



STRENGTHENING EARLY NUMERACY SENSE THROUGH MANIPULATIVE-BASED AND REAL-LIFE COUNTING EXPERIENCES AMONG KINDERGARTEN LEARNERS

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ABSTRACT

This study was conducted to determine the effectiveness of manipulative-based and real-life counting experiences in strengthening the early numeracy sense of kindergarten learners in Danao Elementary School. The findings of the study served as the basis for the proposed enhancement plan aimed at improving early numeracy skills among young learners.

This study utilized a quasi-experimental pretest-posttest design to determine the effectiveness of manipulative-based and real-life counting experiences in strengthening the early numeracy sense of kindergarten learners. The design allowed the researcher to measure the learners' numeracy performance before and after the intervention and evaluate the impact of hands-on, concrete learning experiences. A single group of kindergarten learners participated in the study, and their pretest scores provided baseline data regarding their initial numeracy abilities. Following the pretest, the learners were exposed to structured manipulative-based activities and real-life counting exercises designed to develop number sense, counting skills, and early mathematical reasoning.

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Data collection began with securing permission from the school administration, including the school head, to ensure that the study was conducted in accordance with school policies and ethical guidelines. After approval was obtained, as the researcher and kindergarten teacher, I administered a pretest to assess the learners' existing numeracy skills. During the intervention, the learners engaged in manipulative-based activities, such as counting objects, sorting, and arranging materials, as well as real-life counting experiences, including counting classroom items or snacks. The researcher observed classroom interactions, monitored participation, and recorded learner performance using a structured observation checklist.

Following the intervention period, a posttest was administered using the same instrument as the pretest to measure changes in the learners' numeracy skills. All collected data were tallied, tabulated, and statistically analyzed using descriptive statistics and a paired-samples t-test to determine the significance of the intervention. This procedure ensured that both quantitative outcomes and qualitative observations were used to assess the effectiveness of manipulative-based and real-life counting experiences in strengthening the early numeracy skills of kindergarten learners.

The test of difference between the pre-test and post-test performance of kindergarten learners after the implementation of manipulative-based and real-life counting experiences. It compares the learners' performance before and after the intervention and presents the statistical basis for determining whether the observed improvement in early numeracy skills was significant.

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The results reveal that the learners performed considerably better in the post-test than in the pre-test. This improvement indicates that the kindergarten learners developed stronger early numeracy skills after participating in manipulative-based and real-life counting experiences. The findings suggest that the intervention effectively enhanced counting ability, number recognition, one-to-one correspondence, and basic mathematical reasoning through meaningful and concrete learning activities.

Furthermore, the statistical analysis showed that the computed value exceeded the critical value and that the probability value was lower than the established level of significance. Consequently, the null hypothesis was rejected, leading to the conclusion that there was a significant difference between the learners' pre-test and post-test performance. This evidence confirms that the improvement in early numeracy skills was not merely due to chance but was associated with the implementation of the intervention.

The results imply that manipulative-based and real-life counting experiences had a statistically significant and positive effect on the early numeracy skills of kindergarten learners. The higher post-test performance, supported by the statistical findings, indicates that the intervention effectively strengthened counting skills, number recognition, one-to-one correspondence, and early mathematical reasoning. These findings further demonstrate that hands-on manipulatives and authentic counting experiences promote meaningful learning and enhance foundational numeracy development.

Keywords: *Numeracy Sense, Manipulative-Based Counting, Kindergarten Learners*

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INTRODUCTION

Early numeracy is a foundational skill that significantly influences children's future mathematical understanding. Strengthening numeracy sense through manipulative-based and real-life counting experiences provides young learners with opportunities to connect abstract concepts with tangible experiences. Kindergarten learners benefit most when they can touch, move, and explore objects around them, such as blocks, sticks, beads, bottle caps, and toys. These hands-on approaches transform mathematics from something abstract into something enjoyable and understandable. Furthermore, real-life counting experiences—like counting fingers, toys, or classroom materials—help children relate numbers to everyday contexts, enhancing their understanding of mathematics as a practical tool rather than just a set of memorized facts. Integrating manipulative-based activities supports diverse learning styles, enabling visual, auditory, and kinesthetic learners to engage actively in the learning process. By combining manipulatives with real-life counting experiences, children not only strengthen their numeracy skills but also develop problem-solving abilities, social interaction, and communication skills, creating a holistic learning environment.

