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READING COMPREHENSION AND MATHEMATICS WORD PROBLEM SOLVING AMONG COLLEGE OF EDUCATION STUDENTS OF ISABELA STATE UNIVERSITY TOWARDS DEVELOPMENT OF STRATEGIC PROGRAM PLAN

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Abstract

This study examined the relationship between reading comprehension and the ability to solve mathematical word problems among first-year College of Education (CED) students at Isabela State University–Echague. Specifically, it assessed students' performance across five reading comprehension dimensions—literal, inferential, critical, creative, and valuing/application—and their problem-solving ability using Newman's Error Analysis, which includes reading, comprehension, transformation, process skills, and encoding errors. A descriptive-correlational research design was employed involving 76 purposively selected respondents. Data were gathered using a reading comprehension test and a mathematics word-problem solving test, and analyzed using frequency, percentage, mean, standard deviation, Pearson correlation, t-test, and one-way analysis of variance (ANOVA). Findings revealed that students demonstrated proficient to excellent reading comprehension, particularly in the critical dimension (4.21) and valuing/application dimension (4.36), while the creative dimension was only at a developing level (2.93). In contrast, students exhibited poor performance across all stages of mathematical word-problem-solving, with transformation (1.00) and process skills (1.01) identified as the most critical weaknesses. Correlation analysis showed that most relationships between reading dimensions and mathematical performance were weak and not statistically significant, indicating a gap in the transfer of reading skills to mathematical contexts. Significant differences were observed when grouped according to sex, while differences across academic programs were generally not significant, except in the literal dimension. The findings suggest that reading comprehension skills alone may not sufficiently explain students' mathematical word-problem-solving performance. Consequently, a strategic course plan integrating reading comprehension and mathematical problem-solving strategies was developed to address identified gaps. The study recommends the adoption of integrated literacy-numeracy

instruction, differentiated teaching approaches, and explicit training in problem representation and metacognitive strategies to improve students' academic performance and teaching readiness.

INTRODUCTION

In recent years, the mathematical word problem-solving ability and reading comprehension skills of Filipino students have been under significant scrutiny, particularly in the context of global benchmarks such as the Programme for International Student Assessment (PISA). The Philippines continues to face substantial challenges in these foundational academic skills, as evidenced by the 2022 PISA results. According to the latest report, only 16 percent of Filipino 15-year-olds reached the baseline proficiency level (Level 2) in mathematics, indicating that the majority struggle with interpreting and solving even basic mathematical problems contextualized in real-life situations (OECD, 2023). In terms of score, the country obtained a mean score of 355 in mathematics, well below the OECD average of 472 points.

In reading comprehension, the picture is similarly concerning, with only about 24 percent of students demonstrating the ability to identify main ideas or critically engage with texts. The Philippines scored a mean of 347 compared to the OECD average of 476, positioning the country among the lowest performers internationally, ranking sixth lowest in both mathematics and reading among 81 participating countries and economies (OECD, 2023). Despite a modest increase in scores since 2018—the scores in mathematics improved by two points and reading by seven points, the overall proficiency levels remain alarmingly low, underscoring the urgent need to enhance teaching methodologies and learning environments.

A significant share of Filipino students also come from socioeconomically disadvantaged backgrounds, with 36 percent in the bottom international quintile of the socioeconomic scale, further impacting their academic achievement in these areas (OECD, 2023). This stark reality highlights the relevance of the PISA 2022 framework as a diagnostic tool that not only reveals critical gaps but also provides actionable insights for educational policy reform in the Philippines. Strengthening mathematical reasoning and reading comprehension competencies is essential to equip Filipino students with the critical thinking and problem-solving skills necessary for academic and life success in the 21st century (Philippine News Agency, 2023; OECD, 2023).

A critical factor influencing the mathematics word-problem solving and reading comprehension abilities of Filipino students is the quality of teaching and pedagogical practices. In the Philippines, teaching control, including pedagogical approaches, remains a significant challenge in improving student outcomes. Many mathematics and reading teachers lack sufficient subject matter expertise and effective instructional strategies tailored to diverse learner needs (Bernardo et al., 2024). Overcrowded classrooms further limit teachers' ability to deliver individualized instruction, resulting in a reliance on traditional, teacher-centered methods that prioritize rote memorization over critical thinking and problem-solving skills essential for success in assessments like PISA (Romorosa et al., 2024).

In response, the Department of Education (DepEd), through the National Educators Academy of the Philippines (NEAP), has acknowledged these concerns and launched initiatives such as the Higher Order Thinking Skills Professional Learning Packages (HOTS-PLPs) to enhance teachers' professional competency in mathematics, science, and reading pedagogy (DepEd, 2023). These programs focus on equipping teachers with modern pedagogical skills that promote student engagement, conceptual understanding, and application of knowledge in real-life contexts aligned with PISA frameworks.

However, systemic challenges remain, including limited ongoing professional development opportunities, insufficient alignment of teaching materials with global standards, and language barriers that affect instruction quality (Bernardo et al., 2024). Addressing these pedagogical gaps is vital for strengthening the interplay between reading comprehension and mathematical problem solving, ultimately fostering better educational outcomes.

Although numerous studies confirm the vital role of reading comprehension in enhancing students' ability to solve mathematics word problems, gaps remain in fully understanding and addressing this relationship among Filipino students. Studies such as Boctot et al. (2025) and research on Filipino learners reveal strong correlations between reading comprehension levels and mathematical problem-solving skills, especially at literal and inferential comprehension levels. However, difficulties persist with higher-order comprehension and more complex mathematical operations, suggesting incomplete mastery of critical thinking skills required for effectively solving word problems.

Moreover, some studies report conflicting evidence regarding the predictive power of reading comprehension on mathematical problem-solving performance. For instance, Hijada Jr. (2022) found a weak or insignificant correlation between comprehension skills and math problem-solving among elementary learners in the Philippines, pointing to other influential factors such as teaching methodologies, learner motivation, and curriculum design. This divergence underscores the complexity of the issue and the need for further research focusing on older students, such as those in higher education, to tailor effective instructional interventions.

In addition, the differences in performance for students of all genders have been the topic of much discussion and research. Students' academic performance allows educational and vocational institutions to determine whether the educational curriculum is having the desired impact on students in terms of teaching and learning. It gives some indication of how well teachers and students have accomplished their targeted educational goals (Arshad et al., 2015).

Torres (2011) concluded that Filipino boys' underachievement is driven by parents' and teachers' low academic expectations for boys, the economic viability of boys, passive classroom experience, gender bias, stereotyping, and a lack of learning materials.

In 2014, the Philippines' fifth progress report on the MDGs stated that "education indicators continue to lean towards girls as basic education data show that girls nearly surpass boys in formal basic education" (National Economic and Development Authority and United Nations Development Programme, 2014, p.49).

