

## Development and validation of worksheets to address the least learned competencies in Mathematics 4

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**Abstract:** This study identifies and addresses the least learned competencies in Mathematics among Grade 4 learners in La Purisima Elementary School, Prosperidad District II, Division of Agusan del Sur, for the school year 2023-2024. The research utilized a development research design and involved 31 learners. The research instrument consisted of the Third Periodical Test Questionnaires. Statistical treatments such as frequency, count, percent, weighted mean, t-test of difference, and analysis of variance were employed in analyzing the data.

The researcher utilized the consolidated researcher-made worksheet with topics covering the least learned competencies identified for the third quarter. The study used a development research design, particularly the ADDIE Model phases, namely: Analysis, Design, Development, Implementation, and Evaluation. In the Analysis stage, the least learned skill (LLS) was identified based on the item analysis of the third grading quarterly test. From the LLS obtained, the researcher designed and developed Worksheets in mathematics 4. These materials underwent validation before implementation as intervention materials. Post assessment results showed that the majority of the learners who were previously identified in the Not Mastered Level (51.6%) had moved up either to the Nearly Mastered Level (48.4%) or Mastered Level (51.6%). Nobody was left in the Mastered Level. This strongly support the effectiveness of the validated Worksheets in Mathematics 4.

**Keywords:** Mathematics Education, Least Learned Competencies, Worksheet development, Instructional strategies, ADDIE Model

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### INTRODUCTION

Mathematics education is crucial for equipping learners with essential skills for both academic and real-life success. Altay, Erhan, and Batı (2020) found that using real-life situations in math is effective, while contexts not connected to real life can decrease learners' attention and make them think math has no real-life application. Many learners struggle with specific math competencies, leading to gaps in understanding and proficiency.

Fourth-grade mathematics is a critical stage where learners acquire foundational concepts and skills essential for advanced topics. Research shows that learners often struggle with competencies in Mathematics 4, hindering their progress. For example, learners have difficulty interpreting mathematical problems in real-life contexts, verbalizing their thought processes, or writing down calculations (Fauziyah & Jupri, 2020). To address these challenges, it is important to provide opportunities for learners to engage in real-life problem-solving tasks.

Despite recognizing the least learned competencies in Mathematics 4, there is a lack of effective instructional materials addressing these areas. Textbooks and curriculum guides provide a broad overview but may not meet the diverse learning needs and challenges of specific competencies. This shortage of resources makes it difficult for educators to provide targeted

practice and support. This study aimed to develop and validate worksheets focusing on the least learned competencies in Mathematics 4. These worksheets served as valuable tools for educators, offering targeted exercises and instructional guidance to help overcome difficulties. By providing validated worksheets, the study sought to enhance instructional practices, promote engagement, and improve learners' confidence and proficiency in math. Targeted exercises can help identify areas where learners struggle, allowing educators to tailor their instruction to individual needs. The goal was to create a supportive learning environment where learners could succeed in their mathematical studies, empowering educators and learners to achieve academic success.

The researcher developed and validated worksheets for Mathematics 4, providing meaningful learning experiences for Grade 4 learners. This study was particularly beneficial for Grade 4 mathematics teachers, offering ideas on how to effectively integrate worksheets into teaching and helping learners achieve higher academic success. The worksheets addressed the least learned competencies in the third quarter, providing support for both teachers and learners. They introduced engaging activities, encouraging learners to become independent and responsible for their own learning, and offered various ideas and concepts to enrich their understanding and sharpen their skills.

Finally, the validated worksheets significantly enhanced the learning experience for Grade 4 learners by addressing their least-learned competencies. They provided a structured, engaging, and supportive framework that fostered academic growth and confidence in mathematics. Future research should continue refining these materials, incorporating technological advancements and ongoing feedback to improve educational outcomes.

### *Problem Statement*

This study developed, utilized, and validated comprehensive worksheets designed for Grade 4 Mathematics instruction. This study specifically sought to answer the following questions.