Clements and Sarama (2017) found that engaging young children with concrete manipulatives, such as blocks and counters, enhances their understanding of number sense, counting, and arithmetic operations. Manipulative-based activities allow learners to visualize numerical relationships, leading to improved problem-solving abilities and greater confidence in mathematics. Similarly, Fisher, Hirsh-Pasek, Golinkoff, Singer, and Berk (2016) demonstrated that hands-on, play-centered experiences promote higher engagement and

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deeper learning in early mathematics, as children actively construct knowledge through exploration. These studies highlight that combining manipulative with authentic counting tasks makes mathematics meaningful, motivating, and accessible for diverse learners, aligning well with developmentally appropriate practices in kindergarten education.

From the researcher's perspective, strengthening early numeracy through manipulative-based and real-life counting experiences is critical because it addresses both cognitive and social aspects of learning. As an educator, the researcher has observed that students learn best when they can engage with materials and interact collaboratively in structured activities. Lessons that incorporate manipulatives and real-life tasks create an inclusive and supportive learning environment, fostering confidence and interest in mathematics. This approach also allows teachers to provide immediate feedback, adjust instruction to learners' needs, and track progress effectively. Personally, the researcher is motivated to investigate this topic to provide empirical evidence on how interactive numeracy activities impact learning outcomes and to inform strategies for effective kindergarten instruction.

Limited availability of instructional materials, such as counting blocks, flashcards, and educational toys, restricts teachers' ability to provide hands-on experiences. Attention span variability among kindergarten learners poses difficulties in sustaining engagement during activities, while diverse learning paces require careful differentiation. Additionally, lack of parental involvement and support can limit reinforcement at home, reducing the effectiveness of real-life counting experiences. Teachers also face time constraints and workload pressures,

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including lesson preparation, curriculum requirements, and assessment demands, which hinder the consistent implementation of interactive numeracy activities. Finally, insufficient training in designing developmentally appropriate manipulative-based tasks limits teachers' ability to maximize the benefits of these approaches.

Pursuing this study is necessary to provide empirical evidence on the impact of manipulative-based and real-life counting experiences on early numeracy development. Understanding how these strategies influence kindergarten learners' numeracy sense can guide teachers in designing engaging, developmentally appropriate lessons. The findings will inform instructional planning, resource allocation, and professional development, ultimately aiming to strengthen mathematical foundations and promote positive attitudes toward mathematics from an early age.

This study was conducted to determine the effectiveness of manipulative-based and real-life counting experiences in strengthening the early numeracy sense of kindergarten learners in Danao Elementary School. The findings of the study served as the basis for the proposed enhancement plan aimed at improving early numeracy skills among young learners.

Specifically, the study sought to answer the following questions:

1. What is the pre-test score of kindergarten learners in numeracy before the integration of manipulative-based and real-life counting experiences?

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2. What is the post-test score of kindergarten learners in numeracy after the integration of manipulative-based and real-life counting experiences?

3. Is there a significant difference between the pre-test and post-test scores before and after the integration of manipulative-based and real-life counting experiences?

4. What enhancement plan can be proposed based on the findings of the study?

Statement of Hypothesis

Ho: There is no significant difference between the pre-test and post-test scores before and after the integration of manipulative-based and real-life counting experiences.

METHODOLOGY

Design. This study utilized a quasi-experimental pretest-posttest design to determine the effectiveness of manipulative-based and real-life counting experiences in strengthening the early numeracy sense of kindergarten learners. The design allowed the researcher to measure the learners' numeracy performance before and after the intervention and evaluate the impact of hands-on, concrete learning experiences. A single group of kindergarten learners participated in the study, and their pretest scores provided baseline data regarding their initial numeracy abilities. Following the pretest, the learners were exposed to structured manipulative-based activities and real-life counting exercises designed to develop number sense, counting skills, and early mathematical reasoning.