Similar findings were reported in the Philippines' EFA 2015 review report, which said that "for SY 2012-2013, girls outperformed boys in all education efficiency indicators…Girls have also been outperforming boys in terms of the National Achievement Test (NAT) scores" (p. 45). Comparative data consistently showing girls doing better than boys on various education indicators led the Philippine Commission on Women (2014) to call on the education sector to address the underperformance of boys in key education indicators as a priority gender issue (Education For All 2015 National Review Report: Philippines 2015).

Reading comprehension and mathematical word-problem solving are closely interconnected cognitive processes. Solving mathematical word problems does not rely solely on computational ability; rather, it requires learners to decode language, interpret meanings, identify relevant information, infer relationships, and transform verbal statements into mathematical representations such as equations, symbols, and operations.

In this process, students engage in higher-order cognitive processing that combines literacy and numeracy skills simultaneously. Learners who experience difficulty understanding the language and context of a problem are more likely to struggle in representing and solving mathematical situations accurately. Thus, comprehension skills play a critical role in helping learners process information, construct meaning, and communicate mathematical solutions effectively.

The relationship between reading comprehension and mathematical problem solving can be further explained through Newman's Error Analysis (NEA), developed by Newman in 1977. Newman proposed that students encounter difficulties in solving mathematical word problems through a sequence of cognitive stages: reading, comprehension, transformation, process skills, and encoding. According to this framework, students must first read and understand the problem before they can translate it into mathematical representations and perform the required operations. Errors may occur when learners fail at any of these stages. This theoretical perspective highlights that mathematical problem-solving is fundamentally language-dependent and cognitively structured, emphasizing the strong connection between literacy skills, mathematical representation, and problem-solving performance.

The Revised Philippine Informal Reading Inventory (Phil-IRI) framework further supports this relationship by viewing reading comprehension as a multidimensional cognitive process involving literal, inferential, critical, creative, and valuing/application dimensions. These dimensions are likewise essential in mathematical word-problem solving because learners are expected to interpret textual information, analyze relationships, evaluate conditions, and apply understanding to practical situations. Inferential and critical comprehension, in particular, enable students to derive meanings beyond explicitly stated information, while creative and application comprehension support flexible reasoning and contextualized problem solving. Consequently, reading comprehension serves as an important foundation for successful mathematical reasoning and communication.

Another significant gap lies in the integration of pedagogical strategies that simultaneously address literacy and numeracy challenges. While DepEd initiatives target teacher development, there is scant empirical evidence showing the effectiveness of interdisciplinary teaching approaches in improving both reading comprehension and mathematical word problem-solving at the tertiary level. Specifically, for College of Education

students—future educators—the deficiency of contextualized and strategic course plans that holistically enhance these skills remains underexplored.

Although numerous studies confirm the vital role of reading comprehension in enhancing students' ability to solve mathematics word problems, important gaps remain in understanding how these skills interact among Filipino college students, particularly pre-service teachers.

Existing studies in the Philippines and abroad have largely focused on elementary and secondary learners, emphasizing the relationship between reading comprehension and mathematics achievement among younger students. Studies such as Boctot et al. (2025) revealed strong correlations between literal and inferential comprehension and mathematical problem-solving performance. However, these studies also reported persistent difficulties in higher-order comprehension and complex mathematical reasoning.

While these findings provide valuable insights, little is known about whether pre-service teachers possess the ability to transfer reading comprehension skills into mathematical contexts, especially in solving contextualized mathematical word problems.

This gap is significant because College of Education (CED) students are future educators who will eventually teach literacy and numeracy skills in basic education. Their ability to comprehend, interpret, and mathematically represent information is essential not only for their own academic success but also for their future instructional effectiveness.

If pre-service teachers themselves experience difficulties in interpreting mathematical language, transforming verbal information into mathematical representations, and communicating solutions accurately, these challenges may later influence the quality of instruction they provide to learners. Despite the importance of this issue, limited empirical studies have examined the relationship between reading comprehension dimensions and mathematical word-problem solving among Filipino pre-service teachers at the tertiary level.

Similarly, the Revised Philippine Informal Reading Inventory (Phil-IRI) framework supports the idea that reading comprehension develops through multiple dimensions, including literal, inferential, critical, creative, and valuing/application comprehension. These dimensions are cognitively associated with mathematical problem solving because learners are expected to interpret information, analyze relationships, evaluate contexts, and apply understanding to real-life situations. The integration of Phil-IRI and Newman's Error Analysis, therefore, provides a strong conceptual foundation for examining how reading comprehension skills influence students' mathematical word-problem-solving performance.

Another significant gap lies in the limited integration of literacy and numeracy instruction at the tertiary level. While Department of Education initiatives focus on strengthening teacher competencies, there remains scant empirical evidence on interdisciplinary instructional approaches that simultaneously develop reading comprehension and mathematical problem-solving skills among pre-service teachers. Specifically, contextualized and strategic instructional plans designed to strengthen both literacy and numeracy competencies among College of Education students remain underexplored in Philippine teacher education research.

In response to these gaps, this study aims to examine the relationship between reading comprehension dimensions and mathematical word-problem solving among first-year College of Education students at Isabela State University–Echague and develop a strategic course plan integrating literacy and numeracy instruction. Anchored on the Revised Phil-IRI framework and Newman's Error Analysis, the study seeks to provide an evidence-based instructional framework that will help future educators strengthen their comprehension, reasoning, mathematical representation, and problem-solving skills. Ultimately, the study hopes to contribute to the improvement of teacher preparation programs by promoting stronger integration of literacy and numeracy competencies essential for effective teaching and learning in the 21st century.

Drawing from successful frameworks such as the PISA 2022 and literacy-based mathematics interventions like the SQRQCQ strategy, the program plan intends to scaffold students' abilities to decode, comprehend, and solve mathematical word problems through systematic instruction (Aguila, 2020).

METHODS

Research Design

The study utilized descriptive-correlational research design. This design was appropriate for describing the current levels of students' reading comprehension dimensions and their ability to solve mathematics word problems, as well as for determining the relationship between these two variables.

The descriptive aspect of the study aimed to present the respondents' demographic profile, their levels of performance in each literary reading dimension - literal, inferential, critical, creative, and valuing/application - and their mathematical problem-solving performance categorized according to Newman's Error Analysis, including reading, comprehension, transformation, process skills, and encoding errors. Meanwhile, the correlational aspect examined the relationship between students' reading comprehension dimensions and their mathematical problem-solving performance.

This research design was appropriate for analyzing the interaction between literacy and numeracy competencies, providing empirical data that served as the foundation for developing a strategic course plan aimed at enhancing reading and problem-solving skills.

Respondents and Locale of the Study

The respondents of this study were the 76 first-year College of Education students who were identified by the Office of Student Affairs (OSA) as having below-average scores in the College Admission Test (CAT), specifically those who obtained a score of 36 out of 100, equivalent to 18% or below. These students were currently enrolled at Isabela State University – Echague Campus during the School Year 2025–2026. The respondents came from various programs offered by the College of Education, including Bachelor of Secondary Education (BSE) majors in Mathematics, English, and Filipino, Bachelor of Elementary Education, Bachelor of Early Childhood Education, Bachelor of Physical Education, and Bachelor of Technology and Livelihood Education.

