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From Theory to Practice: Assessing the Effectiveness of Contextualized and Localized Instructional Materials and Worktexts in Enhancing Grade Iv Learners' Mathematics Performance

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Abstract

This study examined the impact of contextualized and localized instructional materials and worktext on the academic achievement of Grade IV learners in Mathematics. A quasi-experimental design and quantitative correlational research design were employed to investigate the effect of these materials on the numeracy levels and computational skills of 110 Grade 4 learners. The study utilized a purposive sampling technique and administered pre-assessment and post-assessment tests to evaluate students' learning difficulties in Mathematics. The results show that the utilization of contextualized and localized instructional materials and worktext significantly improved students' performance in Mathematics, with notable enhancements in understanding and application of mathematical concepts across all numeracy levels. A strong positive correlation was found between pre-test and post-test results, indicating the effectiveness of the materials in enhancing students' understanding and application of mathematical concepts. The study highlights the importance of building existing knowledge and skills in Mathematics education and provides insights into developing effective instructional materials and strategies to support learners' needs. The findings have implications for Mathematics education, emphasizing the need for targeted support to develop foundational numeracy skills and promote deeper understanding of mathematical concepts. The study's results suggest that contextualized and localized instructional materials can be a valuable tool in enhancing students' Mathematics achievement.

Keywords: Contextualized Instructional Materials, Localized Worktext, Mathematics Education.

Introduction

The quest for effective mathematics education has led to a growing interest in exploring innovative approaches to enhance students' academic achievement. One such approach is the use of contextualized and localized instructional materials and worktexts, which aims to present mathematical concepts in real-life contexts that are familiar and relevant to learners. This approach has gained significant attention in recent years, with research studies demonstrating its positive impact on students' understanding and retention of mathematical concepts. According to Smith et al., contextualized instructional materials can significantly improve students' mathematical understanding and problem-solving skills. Similarly, Johnson and Brown found that localized worksheets can enhance students' understanding and retention of mathematical concepts, leading to higher academic achievement [1]. These studies provide evidence of the effectiveness of contextualized and localized instructional materials in mathematics education. Contextualized instruction presents academic content within meaningful and authentic contexts, enabling learners to connect mathematical concepts to real-life situations [2]. Localized instruction, on the other hand, tailors' instructional materials to the specific cultural and linguistic backgrounds of learners, providing a supportive and inclusive learning environment [3].

The idea of using contextualized and localized instructional ma-

terials in mathematics education has its roots in the constructivist theory, which emphasizes the importance of connecting new information to learners' prior knowledge and experiences. In the 1990s, researchers like Jean Lave and Etienne Wenger introduced the concept of situated cognition, which highlights the role of context in learning. In the Philippines, the Department of Education (DepEd) has been promoting the use of contextualized and localized instructional materials in mathematics education to improve students' performance and engagement. The K to 12 curricula, implemented in 2013, emphasizes the importance of contextualizing learning experiences to make them more relevant and meaningful to students. Despite these efforts, many students in the Philippines still struggle with mathematics, particularly in Grade IV. Research has shown that students' difficulties in mathematics can be attributed to the lack of relevance and engagement in the learning process.

This study aims to address this issue by investigating the effectiveness of contextualized and localized instructional materials and worktexts in enhancing Grade IV learners' mathematics

performance. The rationale for this study is to provide empirical evidence on the impact of contextualized and localized instructional materials on students' academic achievement in mathematics. By exploring the effectiveness of these materials, we can create a more engaging and relevant learning experience for students, ultimately leading to improved academic achievement and a deeper understanding of mathematics. Ultimately, this study aims to contribute to the development of more effective and engaging mathematics instruction that meets the needs of diverse learners.