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Following the intervention period, a posttest was administered using the same instrument as the pretest to measure changes in the learners' numeracy skills. All collected data were tallied, tabulated, and statistically analyzed using descriptive statistics and a paired-samples t-test to determine the significance of the intervention. This procedure ensured that both quantitative outcomes and qualitative observations were used to assess the effectiveness of manipulative-based and real-life counting experiences in strengthening the early numeracy skills of kindergarten learners.

The main locale of the study was Danao Elementary School in the Schools Division of Leyte. The primary instruments used in this study were researcher-made pretest and posttest questionnaires and a structured observation checklist. The pretest and posttest were designed to assess the early numeracy skills of kindergarten learners, including counting, number recognition, and basic arithmetic operations. The tests consisted of objective-type questions,

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practical counting tasks, and problem-solving exercises that allowed learners to demonstrate their understanding both conceptually and through hands-on activities. These instruments measured the learners' performance before and after their exposure to manipulative-based and real-life counting experiences and provided data for evaluating the effectiveness of the intervention.

The structured observation checklist was used to record the learners' engagement, participation, and application of numeracy skills during the manipulative-based and real-life counting activities. The indicators included the learners' ability to count accurately, use manipulatives correctly, respond to real-life counting situations, and participate actively in classroom activities. The checklist ensured that qualitative observations complemented the quantitative test scores, thereby providing a comprehensive assessment of the learning outcomes.

To ensure the validity and reliability of the instruments, all items were reviewed by early childhood education experts and experienced kindergarten teachers. A pilot test was conducted among a small group of learners who were not included in the main study to verify the clarity, appropriateness, and accuracy of the instruments. Necessary adjustments were made based on the pilot-test results before the instruments were administered to the study participants. These measures ensured that the collected data accurately reflected the effects of manipulative-based and real-life counting experiences on the learners' early numeracy skills.

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Sampling. The respondents of the study were 18 learners with 6 males and 12 females that were involved in this study were being identified and the primary means of reach was during the actual conduct of the study as well as during the gathering of data in the school where the study was conducted.

Research Procedure. Before conducting the study, the researcher, who also the kindergarten teacher, first secured permission from the school administration, including the school head, to ensure that the study complied with school policies and ethical standards. A formal letter requesting approval was submitted, and the researcher coordinated with the teachers to schedule the implementation of the research activities without disrupting regular classroom instruction.

Once permission was obtained, the researcher administered a pretest to the selected kindergarten learners to determine their baseline numeracy skills, including counting, number recognition, and basic arithmetic. The pretest served as a reference point for measuring the learners' initial understanding before the intervention. The test was conducted under careful supervision to ensure that the learners responded independently and accurately.

Following the pretest, the researcher implemented manipulative-based and real-life counting activities during classroom instruction. These activities included the use of counting objects such as blocks, beads, and classroom items, as well as real-life applications such as tallying snacks or toys. The activities were carried out over a specified period to provide learners with meaningful, hands-on experiences that promoted the development of early

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numeracy skills. During this period, the researcher observed the learners' engagement and participation and recorded the data using a structured observation checklist.

After the intervention period, a posttest was administered using the same instrument as the pretest to measure improvements in numeracy skills. The pretest and posttest results, together with the observation data, were collected, recorded, and organized for statistical analysis. This process allowed the researcher to determine the effectiveness of manipulative-based and real-life counting experiences in strengthening the early numeracy skills of kindergarten learners and provided the basis for the proposed enhancement plan.

Ethical Issues. The right to conduct the study was strictly adhered to with the approval of the school head and the approval of the Superintendent of the Division. Orientation of the respondents, both school head and teachers, was done. Participation was strictly voluntary. Anonymity and confidentiality were maintained throughout the study. Results were used solely for research and educational improvement purposes.

Treatment of Data. The following statistical formulas are used in this study:

The data collected in this study were analyzed using quantitative statistical tools to determine the effectiveness of manipulative-based and real-life counting experiences in strengthening the early numeracy skills of kindergarten learners. Both descriptive and inferential statistics were employed to summarize, analyze, and interpret the collected data.