Research Instrument

To gather the necessary data for this study, two research instruments were utilized. The first instrument, adapted for this study, assessed the reading comprehension dimensions using the short story "Waukewa's Eagle" (Bukham, 1912), following the approach applied by Rivero (2016). This instrument evaluated students' comprehension across five dimensions: literal, inferential, critical, creative, and valuing/application. Participants responded to questions based on the short story to measure their skills in interpreting and analyzing literary texts.

The second instrument, which assessed students' ability to solve mathematical word-problems, was adopted from the study of Agpalza (2019). This instrument was designed to evaluate students' problem-solving skills through a series of structured word problems that measure their ability to understand, interpret, and apply mathematical concepts effectively.

The respondents' scores in carrying out each step to solve the problems were assessed using a rubric based on Newman's Error Analysis.

Indicators	High Level (2)	Moderate Level (1)	Low Level (0)
Reading Errors	Identify the problem completely	Identify the problem incompletely	Did not answer/ Incorrect answer
Reading Comprehension Errors	Write down what is known or given value completely	Write down what is known or given value incompletely	Did not answer/ Incorrect answer
Transformation Errors	Write down the formula or mathematical model correctly	Write down the mathematical model, but do not complete it	Did not answer/ Incorrect answer
Process Skills Errors	Using a particular procedure correctly, the answer is correct	Using a particular procedure correctly, but the answer is wrong	Did not answer/ Incorrect answer
Encoding Errors	The conclusion is rendered right	The conclusion is given less precisely	Did not answer/ Incorrect answer

These instruments were chosen to ensure alignment with the study's objectives of examining the relationship between reading comprehension dimensions and mathematics word-problem-solving ability. Both instruments have been validated in previous studies, providing a reliable basis for collecting accurate and meaningful data for the present research.

Data Gathering Procedure and Analysis

Before conducting the study, the researcher secured approval from the Dean of the College of Education and the University Research Ethics Committee. In addition, a formal request was submitted to the Office of Student Affairs and Services to identify first-year

College of Education students who scored below average, who obtained a score of 36 out of 100, equivalent to 18% or below, during the College Admission Test (CAT) entrance examination for the School Year 2025–2026. After obtaining the necessary approvals, the selected students were oriented about the objectives and procedures of the study. Their participation was entirely voluntary, and informed consent was obtained prior to data collection to ensure ethical compliance.

The administration of the reading comprehension and mathematics word-problem solving tests took place in a controlled classroom environment to maintain uniform testing conditions. Upon completion of the tests, the responses were collected, scored, and analyzed. The data were processed using descriptive statistics, such as the mean and standard deviation, to determine the participants' performance levels. Inferential statistics, specifically the Pearson correlation and t-test, were then applied to identify the relationship between reading comprehension and mathematics word-problem-solving skills, as well as any significant differences when grouped according to relevant variables.

Ethical Considerations

The study strictly adhered to research ethics to ensure the protection, rights, and welfare of the respondents. Formal approval was obtained from the university authorities, and informed consent was secured from the selected students before they participated in the study. All participants were assured that their identities and responses remained confidential and were used solely for academic purposes. Participation in the study was entirely voluntary, and students were given the right to withdraw at any stage without facing any consequences. Furthermore, all data gathered were securely stored and destroyed after the completion of the study to maintain privacy and data integrity. By observing these ethical principles, the researcher ensured that the study upholds integrity, transparency, and respect for the participants at all stages of the research process.

RESULTS AND DISCUSSION

Table 1. Demographic profile of the respondents.

Profile	Frequency (n = 76)	Percentage
Sex		
Male	11	14.50
Female	65	85.50
Program		
Bachelor of Secondary Education Major in English/Filipino/Math	16	21.06
Bachelor of Physical Education	17	22.37
Bachelor of Technology and Livelihood Education	17	22.37
Bachelor of Early Childhood Education/ Bachelor of Elementary Education	26	34.21

A total of 76 respondents participated in the study, with a markedly higher proportion of females (85.50%) compared to males (14.50%). This distribution reflects the common trend in teacher education institutions where female students dominate enrollment, particularly in education-related programs. According to UNESCO (2021), teaching remains a female-dominated profession globally, especially at the basic education level. Similarly, David M. Sadker and Karen Zittleman (2009) noted that gender disparities in education programs often favor female participation due to socio-cultural expectations and career preferences.

In terms of academic program, the largest group of respondents came from the combined BEEd/BECED programs with 26 respondents (34.21%), followed by BPEd and BTLEd with equal representation of 17 respondents (22.37%) each. Meanwhile, respondents from the combined BSE English/Filipino/Mathematics programs accounted for 16 respondents (21.06%). This distribution indicates that the study largely represents students from generalist, early childhood, and skills-oriented teacher education programs.

The dominance of BEEd/BECED students is particularly relevant because elementary and early childhood education strongly emphasize foundational literacy and numeracy competencies. According to the National Association for the Education of Young Children (2020), early exposure to integrated language and mathematical experiences is essential in developing learners' cognitive and problem-solving abilities. Consequently, the high representation of BEEd/BECED students suggests that the respondents may be more familiar with foundational literacy and numeracy integration.

The inclusion of respondents from BSE English/Filipino/Mathematics programs also provides important insight into the relationship between language-oriented and mathematics-oriented disciplines and problem-solving performance. Anderson (2015) emphasized that domain-specific knowledge and cognitive skills significantly influence analytical and problem-solving performance. Likewise, Mayer (2002) explained that mathematical problem-solving is not purely computational but also heavily dependent on language comprehension and cognitive processing.

The participation of students from BPEd and BTLEd further broadens the scope of the study by representing learners from applied and skills-based programs. These disciplines often emphasize experiential and contextualized learning approaches, which may influence how students interpret and solve mathematical word problems.

The demographic profile suggests that the findings of the study largely reflect the perspectives and competencies of female students and those enrolled in foundational and practice-oriented education programs. This has important implications for the proposed strategic course plan. First, instructional interventions should adopt gender-responsive and inclusive approaches that recognize differences in learning engagement and comprehension patterns. Second, the course design should strengthen integrated literacy–numeracy instruction, particularly for future elementary and early childhood educators who are expected to simultaneously teach reading and mathematics.

Furthermore, the diversity of academic programs represented highlights the need for a flexible instructional framework that accommodates varying levels of literacy and mathematical proficiency. As emphasized by Loewenberg Ball (2008), teacher education

programs must strengthen both content knowledge and pedagogical content knowledge to prepare future educators for effective mathematics instruction. Thus, improving reading comprehension as a foundational skill may significantly enhance students' ability to interpret and solve mathematical word problems across disciplines.

Overall, the data underscores the importance of contextualizing the findings of the study based on the demographic characteristics of the respondents to ensure that the proposed strategic course plan remains responsive, inclusive, and relevant to the needs of future educators.

Table 2. Distribution of respondents with correct responses across reading comprehension dimensions.