1. What are the least learned and reflected competencies in Mathematics 4 as reflected in the pre-assessment performance of the learners in the third quarter?
2. How will the worksheets be designed to address the least learned competencies?
3. How do the experts evaluate the worksheets in terms of: intellectual property rights compliance, learning competencies, instructional design and organization, and instructional quality, assessment, and readability?
4. What is the level of post-assessment performance after the utilization of the worksheets?
5. Is there a significant difference between the pre-assessment and post-assessment performances of the learners?

### *Theoretical framework*

This study was anchored on the Constructivist Learning Theory, developed by Jean Piaget (1957). This theory posits that learning is an active and interactive process where individuals construct knowledge and meaning based on their experiences and prior knowledge. It emphasizes the importance of engagement, hands-on activities, and social interactions in the learning process.

Applying Constructivist Learning Theory aimed to enhance learners' mathematical understanding and proficiency. Educators could create opportunities for learners to actively engage in the learning process by providing worksheets specifically designed to address the least

learned competencies. The worksheets served as tools to prompt learners to explore mathematical concepts, apply problem-solving strategies, and reflect on their own learning.

Additionally, Piaget's theory highlighted the significance of active involvement and hands-on experiences in learning. The worksheets incorporated hands-on activities, manipulatives, and real-life situations to promote meaningful learning experiences. By engaging learners in concrete and contextualized tasks, the worksheets facilitated the construction of mathematical knowledge and the application of skills in real-life settings.

## LITERATURE REVIEW

*Assessment methods and techniques for identifying least learned competencies in Mathematics 4*  
Assessment methods and techniques are instrumental in identifying the least learned competencies in Mathematics 4. One commonly used approach is the use of standardized tests. These tests provide a systematic and uniform way to measure learners' knowledge and skills in Mathematics 4. Research by Bach (2020) supports the effectiveness of standardized tests, such as state-mandated assessments or national examinations, in revealing areas where learners demonstrate limited proficiency. By administering these tests, educators can gather valuable data on specific topics or concepts that require further attention and instructional support. The results of standardized tests serve as a foundation for identifying the least learned competencies and informing targeted interventions.

The literature emphasizes the significance of understanding the underlying causes or misconceptions contributing to the least learned competencies in Mathematics 4. Identifying these causes helps educators design targeted interventions and provide explicit instruction in problem areas. Qualitative methods, such as interviews or think-aloud protocols, are valuable tools for delving deeper into learners' reasoning and uncovering misconceptions that hinder their understanding of specific competencies (Carcoba Falomir, 2022). By gaining insights into learners' thought processes and misconceptions, educators can effectively tailor their instructional approaches to address the root causes of these least learned competencies.

### *Level of mathematics achievement*

Mathematics is a critical subject taught at all levels of education. However, the COVID-19 pandemic has unexpectedly worsened the ongoing education crisis and widened the math skills gap among young learners (Sooknanan & Seemungal, 2023). According to the 2022 Program for International Learner Assessment (PISA), the Philippines ranks low in mathematics, with only 16% of Learners reaching at least proficiency level 2. Moreover, most Filipino Learners struggle with foundational mathematical concepts, highlighting an urgent need for remediation and targeted support (SEAMEO INNOTECH, 2022).

Shifting from traditional instruction practices, mathematics educators share an idea of what methods are more practical to address the issue, like the constructivist approach, mastery learning, and systematic approaches. Studies have shown Filipino learners' poor or unsatisfactory performance in mathematics (Azucena et al., 2022). The learners' mathematics underachievement can be attributed to the COVID-19 pandemic, affecting both teachers and learners. The current situation has led to a decline in math learning, as learners' may need more remediation to progress to new lessons, leading to learning gaps (Torres, 2021). Nevertheless, it can be addressed through an intervention (Azucena et al., 2022; Pentang et al., 2020; Pentang, 2021).

*Design and development of effective worksheets in Mathematics*

The design and development of instructional materials are crucial in addressing the least learned competencies in Mathematics. Educators need effective tools and strategies to target these competencies and support learners in their learning journey. Research by Farmonov & Karimova (2023) highlights the importance of incorporating open-ended questions and real-world problem scenarios in worksheets. This approach enhances learners' critical thinking skills and enables them to apply mathematical knowledge to practical situations. Problem-solving worksheets provide opportunities for learners to engage in authentic mathematical reasoning and develop problem-solving strategies to tackle least learned competencies.