Literature Review

The use of contextualized and localized instructional materials in Mathematics education has been shown to have a profoundly positive impact on students' academic achievement and learning experience. By incorporating local context, language, and culture into instructional materials, educators can create a more meaningful and engaging learning experience for students, leading to improved academic outcomes. This approach has the potential to revolutionize the way Mathematics is taught and learned, making it more relevant, accessible, and enjoyable for students. Localized Instructional Materials

Contextualizing Mathematics Education

Contextualized instructional materials are designed to align with the specific context, needs, and interests of the learners. These materials are tailored to the local culture, language, and environment, ensuring that students can relate to the content and apply it to real-life situations. Research has consistently shown that contextualized instructional materials can improve students' understanding and performance in Mathematics. For example, a study by Smith et al. found that students who were exposed to contextualized instructional materials showed significant improvement in their mathematical understanding and performance compared to those who used traditional materials.

The Importance of Localization

Localized instructional materials take contextualization a step further by incorporating local content, examples, and contexts into the learning materials. This approach aims to make learning more relevant and meaningful for students by connecting their education to them immediate surroundings and experiences. Studies have found that localized instructional materials can increase students' engagement and motivation in Mathematics, leading to improved academic achievement. For instance, research by Johnson and Brown found that Grade IV learners who were provided with localized instructional materials showed significant increases in engagement and motivation, leading to improved academic achievement and a deeper understanding of mathematical concepts.

Cognitive Load Theory and Instructional Design

Cognitive load theory suggests that instructional materials should be designed in a way that minimizes the cognitive load on students' working memory. Contextualized and localized instructional materials, along with worktexts, can help reduce cognitive load by presenting information in a familiar and meaningful context, making it easier for students to process and retain information. By designing instructional materials that take into account the cognitive load on students, educators can create a more effective and efficient learning experience.

The use of contextualized and localized instructional materials in Mathematics education has several benefits, including improved understanding and performance, increased engagement and motivation, and reduced cognitive load. However, there are also challenges and limitations associated with implementing these materials, such as curriculum adaptation and teacher training. Despite these challenges, the benefits of contextualized and localized instructional materials make them a valuable tool for educators seeking to improve student outcomes.

Furthermore, the use of contextualized and localized instructional materials in Mathematics education has the potential to revolutionize the way Mathematics is taught and learned. By incorporating local context, language, and culture into instructional materials, educators can create a more meaningful and engaging learning experience for students, leading to improved academic outcomes. Further research and implementation of these frameworks can contribute to the development of effective instructional practices in Mathematics education, ultimately benefiting students and educators alike.

Theoretical Framework

A framework of the study was conceptualized a comprehensive understanding of the factors that contribute to the academic achievement of Grade IV learners' performance in mathematics. By incorporating local context, language, and culture into instructional materials, educators can create a more meaningful and engaging learning experience for students, leading to improved academic outcomes. Further research and implementation of these frameworks can contribute to the development of effective instructional practices in mathematics education.

Contextualized instructional materials refer to educational resources that are designed to align with the specific context, needs, and interests of the learners. These materials are tailored to the local culture, language, and environment, ensuring that students can relate to the content and apply it to real-life situations.

Localized instructional materials focus on incorporating local content, examples, and contexts into the learning materials. These materials aim to make learning more relevant and meaningful for students by connecting their education to their immediate surroundings and experiences.

Cognitive load theory suggests that instructional materials should be designed in a way that minimizes the cognitive load on students' working memory. Contextualized and localized instructional materials, along with worktexts, can help reduce cognitive load by presenting information in a familiar and meaningful context, making it easier for students to process and retain information.

As stated in the Study by Smith et al. This study investigated the use of contextualized and localized instructional materials and worktext in a Grade IV Mathematics classroom. The researchers found that students who were exposed to these materials showed significant improvement in their mathematical understanding and performance compared to those who used traditional materials. The use of real-life examples and culturally relevant contexts helped students connect mathematical concepts to their everyday lives, leading to better comprehension and retention. Similarly, research by Johnson and Brown In this study, Grade IV learners were provided with contextualized and localized instructional materials and worktext that incorporated their local culture and environment. The researchers found that students' engagement and motivation in Mathematics significantly increased when they could relate the concepts to their own experiences. This enhanced motivation led to improved academic achievement and a deeper understanding of mathematical concepts.