Reading Dimension	Frequency	Percent
Literal Dimension		
1. Who is Waukewa?	66	86.84
2. Where did Waukewa find the eagle?	56	73.68
3. What injury did the eagle have when Waukewa found it?	67	88.16
4. What did Waukewa's father instruct him to do after the eagle recovered?	66	86.84
5. How did the eagle rescue Waukewa?	26	34.21
Inferential Dimension		
6. Why did Waukewa decide not to kill the eagle?	40	52.63
7. What emotion did the eagle show when it looked into Waukewa's eyes?	54	71.05
8. Why did Waukewa hide from the eagle after setting it free?	52	68.42
9. Why did Waukewa not notice that his canoe was caught in the rapids?	46	60.53
10. What can be inferred about Waukewa's character from his actions in the story?	69	90.79
Critical Dimension		
11. How does Waukewa show bravery in the story?	65	85.53
12. What does the eagle symbolize in the story?	69	90.79
13. Was Waukewa's decision to release the eagle right or wrong?	69	90.79
14. What lesson about courage can readers learn from Waukewa's actions during the storm?	63	82.89
15. How does the story show cause and effect between kindness and reward?	54	71.05
Creative Dimension		
16. If you could change the ending, how would you rewrite Waukewa's rescue?	46	60.53
17. Imagine Waukewa met the eagle again after many years. What might they say to each other?	28	36.84

18. Suppose Waukewa never found the eagle. How would that change the story's message?	42	55.26
19. Create a short title that best expresses the story's theme.	52	68.42
20. If this story were turned into a movie, which scene would you highlight and why?	52	68.42
Valuing/Application Dimension		
21. What moral lesson does the story teach?	65	85.53
22. How can you apply Waukewa's compassion in your life?	68	89.47
23. How does Waukewa's behavior reflect respect for nature?	62	81.58
24. In your opinion, what does true friendship mean as shown in the story?	66	86.84
25. Which action in the story shows that love and kindness are powerful?	68	89.47

For the inferential dimension, respondents showed moderate to high performance. The highest percentage (90.79%) was observed in identifying Waukewa's character traits based on his actions, indicating that most students could infer deeper meanings and personality attributes from the story. However, lower percentages were recorded in explaining why Waukewa decided not to kill the eagle (52.63%) and why he failed to notice the rapids (60.53%). These findings suggest that while students can conclude from context, some still experience difficulty interpreting implicit meanings and connecting events logically. Snow (2002) emphasized that inferential comprehension requires readers to integrate textual clues with prior knowledge to construct meaning beyond what is directly stated.

In the critical dimension, students demonstrated relatively strong evaluative and analytical skills. The majority correctly answered questions related to the symbolism of the eagle (90.79%) and the appropriateness of Waukewa's decision to release the eagle (90.79%). Similarly, a high percentage recognized how bravery and cause-and-effect relationships were presented in the story. These findings indicate that respondents are capable of evaluating situations, interpreting themes, and making judgments based on textual evidence. According to Paul and Elder (2014), critical reading enables learners to analyze ideas, assess evidence, and form reasoned judgments, which are essential higher-order thinking skills.

Results in the creative dimension showed comparatively lower performance. While 68.42% of respondents were able to create a suitable title for the story and identify scenes worth highlighting in a movie adaptation, only 36.84% successfully answered the question involving an imagined conversation between Waukewa and the eagle after many years. This suggests that students experience greater difficulty in generating imaginative responses and producing original ideas beyond the text. The findings imply that creative thinking remains one of the weaker areas of literary reading comprehension among respondents. This observation supports the argument of Robinson (2011), who noted that traditional educational practices often focus more on memorization and correctness than on creativity and imaginative thinking.

Lastly, the valuing/application dimension recorded consistently high percentages. The majority of respondents correctly identified the moral lesson of the story (85.53%), applied Waukewa's compassion to real-life situations (89.47%), and recognized how kindness and love were reflected in the narrative (89.47%). These results indicate that students are capable of relating literary themes and values to personal experiences and real-life contexts, reflecting strong affective and application-oriented comprehension skills. Krathwohl (2002) explained that the application and valuing domains reflect deeper learning, where learners internalize knowledge and apply it meaningfully in everyday life.

Overall, data demonstrates that students performed best in the critical and valuing/application dimensions, while the creative dimension emerged as the weakest area. The findings suggest that respondents are generally proficient in understanding, evaluating, and applying ideas from literary texts, but they require further enhancement in imaginative and creative thinking skills. These results provide important implications for the development of instructional strategies that strengthen higher-order and creative literacy competencies.

Table 3. Level of performance in the reading comprehension dimension.

Reading Dimension	SD	Mean	Level
Literal Dimension	1.07	3.71	Proficient
Inferential Dimension	1.27	3.45	Proficient
Critical Dimension	0.98	4.21	Excellent
Creative Dimension	1.28	2.93	Developing
Valuing/Application Dimension	0.99	4.36	Excellent

4.21 – 5.00 Excellent, 3.41 – 4.20 Proficient, 2.61 – 3.40 Developing, 1.81 – 2.60 Beginning, 1.00 – 1.80 Poor

The literal dimension obtained a mean of 3.71, interpreted as proficient. This suggests that students are capable of identifying explicit information, recalling details, and understanding the surface-level meaning of texts. This aligns with the findings of William Grabe (2009), who emphasized that literal comprehension forms the foundation of reading proficiency, as it enables readers to decode and recognize textual information accurately. However, while proficiency is evident, the result also implies that literal comprehension alone is insufficient for deeper academic tasks such as problem-solving.

Similarly, the inferential dimension (3.45), also interpreted as proficient, indicates that students can make logical interpretations and draw conclusions beyond the given text. According to Catherine Snow (2002), inferential comprehension is essential for constructing meaning, as it requires readers to connect prior knowledge with textual cues. The slightly lower mean compared to the literal dimension suggests that while students can infer meaning, this skill may not yet be fully developed for complex academic applications such as mathematical word-problem solving.

In contrast, the critical dimension yielded a higher mean of 4.21, classified as excellent. This indicates that students are highly capable of evaluating texts, making judgments, and analyzing arguments. This finding is supported by Richard Paul and Linda Elder (2014), who highlighted that critical reading enables learners to assess credibility, detect bias, and engage in reflective thinking. The strong performance in this dimension suggests that students possess the analytical skills necessary for higher-order learning tasks.

Likewise, the valuing/application dimension recorded the highest mean of 4.36, also interpreted as excellent. This implies that students are highly excellent in relating text to real-life situations and applying learned concepts in meaningful contexts. According to Krathwohl (2002), the valuing domain reflects the internalization of knowledge, where learners attach personal significance to what they read. This strength is particularly important for education students, as it reflects their ability to transfer knowledge into teaching practice.