Overall, the literature on the design and development of instructional materials, specifically worksheets, to address least learned competencies highlights the importance of effective instructional strategies, problem-solving approaches, scaffolding techniques, and the use of visual representations or manipulatives. Incorporating cooperative learning, open-ended questions, scaffolds, and visual aids, and aligning with curriculum standards are key considerations in worksheet design. This review of literature provides valuable insights and guidance for educators in creating instructional materials that effectively target and support learners in overcoming the least learned competencies in Mathematics.

*Validation and efficacy of instructional materials in mathematics*

The validation and efficacy of instructional materials, particularly worksheets, are critical considerations in promoting effective teaching and learning in Mathematics. Research in this area emphasizes the importance of validation methods to ensure the quality and appropriateness of instructional materials. Expert reviews involve subject matter experts evaluating the content, alignment with curriculum standards, and instructional strategies used in the worksheets (Murillo & Tan, 2022). Expert feedback provides valuable insights into the materials' accuracy, clarity, and effectiveness, helping to refine and improve them before implementation.

The impact of instructional materials on learners' mathematical knowledge and skills has been investigated in the existing literature. Studies in this area often compare the performance of learners who received targeted interventions using the instructional materials with a control group (Lacea & Buscano, 2023). For example, a study implemented a set of worksheets specifically designed to address least learned competencies and found significant improvements in learners' performance compared to those who did not receive the intervention. These findings highlight the positive impact of well-designed instructional materials on learners' learning outcomes in Mathematics.

Furthermore, research has focused on the impact of worksheet-based interventions on learners' problem-solving skills. Sipayung et al. (2020) designed mathematics worksheets centered on problem-solving within number-related topics. Their findings revealed that the worksheets were both valid and effective, resulting in increased Learner engagement and notable improvements in problem-solving abilities. Similarly, Tumangger et al. (2024) developed worksheets grounded in the Realistic Mathematics Education (RME) approach using the ADDIE model. The study confirmed that these instructional materials were valid, practical, and significantly contributed to the enhancement of learners' mathematical problem-solving skills.

## METHODOLOGY

### *Research design*

This study used a development research design. This research design is a common research design used to assess changes or differences in a dependent variable (outcome) before and after an intervention or treatment. In this study design, the participant's performance on the outcome variable is assessed before the intervention (pretest) and subsequently after the intervention (post-test). The pretest establishes a baseline measurement of the dependent variable, enabling the researcher to compare the participants' Mathematics performance before and after the intervention.

### *Research Locale*

The study was conducted at La Purisima Elementary School, among the elementary schools in the Schools Division of Agusan del Sur, Municipality of Prosperidad, province of Agusan del Sur. The researcher is currently affiliated with this school.

### *Respondents of the study*

The participants of this study were the Grade 4 learners from La Purisima Elementary School in Prosperidad, Agusan del Sur, for the school year 2023 – 2024. The total number of 31 Grade 4 learners serves as the participants of the study.

### *Research instrument*

In this study, the research instrument utilized the Third Quarter Examination in Mathematics 4 in Pre-Assessment and Post-Assessment Tests. After the analysis of the Pre-Assessment test, the utilization of the Worksheets in Mathematics 4 was conducted. The topics covered in the worksheets were the least learned competencies identified by the researcher, it consisted of practice problems or exercises, step-by-step solutions, and self-assessments and reflections aligned with the learning objectives.

The worksheets were validated using the Experts' Evaluation Tool, which has six indicators: Intellectual Property Rights and Compliance, Learning Competencies, Instructional Design and Organization, Instructional Quality, Assessment, and Readability.

### *Validity and reliability of the research instrument*

The researcher used division-made test questionnaires for the Third Quarter in Mathematics 4. Since the Division Office created these questionnaires, they did not require additional validation. The test questions were already aligned with the Most Essential Competencies for learners, ensuring their reliability and relevance. This alignment guaranteed that the instrument accurately measured the intended competencies and provided trustworthy data for the study.