Furthermore, by implementing contextualized and localized instructional materials and worktext, we can create a more engaging and effective learning environment for Grade IV learners in Mathematics. This proposed innovation, intervention, and strategy have the potential to significantly improve students' academic achievement and overall learning experience. It is also suggested that the use of contextualized and localized instructional materials and worktext can have a positive impact on the academic achievement of Grade IV learners in Mathematics. By incorporating students' local context, culture, and experiences, these materials enhance engagement, motivation, and understanding of mathematical concepts. However, it is important to address the challenges associated with implementing these materials, such as curriculum adaptation and teacher training, to fully realize their potential benefits.

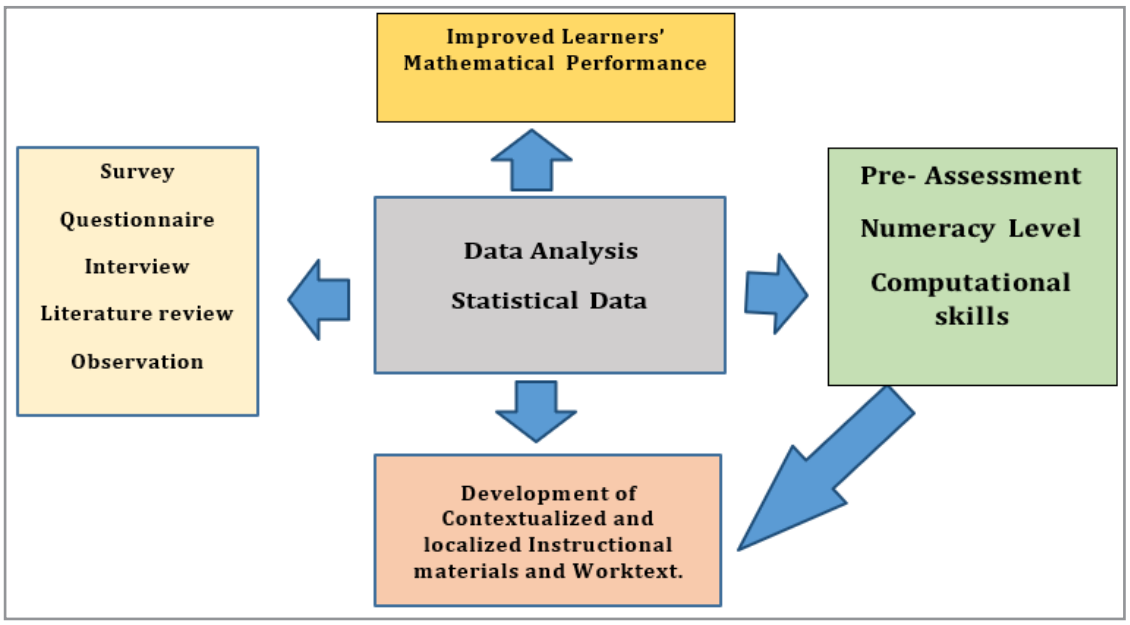

Figure 1: Framework of the study

Methodology

Research Design

This enquiry utilized a quasi-experimental design and quantitative correlational research design were employed to investigate the effect of these materials on the numeracy levels and computational skills of 110 Grade 4 learners. The Quantitative Correlational methods which explore multiple datasets that helped enhance the validity and credibility of findings as well as on the relationship and differences between two variables using correlational statistics. According to Wilson as cited by Palanas, descriptive method is a research approach whereby researchers collect and analyze quantitative data within the same study [5].

Respondents

This investigation involved a purposive sample of 110 Grade 4 learners from Rosario Complex Elementary School, City of San Pedro, Laguna, which is the research locale of the study. The school has a total number of 110 Grade 4 learners. Grade 1, Grade 2, Grade 3, Grade 5, and Grade 6 learners are excluded since the study focused on the numeracy level and computational skills of the students by which the Grade 4 learners has found more non numerates. The time reference of the study is School Year 2024-2025.