However, the creative dimension obtained the lowest mean of 2.93, interpreted as developing. This indicates that students have relatively limited ability to generate new ideas, reinterpret texts, or engage in imaginative thinking based on reading materials. This finding is consistent with the observations of Ken Robinson (2011), who argued that traditional education systems often emphasize correctness over creativity, thereby limiting students' creative expression. The higher standard deviation in this dimension also suggests variability among students, indicating uneven development of creative skills.

The results highlight a balanced but uneven reading profile among respondents. While students demonstrate strong capabilities in critical and application-based reading, their relatively lower performance in inferential and creative dimensions may pose challenges in tasks that require deeper interpretation and innovative thinking—particularly in mathematical word-problem solving, where understanding implicit relationships and generating solution strategies are essential.

From a pedagogical perspective, these findings suggest the need to strengthen inferential and creative reading skills within the curriculum. As noted by Louise Rosenblatt (1978), reading is a transactional process where meaning is constructed through interaction between the reader and the text. Enhancing this interaction through open-ended questions, problem-based learning, and integrative literacy strategies can improve both comprehension and creativity.

Moreover, the strong performance in valuing/application and critical dimensions provides a solid foundation for designing a strategic course plan that leverages these strengths. Instructional strategies may include contextualized learning, reflective activities, and real-world problem-solving tasks that integrate reading and mathematics. According to Mayer (2002), meaningful learning occurs when learners actively integrate new information with prior knowledge—an approach highly relevant for improving performance in word problems.

In summary, the result suggests that while CED students possess strong evaluative and application skills, targeted interventions are needed to enhance their inferential and creative reading abilities. Addressing these gaps will be critical in improving their overall academic performance and preparing them as future educators capable of fostering higher-order thinking among learners.

Table 4. Performance in solving mathematics word problems based on Newman's error analysis.

Ability	SD	Mean	Level
Reading Errors	0.79	1.46	Poor
Comprehension Errors	1.31	1.62	Poor

Transformation Errors	0.00	1.00	Poor
Process Skills Errors	0.11	1.01	Poor
Encoding Errors	0.16	1.03	Poor

4.21 – 5.00 Excellent, 3.41 – 4.20 Proficient, 2.61 – 3.40 Developing, 1.81 – 2.60 Beginning, 1.00 – 1.80 Poor

Similarly, the comprehension errors recorded a mean of 1.62, also at a poor level. This indicates that even when students can read the words, they have difficulty understanding the meaning of the problem. Catherine Snow (2002) emphasized that comprehension involves constructing meaning from text, which is essential in translating word problems into mathematical representations. The relatively higher standard deviation suggests variability among students, with some demonstrating better comprehension than others.

The transformation errors yielded a mean of 1.00, indicating a uniformly poor performance across respondents. This stage involves converting a verbal problem into a mathematical equation or strategy. According to Richard E. Mayer (2002), transformation is a critical cognitive process that links language comprehension to problem-solving. The zero standard deviation implies that all respondents consistently struggled in this stage, highlighting a major gap in their ability to model problems mathematically.

In terms of process skills errors, the mean of 1.01 also reflects a poor level. This suggests that students have difficulty performing the necessary mathematical operations even after identifying the correct procedure. George Pólya (1945) emphasized that successful problem-solving requires not only understanding the problem but also executing appropriate strategies accurately. The low variability indicates that this difficulty is widespread among respondents.

Finally, the encoding errors obtained a mean of 1.03, interpreted as poor. Encoding refers to expressing the final answer correctly, including proper units and interpretation. According to Alan Schoenfeld (1985), students often fail to communicate their solutions effectively, even when they arrive at correct answers. This finding suggests that students struggle to finalize and present their solutions appropriately.

The results indicate a systemic weakness across all stages of mathematical problem-solving, with the most critical gaps observed in transformation and process skills. These findings strongly suggest that students' difficulties are not limited to computation but extend to language comprehension, cognitive processing, and solution representation.

From an instructional perspective, the poor performance in reading and comprehension errors highlights the need to integrate literacy-based approaches in mathematics instruction. As supported by Pugalee (2001), incorporating reading and writing strategies in mathematics enhances students' ability to understand and solve word problems.

The uniformly poor performance in transformation errors is particularly concerning, as it indicates that students are unable to bridge the gap between language and mathematics. This calls for explicit teaching of problem representation strategies, such as identifying key information, using diagrams, and formulating equations. According to Jerome Bruner (1966), learning is most effective when students are guided through structured representations that connect abstract concepts to concrete understanding.

Furthermore, the results suggest the need for a strategic course plan that emphasizes step-by-step problem-solving frameworks, such as scaffolding and guided practice. Strengthening students' metacognitive skills—planning, monitoring, and evaluating their

solutions−can also improve performance. Alan Schoenfeld (1985) highlighted that metacognition plays a crucial role in successful problem-solving.

Overall, the result underscores a critical gap in students' ability to solve mathematical word problems, despite their relatively strong reading performance in certain dimensions (Table 2). This disconnect highlights the urgent need for integrated literacy and numeracy instruction, which should be a central component of the proposed strategic course plan. Addressing these gaps will not only improve academic performance but also enhance the preparedness of future educators in teaching mathematics effectively.

Table 5. Relationship between the reading comprehension dimensions and performance in solving mathematics word problems.

Variables	Reading Error		Comprehension Error		Transformation Error		Process Skill Error		Encoding Error	
	r	sig	r	sig	r	sig	r	sig	r	sig
Literal	0.16^{ns}	0.17	0.21^{ns}	0.07	0.03^{ns}	0.79	-0.19^{ns}	0.11	-0.11^{ns}	0.34
Inferential	-0.12^{ns}	0.32	-0.23^{ns}	0.04	0.05^{ns}	0.66	0.14^{ns}	0.22	0.14^{ns}	0.24
Critical	-0.16^{ns}	0.17	-0.13^{ns}	0.25	-0.14^{ns}	0.22	-0.02^{ns}	0.83	0.05^{ns}	0.68
Creative	-0.11^{ns}	0.32	-0.02^{ns}	0.84	-0.18^{ns}	0.13	0.01^{ns}	0.96	-0.06^{ns}	0.63
Valuing/ Application	0.27*	0.02	0.25*	0.03	0.08^{ns}	0.52	0.08^{ns}	0.52	0.11^{ns}	0.35

* significant at 0.05

Across the literal, inferential, critical, and creative dimensions, the correlation coefficients (r-values) are generally low and non-significant. This suggests that students' ability to identify explicit information (literal), infer meaning (inferential), evaluate texts (critical), and generate new ideas (creative) does not directly translate into improved performance in solving mathematical word problems. For instance, literal comprehension shows weak and non-significant correlations with all error types (e.g., r = 0.16 for reading errors, p = 0.17), implying that basic reading ability alone is insufficient for successful mathematical problem-solving. This supports the argument of Mayer (2002) that solving word problems requires not only understanding text but also integrating cognitive processes such as representation and strategy selection.

Similarly, inferential comprehension, although essential for deeper understanding, shows no significant relationship with most error types. This finding contrasts with the assertion of Snow (2002), who emphasized that inferential skills are critical for meaning construction. The discrepancy may suggest that students are not effectively applying their inferential reading skills in mathematical contexts, pointing to a disconnect between literacy and numeracy domains.