### *Data Gathering Procedure*

Upon the approval of the thesis proposal by the thesis Evaluation Committee, the researcher asked permission, through a permit letter from the Head of La Purisima Elementary School, to conduct research on the respondents to gather the data needed for her study.

The school Head approved the researcher's conduct of research with the respondents. Then, the researcher administered the pre-assessment tests. After gathering the necessary data for the

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pre-assessment, the researcher conducted statistical analysis to determine the least learned competencies. With this, the researcher developed a worksheet that the learners will use.

After administering the intervention, a post-assessment test was conducted. The post-assessment test was similar to the pre-assessment to see if there was a significant difference before and after the intervention. The results were statistically analyzed using a Paired Sample t-test to determine if there was a significant difference between the pre-assessment and post-assessment tests.

#### *Data Analysis Procedure*

The following statistical treatment were used to analyze the data:

Frequency count was employed to determine the occurrence of each identified competency within the datasets, highlighting the competencies with the least frequency, indicating those that are the least learned among Grade 4 learners in Mathematics.

Percentage determined the equivalent of the frequency count in terms of hundred.

Mean determined the average score of the learners on the Third Quarter Test in Mathematics 4.

Paired Sample T-test was used to analyze the difference between the pre- and post-assessment results on the Third Quarter Test in Mathematics 4.

## DISCUSSION OF FINDINGS

### *Pre-assessment performance of Grade 4 learners in the third quarter*

During the pre-Assessment conducted by the researcher to measure learners' prior knowledge and understanding before beginning instruction, it was found that 16 or 51.6% of the learners got a 20 or below, indicating that the competency is not mastered. One possible reason for this outcome is that s may have lacked prior knowledge or foundational skills necessary for understanding more advanced concepts. This aligns with findings by Velez and Abuzo (2023), who reported that learners with low mathematics self-efficacy and motivation tend to exhibit weaker problem-solving skills, suggesting that foundational gaps significantly impact learners' ability to grasp complex mathematical concepts. Factors such as insufficient instructional support, limited practice opportunities, and anxiety towards mathematics could have contributed to these low scores. This substantial proportion indicates that a majority of learners face considerable challenges in mastering essential learning competencies, highlighting the need for targeted instructional support and intervention.

The pre-assessment data reveals that 15 learners (48.4%) are categorized under the "Nearly Mastered" level. This indicates that while these Learners have a foundational understanding of the competencies, they have not yet achieved full mastery. Such outcomes may stem from inconsistent learning experiences or instructional gaps, which hinder the complete comprehension of the material. The substantial proportion of Learners in this category underscores the need for targeted instructional strategies to bridge these learning gaps.

Notably, the data also shows a 0% performance in the "Mastered" level, signifying that none of the learners have attained a high level of competency. This absence highlights a critical area for educational intervention, emphasizing the urgency to implement support mechanisms that facilitate the transition from partial understanding to full mastery.

These findings align with recent research emphasizing the importance of identifying the root causes of learners' academic challenges to develop effective educational interventions. For

instance, a study by Chen et al. (2023) found that certain behavioral indicators, such as counting out loud, were significantly associated with math anxiety among elementary learners, suggesting that addressing these behaviors could alleviate anxiety and improve performance.

In assessing learners' mastery levels, the Department of Education's standard scale was utilized: Mastered Skills: 75% and above, Nearly Mastered Skills: 51%–74% and Not Mastered Skills: 50% and below.

According to this scale, 11 competencies were identified as Least Learned Skills, with mean percentages below 50%. Conversely, three competencies achieved mean scores of 60% and above, categorized as Nearly Mastered. The prevalence of competencies in the Least Learned category indicates significant challenges in mastering third-quarter Mathematics competencies.

Factors contributing to these challenges include a lack of foundational skills necessary for understanding complex mathematical concepts. Moreover, engagement and motivation play crucial roles. Studies have shown that learners with low mathematics self-efficacy and motivation tend to exhibit weaker problem-solving skills, suggesting that foundational gaps significantly impact learners' ability to grasp complex mathematical concepts (Velez & Abuzo, 2023). Furthermore, math anxiety has been identified as a significant barrier to performance and retention of mathematical concepts (Ng, 2022).