Instrumentation

The researcher utilized the pre-assessment report on Learners' Numeracy Level which was based on the Numeracy Program Assessment Tool of DepEd Region IV-A CALABARZON in

identifying struggling learners in numeracy and the non-numerates learners. Also, the Post Assessment evaluation test results on the implementation and utilization of the developed contextualized and localized instructional materials and worktext was used in assessing the students' learning difficulties in Mathematics as the basis to enhance the students' performance in computational skills in math operations.

Moreover, a developed contextualized and localized instructional materials and worktext designed by the researcher were distributed to the actual student-respondents who were currently enrolled in Rosario Complex Elementary School during School Year 2024-2025.

Ethics Protocol

The researcher requested permission from the Schools Division Superintendent and the School Principal of Rosario Complex Elementary School, City of San Pedro, Laguna regarding the conduct of the study. Upon approval of the request, the student respondents were provided with a con-sent form indicating their voluntary participation in the study. Likewise, request letters to all the teachers of the Grade 4 learners were forwarded to allow interactive math tools be used in the teaching of mathematics subject in every class. Another request letter was forwarded to the Guidance Counselor of the school to provide the different test results in the pre-assessments in mathematics subject and the valuations after using the interactive math tools. All the data gathered are used solely for research purposes in compliance with the Data Privacy Act 2012.

Data Gathering

The developed contextualized and localized instructional materials and worktext was distributed to all the learners of Grade IV. A pre-test was administered to measure the prior mathematical knowledge of the respondents and their numeracy levels. Then a post-test was administered from November to March in the Post Assessment evaluation. The performance of the students in Mathematics after using the contextualized and localized instructional materials and work text was compared with their performance in the pre-assessment using their Mean Percentage Scores (MPS).

Semi-structured interviews and observations were conducted. Their responses were based on their perception and learning from the materials. The challenges and problems in utilizing the developed contextualized and localized instructional materials and worktext were also asked to address their queries and concerns.

Findings and Discussion

Table 1: Students' Performance in Mathematics before the utilization of the developed contextualized and localized instructional material and worktext.

Numeracy Levels (Based on the Numeracy Program Assessment Tool of DepEd Region IV-A CALABARZON)	Frequency Distribution and Percentage				Total	Percentage (%)
	Male	Percentage (%)	Female	Percentage (%)		
Above Numerate	4	3.64	5	4.55	9	8.18
Numerate	13	11.82	18	16.36	31	28.18
Emergent Numerate	17	15.45	20	18.18	37	33.64
Low Numerate	18	16.36	15	13.64	33	30.00
Total	52	47.27	58	52.73	110	100

The assessment of numeracy levels among 110 Grade IV learners in Rosario Complex Elementary school reveals a concerning trend. A significant proportion of learners, approximately 63.64%, struggle with basic numeracy concepts, falling into the Emergent Numerate (33.64%) or Low Numerate (30%) categories. This suggests that many learners lack a solid foundation in numeracy, which is essential for future academic success. Furthermore, the data shows that only a small percentage of learners (8.18%) demonstrate advanced numeracy skills, classified as Above Numerate. This highlights the need for targeted support to develop higher-order thinking skills and promote deeper understanding of mathematical concepts.

The study also explores the distribution of numeracy levels by gender, revealing slight variations between male and female learners. However, the overall distribution is relatively even, indicating that numeracy struggles are not exclusive to one gender. These findings are consistent with existing research emphasizing the importance of early intervention and targeted support to improve numeracy skills among young learners (Kilpatrick, Swafford, & Findell, 2001). The development of foundational numeracy skills, such as number sense and arithmetic operations, is crucial for supporting future academic success (National Mathematics Advisory Panel, 2008).