The critical and creative dimensions also exhibit weak and non-significant correlations across all error types. Despite students demonstrating high performance in critical reading, as shown in Table 2, this skill does not significantly reduce errors in mathematical problem-solving. According to Schoenfeld (1985), problem-solving in mathematics requires domain-specific strategies and metacognitive regulation, which may not automatically develop through general reading proficiency alone.

A notable exception is observed in the valuing/application dimension, which shows a significant positive relationship with comprehension errors (r = 0.25, p = 0.03) and a near-significant relationship with reading errors (r = 0.27, p = 0.02). The positive correlation suggests

that higher levels of valuing/application are associated with increased comprehension errors, which may appear counterintuitive. However, this could indicate that students who actively relate texts to real-life contexts may overinterpret or misinterpret problem statements, leading to errors in understanding. This aligns with the view of Rosenblatt (1978), who posited that readers construct meaning based on personal experiences, which can sometimes lead to subjective misinterpretations.

The findings highlight a weak linkage between reading comprehension skills and mathematical word-problem performance, suggesting that proficiency in reading does not automatically ensure success in mathematics. This reinforces the idea that mathematical problem-solving is a multidimensional process involving language comprehension, conceptual understanding, and procedural knowledge.

From a curriculum perspective, the results underscore the need for explicit integration of literacy and numeracy instruction. As emphasized by Pugalee (2001), students benefit from structured opportunities to read, interpret, and communicate mathematical ideas. Teaching strategies such as guided problem analysis, the use of graphic organizers, and think-aloud protocols can help bridge the gap between reading and mathematics.

The significant relationship involving the valuing/application dimension suggests that contextualized learning approaches must be carefully guided to avoid misinterpretation. Instructors should scaffold students' ability to extract relevant information while minimizing cognitive overload. According to Sweller (1988), excessive cognitive load can hinder problem-solving performance, especially when learners struggle to process both linguistic and mathematical information simultaneously.

Furthermore, the overall lack of significant relationships indicates the need to strengthen transformation and representation skills, which serve as the bridge between reading and mathematical reasoning. Instructional models such as step-by-step problem-solving frameworks and metacognitive training should be incorporated into the proposed strategic course plan.

In summary, result reveals that while students possess varying levels of reading proficiency, these skills are not strongly associated with their ability to solve mathematical word problems. This highlights a critical instructional gap and supports the need for a targeted, integrative course design that explicitly connects reading comprehension processes with mathematical problem-solving strategies.

Table 6. Difference between the level of reading comprehension dimensions and the ability to solve mathematics word problems when grouped according to sex.

Literary Reading Dimension	Group Means				t	p-value
	Male		Female			
	Mean	Description	Mean	Description		
Literal	3.45	Proficient	3.75	Proficient	30.27**	<0.001
Inferential	3.18	Developing	3.49	Proficient	23.68**	<0.001
Critical	4.09	Proficient	4.23	Excellent	37.30**	<0.001
Creative	2.91	Beginning	2.94	Developing	20.00**	<0.001
Valuing/ Application	4.27	Excellent	4.37	Excellent	38.38**	<0.001

** highly significant at 0.01

The results show that female students consistently obtained higher mean scores than male students across all reading dimensions, and all differences are statistically significant ($p = 0.00$).

For the literal dimension, female students (3.75) outperformed male students (3.45). This indicates that female respondents demonstrate a stronger ability to identify explicit information and recall details from texts. This finding is consistent with large-scale assessments reported by OECD (2019), which consistently show that females outperform males in reading literacy across participating countries.

Similarly, in the inferential dimension, females (3.49) scored higher than males (3.18), suggesting better ability to interpret implicit meanings and draw conclusions. According to Moje (2015), female learners tend to engage more deeply with texts, enabling stronger inferential comprehension skills. This may explain their advantage in constructing meaning beyond surface-level understanding.

In the critical dimension, both groups performed at a high level, but females (4.23) slightly exceeded males (4.09). This indicates that female students demonstrate stronger evaluative and analytical reading skills. Paul and Elder (2014) emphasized that critical thinking develops through consistent engagement with texts, which may be more prevalent among female learners based on reading habits.

For the creative dimension, both groups showed relatively lower performance, with females (2.94) slightly higher than males (2.91). Although the difference is minimal, it remains statistically significant. This suggests that while creativity is generally underdeveloped among respondents, as seen in Table 2, female students still demonstrate a marginal advantage. Robinson (2011) noted that creativity is often underemphasized in formal education, which may explain the overall lower scores regardless of sex.

Lastly, in the valuing/application dimension, females (4.37) again outperformed males (4.27), indicating a stronger ability to relate reading materials to real-life contexts and apply learned concepts. According to Krathwohl (2002), the valuing domain reflects deeper internalization of knowledge, suggesting that female students may be more adept at connecting academic content to practical experiences.

The findings clearly indicate that sex is a significant factor influencing reading comprehension across all dimensions, with female students demonstrating consistently higher performance. This has important implications for both instruction and curriculum design. First, the results suggest the need for gender-responsive teaching strategies that support male students in improving their reading comprehension skills. According to UNESCO (2021), addressing gender disparities in literacy requires targeted interventions, such as differentiated instruction, the use of engaging reading materials, and the incorporation of active learning strategies that appeal to diverse learners.

Second, since reading comprehension is closely linked to success in mathematical word-problem solving, the lower performance of male students may contribute to greater difficulty in solving such problems. As emphasized by Mayer (2002), comprehension of problem statements is a critical step in mathematical problem-solving. Therefore, strengthening reading skills, particularly among male students, can improve their overall academic performance in mathematics.

Third, the consistently high performance of female students in higher-order dimensions (critical and valuing/application) suggests that instructional strategies can

leverage these strengths by incorporating collaborative learning, reflective activities, and contextualized problem-solving tasks. At the same time, efforts should be made to enhance the creative dimension, which remains the weakest area for both groups.

Finally, the significant differences across all dimensions highlight the importance of inclusive and adaptive course planning. The proposed strategic course plan should incorporate varied instructional approaches, such as scaffolding, differentiated tasks, and integrative literacy–numeracy activities, to ensure that both male and female students can develop balanced reading and problem-solving skills.

Overall, result demonstrates that female students have a significant advantage in all reading comprehension dimensions. This underscores the need for targeted interventions to support male learners while maintaining and enhancing the strengths of female students. Addressing these differences is essential in developing an effective and inclusive course plan that improves both reading comprehension and mathematical problem-solving abilities among CED students.

Table 14. Difference between the level of reading comprehension dimensions and the ability to solve mathematics word problems when grouped according to program.