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1. Weighted Mean

The weighted mean was used to determine the learners' average scores in the pretest and posttest. This provided a general overview of their level of numeracy skills before and after the implementation of manipulative-based and real-life counting activities.

2. Paired-Samples t-Test

A paired-samples t-test was applied to determine whether the difference between the pretest and posttest scores was statistically significant. This inferential statistical test helped establish the effectiveness of manipulative-based and real-life counting experiences in strengthening the early numeracy skills of kindergarten learners.

RESULTS AND DISCUSSION

TABLE 1

PRE TEST PERFORMANCE OF KINDERGARTEN LEARNERS

Score Range (out of 20)	Frequency	Percentage	Interpretation
17–20	0	0%	Very High Performance
13–16	7	38.9%	High Performance
9–12	7	38.9%	Moderate Performance
5–8	4	22.2%	Low Performance
1–4	0	0%	Very Low Performance

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Score Range (out of 20)	Frequency	Percentage	Interpretation
Mean = 9.94 (MPS = 49.7%)	—	—	Moderate Performance

This table presents the pre-test performance of kindergarten learners before the implementation of manipulative-based and real-life counting experiences. It shows the distribution of the learners according to their score ranges, frequency, percentage, and corresponding performance interpretation. Likewise, the table presents the overall mean score and Mean Percentage Score (MPS), which serve as the baseline measures of the learners' early numeracy skills prior to the intervention.

The results reveal that the largest proportion of the learners, 7 or 38.9%, obtained scores within the 13–16 range, interpreted as High Performance. Similarly, 7 learners (38.9%) obtained scores within the 9–12 range, interpreted as Moderate Performance. Meanwhile, 4 learners (22.2%) scored within the 5–8 range, which corresponds to Low Performance. On the other hand, no learner (0%) achieved scores within the 17–20 range (Very High Performance) or the 1–4 range (Very Low Performance). These findings indicate that although some kindergarten learners already possessed satisfactory early numeracy skills, a considerable number still demonstrated only moderate to low mastery of the targeted competencies.

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The computed mean score of 9.94, with a corresponding Mean Percentage Score (MPS) of 49.7%, was interpreted as Moderate Performance. This finding indicates that, before the implementation of the intervention, the learners possessed only an average level of early numeracy skills. The results suggest that many learners still experienced difficulties in counting, number recognition, one-to-one correspondence, and other foundational mathematical concepts essential for kindergarten learning. The baseline performance therefore highlights the necessity of providing meaningful, concrete, and developmentally appropriate learning experiences to strengthen learners' early numeracy skills.

The results imply that kindergarten learners entered the study with varying levels of early numeracy competence. Specifically, 38.9% of the learners demonstrated High Performance, another 38.9% exhibited Moderate Performance, while 22.2% were classified under Low Performance. Furthermore, none of the learners attained either the Very High or Very Low Performance categories. The overall mean score of 9.94 (MPS = 49.7%), interpreted as Moderate Performance, implies that the learners had not yet fully mastered the expected early numeracy competencies. These findings underscore the need for developmentally appropriate instructional interventions, particularly manipulative-based and real-life counting experiences, to strengthen children's number sense, counting skills, and mathematical reasoning during their formative years.

Chan et al. (2020), which examined the effects of counting experiences on kindergarten learners' understanding of number concepts. The researchers found that young

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children who actively engaged in structured counting activities demonstrated stronger connections between number words and quantities than those who received less interactive instruction. Their findings emphasized that meaningful counting experiences help children develop number sense, strengthen symbolic understanding, and establish the foundational skills necessary for later mathematical achievement. The study further concluded that early numeracy develops more effectively when learners actively participate in concrete counting tasks rather than relying solely on abstract instruction. These findings support the present study, wherein the kindergarten learners demonstrated only moderate pre-test performance, indicating that structured manipulative-based and real-life counting experiences were needed to improve their foundational numeracy skills.