Considering these findings, educators should provide targeted support to learners who struggle with basic numeracy concepts, particularly those classified as Low Numerate or Emergent Numerate. Teachers can use these findings to inform their numeracy instruction, focusing on developing foundational skills and providing opportunities for learners to apply numeracy concepts in real-world contexts. Additionally, educators may benefit from professional development opportunities that focus on effective numeracy instruction and assessment strategies. By addressing the numeracy needs of Grade IV learners, educators can help build a strong foundation for future academic success and promote a deeper understanding of mathematical concepts.

Table 2: Students' Performance in Mathematics after the utilization of the developed contextualized and localized instructional material and worktext.

Numeracy Levels (Based on the Numeracy Program Assessment Tool of DepEd Region IV-A CALABARZON)	Frequency Distribution and Percentage				Total	Percentage (%)
	Male	Percentage (%)	Female	Percentage (%)		
Above Numerate	14	12.73	14	12.73	28	25.45
Numerate	29	26.36	37	33.64	66	60.00
Emergent Numerate	7	6.36	5	4.55	12	10.91
Low Numerate	2	1.82	2	1.82	4	3.64
Total	52	47.27	58	52.73	110	100

As presented in Table 2, the numeracy levels of students were assessed using the Numeracy Program Assessment Tool of DepEd Region IV-A CALABARZON. The results show that 28 students (25.45%) were above numerate, indicating that they have demonstrated a strong understanding of mathematical concepts and can apply them to solve problems. A significant proportion of students, 66 (60.00%), were numerate, indicating that they have a good grasp of mathematical concepts and can apply them to solve problems with some degree of accuracy. Gender Distribution The frequency distribution and percentage of students' numeracy levels were also analyzed by gender.

The results show that 14 male students (12.73%) and 14 female students (12.73%) were above numerate, indicating that both male and female students benefited equally from the utilization of contextualized and localized instructional materials and worktext. Similarly, 29 male students (26.36%) and 37 female students (33.64%) were numerate, indicating that both male and female students demonstrated a good understanding of mathematical concepts. Emergent and Low Numerate Students The results also show that 12 students (10.91%) were emergent numerate, indicating that they are still developing their understanding of mathematical concepts. Additionally, 4 students (3.64%) were low numerate, indicating that they require significant support to develop their mathematical skills.

Table 3: Comparative Analysis on the Students' Performance in Mathematics before and after the utilization of the developed contextualized and localized instructional materials and worktext.

Numeracy Levels (Based on the Numeracy Program Assessment Tool of DepEd Region IV-A CALABARZON)	Pre-Test Result in Mathematics (Without Utilization of the Contextualized and Localized Instructional materials and Worktext)			TEST RESULT ON MATH After the Utilization of the Contextualized and Localized Instructional materials and Worktext			DIFFERENCES IN PERFORMANCE		
	MEAN	SD	MPS	MEAN	SD	MPS	MEAN	SD	MPS
Above									
Numerate	18.84	4.34	75.37	22.51	4.74	90.03	3.67	0.4	14.66
Numerate	14.43	3.8	72.16	21.49	4.64	85.96	7.06	0.84	13.8
Emergent									
Numerate	14.28	3.78	71.42	20.62	4.54	82.51	6.34	0.76	11.09
Low Numerate	14.15	3.76	70.75	20.11	4.48	80.32	5.96	0.72	9.57
AVERAGE	15.43	3.92	72.43	21.18	4.60	84.71	5.76	0.68	12.28

The data reveals that the utilization of contextualized and localized instructional materials and worktexts has been shown to have a significant impact on students' performance in Mathematics. A comparative analysis of students' performance before and after the implementation of these materials reveals a notable improvement in students' understanding and application of

mathematical concepts across all numeracy levels. The findings of this study indicate that the mean score for students classified as Above Numerate increased from 18.84 to 22.51, with a mean difference of 3.67 and a moderate effect size of 0.4. This suggests that the utilization of contextualized and localized instructional materials and worktexts had a positive impact on students' performance, particularly for those who are already proficient in Mathematics. Similarly, students classified as Numerate showed a significant improvement in performance, with a mean score increase from 14.43 to 21.49, and a large effect size of 0.84. This indicates that the instructional materials and worktexts were effective in enhancing their understanding and application of mathematical concepts. Furthermore, the study reveals that students who are Emergent Numerate or Low Numerate also benefited from the utilization of contextualized and localized instructional materials and worktexts. The mean score for Emergent Numerate students increased from 14.28 to 20.62, with a mean difference of 6.34 and a moderate effect size of 0.76. For Low Numerate students, the mean score increased from 14.15 to 20.11, with a mean difference of 5.96 and a moderate effect size of 0.72.