Reading Comprehension Dimension	Group Means				F-value	p-value
	BSE Eng/Fil/Math	BPEd	BTLED	BEEd/ BECED		
Literal	3.67	3.76	3.44	3.88	0.57^{ns}	0.63
Inferential	3.89	2.71	3.94	3.32	3.96*	0.01
Critical	4.44	4.00	4.63	3.92	2.40^{ns}	0.08
Creative	2.61	2.88	3.50	2.84	1.51^{ns}	0.22
Valuing/ Application	4.50	4.53	4.19	4.24	0.56^{ns}	0.64

* Significant at 0.05

The literal dimension showed no statistically significant difference (F = 0.57, p = 0.63), although mean scores varied slightly across programs, ranging from 3.44 (BTLEd) to 3.88 (BEEd/BECED). These findings indicate that respondents generally possess comparable abilities in identifying explicit information and recalling details from the text, regardless of academic program. According to Grabe (2009), literal comprehension serves as the foundational stage of reading and is commonly developed through regular exposure to academic texts across disciplines.

In contrast, the inferential dimension revealed a statistically significant difference (F = 3.96, p = 0.01). Students from BSE English/Filipino/Mathematics obtained relatively higher mean scores (3.89), followed by BTLEd (3.94), while BPEd recorded the lowest mean (2.71). This finding suggests that students' ability to infer meaning, interpret implicit information, and establish relationships among ideas differ depending on academic exposure and program orientation. According to Snow (2002), inferential comprehension requires higher-order cognitive processing and deeper engagement with texts, skills that are often more emphasized in language-oriented and academically intensive programs.

The critical dimension showed no significant difference (F = 2.40, p = 0.08), although relatively high mean scores were observed across all programs, ranging from 3.92 to 4.63. This indicates that respondents generally possess strong evaluative and analytical reading skills

regardless of specialization. As emphasized by Paul and Elder (2014), critical thinking skills can be cultivated across disciplines through reflective and analytical learning experiences.

Similarly, the creative dimension did not show a statistically significant difference ($F = 1.51$, $p = 0.22$), although it recorded the lowest mean scores among all reading dimensions. BTLEd students obtained the highest mean (3.50), while BSE English/Filipino/Mathematics recorded the lowest (2.61). These findings suggest that creative thinking skills remain relatively underdeveloped across programs. Ken Robinson (2011) argued that traditional educational systems often emphasize correctness and standardization more than imagination and creativity, which may explain the generally lower creative reading performance.

Likewise, the valuing/application dimension revealed no significant difference ($F = 0.56$, $p = 0.64$), with consistently high mean scores across programs ranging from 4.19 to 4.53. This indicates that students, regardless of specialization, are generally capable of applying literary insights and values to real-life situations. According to Krathwohl (2002), application-oriented learning reflects deeper internalization of knowledge and values.

The findings indicate that the academic program has limited influence on most reading comprehension dimensions, except for inferential comprehension. This suggests that while foundational, critical, creative, and application-oriented reading skills are relatively comparable across programs, the ability to interpret implied meanings and construct deeper understanding varies depending on academic exposure and disciplinary emphasis.

The significant difference observed in the inferential dimension highlights the need to strengthen higher-order comprehension skills, particularly among students from programs with lower inferential performance, such as BPEd. Instructional interventions may include guided interpretation activities, reflective reading exercises, and contextual analysis tasks designed to improve students' ability to infer and synthesize information from texts.

Furthermore, the generally low performance observed in the creative dimension across programs suggests a broader curricular gap in fostering imaginative and innovative thinking. Incorporating open-ended tasks, interdisciplinary activities, and problem-based learning strategies may help enhance both creativity and problem-solving abilities. As emphasized by Schoenfeld (1985), effective problem-solving requires not only analytical reasoning but also creativity and flexible thinking.

From a course design perspective, the findings support the implementation of a differentiated yet integrative instructional framework that strengthens inferential comprehension and creative literacy skills while explicitly connecting literacy and numeracy instruction. Such an approach may help improve students' mathematical word-problem-solving abilities and overall academic performance.

Overall, the results demonstrate that reading comprehension dimensions are generally comparable across academic programs, with significant variation observed only in inferential comprehension. These findings reinforce the importance of designing a strategic and responsive course plan that develops higher-order reading skills and strengthens the integration of literacy and mathematical reasoning.

Proposed Strategic Program Plan

Integrated Literacy–Numeracy for Mathematical Word-Problem Solving

Course Information

Course Title: Integrated Literacy and Mathematical Problem-Solving
Credits: 3 units
Target Learners: CED students (all programs)
Duration: 16 weeks (1 semester)
Pre-requisite: Basic Mathematics and Academic Reading

Rationale

The proposed course, Integrated Literacy–Numeracy for Mathematical Word-Problem Solving, was developed in response to the findings of the study, which revealed important gaps between students' reading comprehension abilities and their mathematical problem-solving performance. Results showed that respondents demonstrated relatively strong performance in the critical and valuing/application dimensions of reading comprehension, while the creative dimension remained at a developing level, and inferential comprehension showed moderate performance. These findings suggest that although students are capable of evaluating ideas and applying concepts to real-life situations, they still experience difficulty in generating creative responses and interpreting implied meanings from texts.

Despite the generally adequate reading comprehension performance, respondents exhibited poor performance across all stages of Newman's Error Analysis, particularly in transformation, process skill, and encoding errors. This indicates that students struggle not only with computation but also with understanding mathematical language, translating verbal statements into mathematical representations, executing procedures, and communicating final answers correctly. The findings further revealed weak and mostly non-significant relationships between reading comprehension dimensions and mathematical problem-solving performance, suggesting that students are unable to effectively transfer reading comprehension skills into mathematical contexts.

Moreover, significant differences observed according to sex and selected reading dimensions by program imply the need for differentiated and scaffolded instructional approaches that accommodate varying learner characteristics and academic backgrounds. These findings highlight the importance of integrating literacy and numeracy instruction rather than teaching them as separate domains. According to Mayer (2002), mathematical problem-solving requires the integration of language comprehension, cognitive processing, and procedural reasoning. Similarly, Pólya (1945) emphasized that successful problem-solving begins with understanding and interpreting the problem before applying solution strategies.

The proposed course aims to explicitly bridge literacy and numeracy by developing students' reading comprehension, inferential reasoning, problem representation, procedural fluency, and mathematical communication skills through structured and staged instruction. It is expected to strengthen students' ability to interpret mathematical word problems and apply higher-order thinking skills necessary for effective problem-solving and future teaching practice.

General Objective

To develop students' integrated literacy–numeracy competence by strengthening reading comprehension dimensions and systematically reducing errors in mathematical word-problem solving.

Specific Learning Outcomes

1. Demonstrate proficiency across literal, inferential, critical, creative, and valuing/application reading dimensions.
2. Accurately complete all stages of Newman's Error Analysis.
3. Translate word problems into correct mathematical representations.
4. Apply appropriate solution strategies and justify answers clearly.
5. Design literacy-integrated math tasks for classroom use.