#### *Worksheets design process using ADDIE instructional model*

The Development of Worksheet in Mathematics 4 was carried out using ADDIE as an Instructional Model.

The first phase is Analysis. The researcher prepared the pretest-posttest material based on Mathematics 4 learners in the Third Quarter. The researcher used material based on Mathematics 4, Quarter 3 following DepEd standards of the Most Essential Learning Competencies (MELCs) of the K-12 Curriculum. The researcher administered pretest-posttest to Grade 4 learners for item analysis and data gathering for the Least Learned Competencies. Based on the result of the Pre-assessment Test, the researcher felt the need to develop Worksheets in Mathematics 4 to address the least learned competencies in the Third Quarter.

Next is the Design phase. After determining the Least Learned Competencies and identifying instructional pedagogies are determined in designing the Worksheets in Mathematics 4. Thorough research was conducted in outlining the activities to ensure the interconnectedness to learning objectives. Also, the preparation of the Experts' Evaluation Tool for the validation of the developed worksheet was completed.

Development phase. The designed worksheet was created. This phase was intended to produce revised worksheets based on experts' suggestions. The results of the validation of the experts were carried out. Through this validation activity, an assessment of the developed worksheets was obtained.

In the Implementation phase, the utilization of the developed worksheets was carried out by the Grade 4 learners in La Purisima Elementary School under the time limit. Utilized the developed Materials as the class intervention materials

Finally, in the Evaluation phase, the researcher conducted the Post-test and evaluated the Performance of the learners after the utilization of the Worksheets. The result of the Post Assessment Test was determined as the success of the worksheets in addressing the Least Learned Competencies in Mathematics 4.

### *Evaluation of worksheets*

The evaluation of the worksheets was conducted to ensure compliance with the content standards set by the Department of Education. The process involved a thorough review of each worksheet by the experts. The evaluation focused on determining whether the content aligns with the curriculum standards and promotes meaningful learning experiences for learners.

Based on the weighted mean of 2.82, the Worksheets in Mathematics 4 have satisfactorily met the criterion of usability and content. This indicates that the worksheets were ethically crafted, aligned to the standard competencies of the K-12 Curriculum, well-designed, user-friendly, and effectively supported the teaching and learning process.

Overall, the Worksheet in Mathematics 4 is very valid and feasible to help lessons in class so that learning can be more effective and optimal.

### *Post-assessment performance of the learners*

The Table shows the post-assessment results of 31 learners. Sixteen learners (51.6%) scored between 31 and 40, indicating they reached the Mastered Skill level. The remaining 15 learners (48.4%) achieved Nearly Mastered Skills. No learners fell into the Not Mastered Skill level. These results indicate that the developed worksheets in Mathematics 4 were effective interventions. Comparing pre-test and post-test results, there was a significant improvement, with learners showing increased concentration around the mean and mastery of skills. This improvement aligns with the findings of Aguhayon et al. (2020), who emphasized that differentiated instruction is effective in addressing learners' diverse learning needs and enhancing their confidence in performing fundamental mathematical operations.

## CONCLUSION

Based on the findings of the study, several key conclusions were drawn. The least learned competencies in Mathematics were primarily related to basic geometric concepts and operations involving time and measurement, indicating specific areas where learners faced the most challenges.

The design process of the worksheets, which included thorough analysis, expert validation, and iterative refinement, successfully ensured that the materials were carefully tailored to meet the learners' needs. Expert evaluations reflected an extremely favorable reaction, confirming the high quality and appropriateness of the developed Mathematics 4 worksheets. Furthermore, the post-assessment results demonstrated the worksheets' effectiveness in enhancing learners' mathematical understanding and proficiency, showing clear improvements in performance.

There was a statistically significant difference between learners' pre-assessment and post-assessment results, which led to the rejection of the null hypothesis, affirming the worksheets' positive impact. Finally, implementing the recommended improvements—including proper citation, well-organized topics, readable fonts, accuracy, learner-centered activities, visual aids, differentiated instruction, curriculum alignment, and continuous feedback—will further strengthen and enhance the effectiveness of the Mathematics 4 worksheets, ensuring they remain relevant, engaging, and supportive of learners' progress.

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