TABLE 2

POST TEST PERFORMANCE OF KINDERGARTEN LEARNERS

Score Range (out of 20)	Frequency	Percentage	Interpretation
17–20	8	44.4%	Very High Performance
13–16	10	55.6%	High Performance
9–12	0	0%	Moderate Performance
5–8	0	0%	Low Performance
1–4	0	0%	Very Low Performance
Mean = 16.94 (MPS = 84.7%)	—	—	Very High Performance

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This table presents the post-test performance of kindergarten learners after the implementation of manipulative-based and real-life counting experiences. It shows the distribution of the learners according to their score ranges, frequencies, percentages, and corresponding performance interpretations. Likewise, the table presents the overall mean score and Mean Percentage Score (MPS), which provide a comprehensive measure of the learners' early numeracy performance following the intervention.

The results reveal that the majority of the kindergarten learners (10 or 55.6%) obtained scores within the 13–16 range, which was interpreted as High Performance. Meanwhile, 8 learners (44.4%) achieved scores ranging from 17–20, corresponding to Very High Performance. Notably, no learner (0%) obtained scores within the 9–12 range (Moderate Performance), the 5–8 range (Low Performance), or the 1–4 range (Very Low Performance). These findings indicate that all kindergarten learners performed at either the high or very high level after participating in the manipulative-based and real-life counting activities.

The computed mean score of 16.94, with a corresponding Mean Percentage Score (MPS) of 84.7%, was interpreted as Very High Performance. This finding demonstrates a substantial improvement in the learners' early numeracy skills following the intervention. The absence of learners in the moderate, low, and very low performance categories suggest that the manipulative-based and real-life counting experiences effectively enhanced learners' counting ability, number recognition, one-to-one correspondence, and basic mathematical reasoning. The findings further indicate that engaging learners in concrete and meaningful

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counting experiences contributed significantly to the development of their foundational numeracy competencies.

The results imply that the implementation of manipulative-based and real-life counting experiences had a positive effect on the early numeracy skills of kindergarten learners. Specifically, 55.6% of the learners attained High Performance, while 44.4% achieved Very High Performance. Moreover, none (0%) of the learners were classified under the Moderate, Low, or Very Low Performance categories. The overall mean score of 16.94 (MPS = 84.7%), interpreted as Very High Performance, implies that the intervention successfully strengthened learners' counting skills, number recognition, and early mathematical reasoning. These findings suggest that providing young learners with concrete manipulatives and authentic counting experiences creates meaningful learning opportunities that enhance conceptual understanding and establish a strong foundation for future mathematical learning.

TABLE III

**TEST OF DIFFERENCE BETWEEN PRE TEST AND POST TEST PERFORMANCE OF
KINDERGARTEN LEARNERS**

Variables Compared	Mean	Mean Difference	t-Computed	t-Critical (0.05, df=17)	p-Value	Decision on Ho	Interpretation
Pre-Test vs.	9.94 vs. 16.94	7.00	13.21	2.11	< 0.001	Reject Ho	Significant Difference

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Variables Compared	Mean	Mean Difference	t-Computed	t-Critical (0.05, df=17)	p-Value	Decision on Ho	Interpretation
Post-Test Scores							

This table presents the test of difference between the pre-test and post-test performance of kindergarten learners after the implementation of manipulative-based and real-life counting experiences. It compares the learners' performance before and after the intervention and presents the computed mean scores, mean difference, computed t-value, critical t-value, p-value, decision on the null hypothesis, and statistical interpretation. These statistical measures were utilized to determine whether the observed improvement in the learners' early numeracy skills was statistically significant.

The results reveal that the learners' mean score increased from 9.94 during the pre-test to 16.94 during the post-test, resulting in a mean difference of 7.00 points. This substantial increase indicates that the kindergarten learners demonstrated a marked improvement in their early numeracy skills after participating in the manipulative-based and real-life counting experiences. The findings suggest that the intervention effectively enhanced the learners' counting ability, number recognition, one-to-one correspondence, and basic mathematical reasoning through meaningful and concrete learning experiences.