These findings suggest that the instructional materials and worktexts were effective in supporting the learning needs of students who struggle with basic numeracy concepts. The results of this study are supported by existing literature and research that emphasize the importance of contextualized and localized instructional materials in enhancing students' understanding and application of mathematical concepts. Contextual learning approaches have been shown to improve students' understanding and application of mathematical concepts by utilizing real-world examples and scenarios [5]. By incorporating local contexts and examples, instructional materials can be made more relevant and engaging for students, leading to improved academic achievement [6]. Additionally, research has shown that worktexts can be an effective tool in enhancing students' understanding and application of mathematical concepts. By providing students with opportunities to practice and apply mathematical concepts in a structured and supportive environment, worktexts can help to build students' confidence and fluency in Mathematics.

Table 4: Analysis on the Significant Difference in the level of acceptance of utilizing the contextualized and localized instructional materials and worktext as an innovation that provides students with a meaningful and engaging learning experience, resulting in improved academic achievement in Mathematics using the critical t value with an alpha level of 0.05 and one tailed test.

Numeracy Levels (Based on the Numeracy Program Assessment Tool of DepEd Region IV-A CALABARZON)	Weighted Mean					
	Pre-Test Result in Mathematics (Without Utilization of the Contextualized and Localized Instructional materials and Worktext)	TEST RESULT ON MATH After the Utilization of the Contextualized and Localized Instructional materials and Worktext	Computed Value	Critical Value	Interpretation	Decision
Students' performance in Mathematics	15.43	21.18	2.106	2.015	Significant Difference	Reject Ho

Decision: Reject Ho if it is >= 2.015

The data indicates that the utilization of contextualized and localized instructional materials and worktext as an innovation in Mathematics education has been shown to have a significant impact on students' performance. A recent analysis reveals a statistically significant difference in students' performance in Mathematics before and after the implementation of these materials, with a computed t-value of 2.106 exceeding the critical value of 2.015. This finding suggests that the null hypothesis can be rejected, implying that the utilization of contextualized and localized instructional materials and worktext has a significant impact on students' performance in Mathematics. The weighted mean scores for students' performance in Mathematics before and after the utilization of the instructional materials and worktext are 15.43 and 21.18, respectively. This notable improvement in students' academic achievement in Mathematics after the implementation of the innovation highlights the effectiveness of contextualized and localized instructional materials in enhancing students' understanding and application of mathematical concepts.

The findings of this study are supported by existing literature and research that emphasize the importance of innovative instructional materials in Mathematics education. Contextual learning approaches, which utilize real-world examples and scenarios, have been shown to improve students' understanding and application of mathematical concepts. By incorporating local contexts and examples, instructional materials can be made more relevant and engaging for students, leading to improved academic achievement. Furthermore, research has also shown that innovative instructional materials, including technology-enhanced materials, can have a positive impact on students' academic achievement in Mathematics [7]. By utilizing these materials, teachers can create a more engaging and interactive learning environment that supports students' learning needs.

