, adaptable, and shareable. Encouraging educators to share resources can help alleviate the shortage of learning materials."*

OER offers accessible, adaptable, and collaborative learning materials, potentially democratizing education and fostering global collaboration. Despite challenges, its benefits include cost savings, customization, and global collaboration.

Reinforcement

Under this category, respondents identified two factors as a possible solution in the implementation of special mathematics education, 1) active learning techniques, and 2) personalized learning plans.

Active Learning Techniques

Active learning techniques engages students in the learning process through activities, discussions, and problem-solving, as opposed to traditional passive learning methods like lectures. Active learning techniques encourage students to think critically, apply knowledge, and participate actively in their own learning. These techniques can be applied across various disciplines and educational levels to enhance understanding and retention. Participant 10 and 12 stated that *"We need to incorporate active learning methods such as group discussions, case studies, hands-on activities, and interactive simulations."* These approaches engage learners actively, making the learning experience more memorable. In this way, students engage with the mathematics in ways that allow them to construct their own understanding of concepts and procedures. There are a variety of instructional practices that MTEs can use to engage PTs with the mathematics and promote an active learning environment.

As stated by Litster et al. (2020) active learning mathematics classrooms incorporate meaningful activities that emphasize reasoning, thinking and active interaction with mathematics. Current mathematics standards and curricula recommend that Mathematics Teacher Educators (MTEs) use elements of active learning in their mathematics content courses specifically designed for Prospective Teachers (PTs) as they prepare PTs to learn and teach mathematics. However, it can be very difficult for PTs to shift their pedagogical dispositions towards instruction associated with active learning because they typically have not experienced mathematics taught in this way.

Active learning strategies that simultaneously integrate intellectual, social and physical engagement are most likely to provide a more pleasant experience for students, while working on important contents that they need to learn (Edwards, 2015). In this sense, the adoption of an active learning approach tends to increase students' performance and interest in STEM disciplines (Vale & Barbosa, 2020a), raising their expectations/motivations regarding learning (of mathematics). To better understand principles underlying the intellectual, social and physical dimensions we will discuss each strand individually.

It is part of the teacher's role to ensure that students become intellectually engaged with the contents to address, showing intrinsic motivation to establish relationships, develop conceptual understanding and use critical thinking, which allow them to go beyond memorization or the acquisition of a more limited comprehension (Edwards, 2015). In the particular case of mathematics, it is

through problem-solving tasks, which foster reasoning and communication, that the teacher is able to challenge students, helping them establish connections and reach a deeper understanding (Edwards, 2015; Vale & Barbosa, 2020a).

Personalized Learning Plans

Personalized Learning Plans (PLPs) are student-centered educational strategies involving collaboration between students, educators, and parents, aiming to prepare students for success in an evolving world.

Participant 9, said that *"tailor learning experiences to individual needs. Recognize that learners have different strengths and weaknesses, and provide resources or activities that cater to their specific requirements."*

Even though many educators had heard the term personalized learning and thought they understood what it meant, this term has often become confused with other, similar concepts such as differentiation, individualization, blended learning, and project-based learning. School districts are transitioning to personalized learning classrooms, incorporating different concepts such as differentiation, individualization, blended learning, and project-based learning. Differentiation involves students choosing from a predesigned curriculum based on individual needs, while individualization involves students choosing from a predesigned curriculum. Blended learning allows students to learn online with some control over time, place, path, and pace. It allows for various projects and technology to support practice and target weak areas. Project-based learning allows students to explore real-world problems and build 21st-century skills. These projects can be completed by individual students, small groups, or whole grade levels, allowing students to be involved in all aspects of development, research, and decision-making.

V. CONCLUSIONS

Based on the findings, the following conclusions were drawn.

1. Majority of the respondents were 26 – 30 years old, females, started teaching between 1 to 5 years, completed academic requirements in a Master's Degree, and had attended school based-trainings and seminars.
2. The use of available instructional materials was "much available" to support the implementation of Special Mathematics Education.
3. The level of implementation of Special Mathematics Education along with objectives of lesson, pedagogical approaches, and assessment of learning was "very highly implemented" as it indicates a commendable degree of success and effectiveness in incorporating these elements into the educational context.
4. The level of Mathematics performance of the Special Mathematics Classes in Narvacan National Central High School was "outstanding". This shows a very high level of accomplishment and subject-matter expertise.
5. The trainings and seminars attended by the respondents at the international level are significantly related to the availability of instructional materials. The level of availability of instructional materials was significantly related to the learners' performance. Furthermore, the extent of implementation of Special Mathematics Education was significantly related to leaners' performance.
6. Inadequate learning materials for learners under resources category and low learning retention under reinforcement category emerged to have been the problems encountered by the respondents.
7. Learning can be reinforced through technology integration, Open Education Resources as active learning techniques and personalized learning plans.

VI. RECOMMENDATIONS

Based on the conclusions, the following recommendations are hereby offered.

1. The teachers are encouraged to pursue the post graduate education leading to the completion of a master's degree. Encouraging teachers to pursue postgraduate education leading to the completion of a master's degree is a strategic initiative that can yield significant benefits for both educators and the educational institution.
2. The teachers shall actively augment existing materials, educational institutions foster a culture of innovation, adaptability, and student-centered learning. This approach acknowledges the dynamic nature of education and recognizes the pivotal role teachers play in shaping the educational experience for their students.
3. Teachers shall sustain the implementation of Special Mathematics Class by maintaining and continually improving special math instruction, teachers play a pivotal role in creating an inclusive and supportive learning environment where every student can thrive in their mathematical learning journey.
4. The teachers should continue to support students' great achievement by providing them with relevant and constructive activities. By continuing to support students' great achievement through relevant and constructive activities, teachers contribute to a vibrant and dynamic learning environment that prepares students not only for academic success but also for the challenges of the ever-changing world beyond the classroom.

5. Teachers shall participate in LAC sessions, seminars, and training programs at regional and international levels is an investment in the continuous improvement of education. It empowers educators to stay current, share experiences, and contribute to a global community of practice, ultimately benefiting both teachers and their students.
6. The teachers should regularly gather feedback from both learners and educators, and be open to adjusting based on the evolving needs of the educational community.
7. The teachers should provide solutions to existing problems in teaching mathematics. Educational institutions can create a more dynamic and responsive learning environment that harness the power of technology and adapts to the unique needs of each learner. This approach lays the foundation for a more inclusive and effective educational experience.

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