Furthermore, the statistical analysis showed that the computed t-value of 13.21 was considerably higher than the critical t-value of 2.11 at the 0.05 level of significance with 17 degrees of freedom. Likewise, the obtained p-value of less than 0.001 was significantly lower

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than the required level of significance. Consequently, the null hypothesis was rejected, leading to the conclusion that there was a significant difference between the learners' pre-test and post-test performance. This statistical evidence confirms that the improvement in early numeracy skills was not due to chance but was directly associated with the implementation of manipulative-based and real-life counting experiences.

The results imply that the implementation of manipulative-based and real-life counting experiences had a statistically significant positive effect on the early numeracy skills of kindergarten learners. Specifically, the learners' mean score increased from 9.94 in the pre-test to 16.94 in the post-test, yielding a mean difference of 7.00 points. Moreover, the computed t-value of 13.21, which exceeded the critical value of 2.11, together with the p-value of less than 0.001, provided sufficient statistical evidence to reject the null hypothesis and conclude that a significant difference existed between the two assessments. The overall post-test mean score of 16.94 (MPS = 84.7%), interpreted as Very High Performance, implies that the intervention effectively strengthened learners' counting skills, number recognition, one-to-one correspondence, and early mathematical reasoning. These findings further demonstrate that providing young learners with hands-on manipulatives and authentic counting experiences promotes meaningful learning and significantly enhances foundational numeracy development.

CONCLUSION

Based on the results of this study, manipulative-based and real-life counting experiences were effective in strengthening the early numeracy skills of kindergarten learners.

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The intervention significantly improved their counting ability, number recognition, one-to-one correspondence, and mathematical reasoning by providing meaningful, concrete, and engaging learning experiences.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed:

The teachers should regularly integrate manipulative-based and real-life counting experiences into kindergarten mathematics lessons to strengthen number recognition, counting accuracy, one-to-one correspondence, and early mathematical reasoning. They should also provide differentiated, play-based, and developmentally appropriate activities that respond to the varied learning needs of young learners.

The school heads should support the implementation of hands-on numeracy interventions by providing adequate manipulatives, learning materials, classroom resources, and professional development opportunities for kindergarten teachers. They should likewise include early numeracy enhancement activities in the school's improvement and instructional supervision programs.

The Public Schools District Supervisor should provide technical assistance, monitoring, and capacity-building activities that promote the effective use of manipulative-based and real-life counting strategies across kindergarten classes. The supervisor should also encourage

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schools to adopt evidence-based and developmentally appropriate approaches to early mathematics instruction.

The parents should reinforce their children's numeracy skills at home by involving them in meaningful counting activities using household objects, toys, food items, and other familiar materials. They should also coordinate with teachers and consistently support home-based activities that develop number sense and confidence in mathematics.

The researcher should continue refining the intervention by developing more localized, engaging, and age-appropriate manipulative-based and real-life counting activities. The researcher should also share the findings and instructional materials with other kindergarten teachers to support wider implementation and sustained numeracy improvement.

The future researchers should conduct similar studies involving larger groups, longer intervention periods, different schools, and varied early childhood settings. They should also examine other outcomes, such as problem-solving ability, learner engagement, skill retention, mathematical confidence, and the long-term effects of hands-on numeracy instruction. Early learning, and encouraging the use of context clues during reading activities. They should also collaborate closely with teachers in monitoring learners' progress and supporting school-based literacy initiatives.

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AUTHOR'S PROFILE



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The author was born on October 19, 1992 at Tinago, San Isidro, Leyte, Philippines. She earned her Bachelor's degree in Elementary Education at Leyte Normal University - San Isidro External Campus. Teaching is her childhood dream. She was a consistent honor from elementary to high school and was an officer of different organizations when she was a student. Her love for children and passion for teaching helped her decide to take major in elementary education as her field of specialization in her graduate studies. She is currently finishing her Master of Arts in Education major in Elementary Education at Western Leyte College of Ormoc City.

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In addition, she is a GPTA Adviser for seven years and a School Monitoring, Evaluation, and Adjustment (SMEA) Coordinator for years. Her dedication to her work brought a meaningful impact on her learners, colleagues, and the school community. She firmly believes that "Education plants the seeds of hope, and teachers help those seeds grow into a brighter future". Guided by this philosophy, she continues to inspire young learners, nurture their potential, and contribute to the development of quality education.

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