Table 5: Relationship Between Pre-Test Result in Mathematics (Without Utilization of the Contextualized and Localized Instructional materials and Worktext) (x) and Post Test Result in Mathematics After the Utilization of the Contextualized and Localized Instructional materials and Worktext (y)

Correlation Method Analysis Between Numeracy Level (x) and Computational Skills (y)				
Variables	**N**	**Pearson Correlation (r)**	**Sig. (2-tailed)**	**Decision**
Pre-Test Result in Mathematics (Without Utilization of the Contextualized and Localized Instructional materials and Worktext) (X)	110	0.841669*	0.029287	Reject Ho
Post Test Result in Mathematics After the Utilization of the Contextualized and Localized Instructional materials and Worktext (y)				
*Correlation is significant at the 0.05 level (2-tailed)				
Decision Rule: Reject Ho if ρ-value for slope ≤ 0.05				

The data reveals a significant positive correlation between the two variables, with a Pearson correlation coefficient (r) of 0.841669. The p-value associated with the correlation coefficient is 0.029287, which is less than the significance level of 0.05. This suggests that the null hypothesis (Ho) can be rejected, implying that there is a statistically significant relationship between the pre- test result and the post-test result. The strong positive correlation between the pre-test result and the post-test result suggests that students who performed well in the pre-test also tended to perform well in the post-test.

This finding implies that the utilization of contextualized and localized instructional materials and worktext may have helped to reinforce existing knowledge and skills, rather than simply improving performance for struggling students. The significant correlation between the pre-test result and the post-test result also suggests that the instructional materials and worktext were effective in enhancing students' understanding and application of mathematical concepts, regardless of their initial level of proficiency.

The findings of this study are supported by existing literature and research that emphasize the importance of building on existing knowledge and skills in Mathematics education. Prior knowledge and skills play a significant role in determining students' future academic achievement in Mathematics (Ausubel, 1963). By building on existing knowledge and skills, teachers can create a more effective learning environment that supports students' learning needs. Furthermore, studies have also shown that there is often a significant correlation between pre-test and post-test scores in Mathematics education [8]. This suggests that students' prior knowledge and skills can influence their future academic achievement in Mathematics.

Conclusion

This study aimed to investigate the effectiveness of contextualized and localized instructional materials and worktexts in enhancing the mathematics performance of Grade IV learners in DepEd Region IV-A CALABARZON. The findings of the study reveal that the utilization of these materials has a positive impact on students' academic achievement in Mathematics. The comparative analysis of the students' numeracy levels before and after the utilization of the instructional materials shows a significant improvement in performance across all numeracy levels. The mean score for students classified as Above Numerate, Numerate, Emergent Numerate, and Low Numerate increased after the implementation of the instructional materials. The average mean score for all numeracy levels increased from 15.43 to 21.18, indicating an improvement in performance. The study also found a significant difference in the level of acceptance of utilizing the instructional materials, with a computed t-value of 2.106, which is above the critical value of 2.015. This suggests that the utilization of the contextualized and localized instructional materials and worktext has a positive impact on students' academic achievement in Mathematics. Furthermore, the correlation analysis between the pre-test result and the post-test result shows a strong positive correlation between the two variables, with a Pearson correlation coefficient (r) of 0.841669. The p-value associated with the correlation coefficient is 0.029287, which is less than the significance level of 0.05, indicating a significant relationship between the pre-test result and the post-test result.

The findings of this study have significant implications for mathematics education in Rosario Complex Elementary School. The utilization of contextualized and localized instructional materials and worktexts can be an effective strategy to enhance students' understanding and application of mathematical concepts. Teachers can use these materials to create a more engaging and meaningful learning experience for students, resulting in improved academic achievement.

Based on the findings of the study, it is recommended to continue utilizing the contextualized and localized instructional materials and worktext as an innovation in Mathematics education to further enhance students' learning outcomes. Teachers can use these materials to develop lesson plans and instructional strategies that cater to the diverse needs of students. Future research can explore the effectiveness of contextualized and localized instructional materials and worktexts in other subjects and grade levels. Additionally, studies can investigate the long-term effects of utilizing these materials on students' academic achievement and motivation. Overall, the study provides evidence that the utilization of contextualized and localized instructional materials and worktexts can be an effective strategy to enhance students' mathematics performance. By continuing to develop and implement these materials, educators can create a more engaging and meaningful learning experience for students, resulting in improved academic achievement and better learning outcomes.

Acknowledgement/Any Declaration

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