Design Framework

The course adopts an integrated learning flow - Text → Meaning → Representation → Procedure → Answer → Reflection, to systematically guide students from reading comprehension to accurate mathematical problem-solving. This framework ensures that learners first construct meaning from the text, translate it into appropriate representations, apply correct procedures, and arrive at solutions, followed by reflective thinking to evaluate their process and answers. It is anchored on the principles of Pólya (1945), emphasizing the stages of understanding, planning, solving, and checking; Mayer (2002), which highlights meaningful learning through active cognitive processing and integration of knowledge; and Schoenfeld (1985), which underscores the role of metacognition in monitoring, regulating, and improving problem-solving performance.

Modules and Intervention Focus

Module	Title	Targets	Weaknesses	Key Skills	Strategies	Outputs
Module 1	Reading Accuracy and Vocabulary in Mathematics	Reading Errors	Poor reading	• Identifying keywords, symbols, and units • Literal comprehension	• Think-aloud reading • Math vocabulary drills • Sentence unpacking	• Annotated word problems • Vocabulary logs
Module 2	Meaning Construction and Interpretation	Comprehension Errors	Poor comprehension	• Inferential reading • Identifying given/required	• Graphic organizers (problem maps) • Question prompts: *What is asked? What is given?*	• Problem paraphrasing sheets • Structured interpretation template
Module 3	Mathematical Representation and Modeling	Transformation Errors (Critical Gap)	Uniform poor performance	• Converting text to equations/models • Selecting solution strategies	• Schema-based instruction • Use of diagrams (bar model, flowchart)	• Equation-building exercises • Model-based solutions

Module 4	Procedural Fluency and Strategy Application	Process Skills Errors		• Computation accuracy • Strategy selection	• Guided practice • Error analysis workshops • Multiple-solution methods	• Solved problem sets with explanations • Peer-reviewed solutions
Module 5	Mathematical Communication	Encoding Errors		• Writing final answers clearly • Interpreting results with units	• Math journaling • Structured answer formats	• Written solution reports • Reflection journals
Module 6	Creativity and Real-Life Application	Creative & Application Dimensions (weakest reading area)		• Problem posing • Contextualization	• Real-world tasks • Interdisciplinary projects	• Student-created word problems • Community-based math tasks

Differentiated Instruction Plan

The differentiated instruction plan was developed based on the findings of the study, particularly the significant differences observed according to sex and selected reading comprehension dimensions across academic programs. The plan recognizes that students possess varying strengths, learning styles, and academic needs; therefore, instructional strategies must be responsive, inclusive, and learner-centered.

In terms of sex, the findings suggest the need to provide additional support for male students, particularly through structured scaffolding and guided learning activities. Instructional approaches should incorporate active, visual, and problem-based tasks that encourage engagement, participation, and hands-on learning experiences. The use of graphic organizers, visual representations, collaborative problem-solving, and contextualized activities may help strengthen comprehension and mathematical reasoning skills. According to Richard E. Mayer (2002), learners benefit from instructional materials that combine verbal and visual processing to improve understanding and retention.

With respect to academic programs, differentiated strategies should also be implemented according to students' disciplinary needs and strengths. For students in the BSE English and Filipino programs, instruction should focus on strengthening the transformation of textual information into mathematical representations and equations. Although these students may demonstrate strong language comprehension, they may require additional support in applying literacy skills within mathematical contexts.

For BSE Mathematics students, instructional activities should emphasize creative thinking and language interpretation. While mathematics students may possess stronger procedural and analytical skills, they may benefit from activities that develop imaginative reasoning, contextual interpretation, and communication skills in solving word problems.

Students from BPEd, BTLEd, and BEEd programs should receive greater reinforcement in inferential comprehension and problem interpretation. Instructional interventions may include guided reading strategies, contextual analysis, and scaffolded problem-solving tasks

that help students identify relationships, interpret implicit meanings, and connect textual information logically.

Meanwhile, for BECED students, instruction should focus on strengthening foundational literacy–numeracy integration. Since early childhood education emphasizes the teaching of both reading and mathematics at foundational levels, activities should highlight the connection between language comprehension, numeracy concepts, and problem-solving skills through contextualized and developmentally appropriate learning experiences.

Overall, the differentiated instruction plan aims to provide targeted and responsive learning experiences that address students' diverse needs while strengthening the integration of literacy and numeracy skills necessary for effective mathematical word-problem solving.

Teaching-Learning Strategies

The course will use different learner-centered teaching strategies to improve students' reading comprehension and mathematical word-problem-solving skills. Problem-Based Learning (PBL) will expose students to real-life and meaningful problems that encourage critical thinking and application of knowledge. The Think-Aloud Strategy will help students understand how to analyze and solve problems by listening to teachers explain their thinking process step by step.

The course will also apply Scaffolded Instruction, where teachers provide guidance and support until students become confident in solving problems independently. Collaborative Learning will allow students to work in groups, share ideas, and learn from one another while solving mathematical tasks. In addition, Metacognitive Reflection will encourage students to reflect on their thinking processes, identify mistakes, and improve their problem-solving strategies. These approaches aim to strengthen students' literacy and numeracy skills and help them become more effective problem solvers.

Assessment Plan

The course will use diagnostic, formative, and summative assessments to monitor students' progress in reading comprehension and mathematical word-problem solving. For the diagnostic assessment, a pre-test based on Newman's Error Analysis will be administered to identify students' strengths and weaknesses in problem-solving.

For the formative assessment, students will complete reading logs, problem-solving journals, and quizzes after each module to continuously monitor their understanding and skill development. These activities will help teachers provide immediate feedback and support.

For the summative assessment, students will take a post-test using the Newman framework to measure improvement in problem-solving skills. They will also submit a portfolio containing their compiled outputs and complete a performance task where they solve and create mathematical word problems to demonstrate their understanding and application of literacy and numeracy skills.

Monitoring and Evaluation

The effectiveness of the course will be monitored and evaluated through continuous assessment of students' literacy and mathematical problem-solving performance. Reduction in students' problem-solving errors will be measured using Newman's Error Analysis checklist administered during the pre-test and post-test. Improvement in reading comprehension skills will be assessed monthly using a reading rubric to monitor students' progress across the

different reading dimensions. Meanwhile, students' ability to transfer reading comprehension skills into mathematical problem-solving will be evaluated through performance tasks administered during the midterm and final periods. These monitoring tools will help determine the effectiveness of the course and identify areas needing further instructional support.

Expected Outcomes

The course is expected to improve students' inferential and creative reading skills, enabling them to better interpret, analyze, and generate ideas from texts. It also aims to reduce students' errors across all stages of Newman's Error Analysis, particularly in comprehension, transformation, process skills, and encoding. Through integrated instruction, students are expected to develop stronger connections between literacy and numeracy, allowing them to apply reading comprehension skills effectively in solving mathematical word problems. Ultimately, the course seeks to better prepare future teachers by strengthening their problem-solving abilities, critical thinking, and instructional readiness in both reading and mathematics.

CONCLUSION AND FUTURE WORKS

Based on the findings of the study, it can be concluded that respondents generally possess adequate to high levels of literary reading comprehension, particularly in the critical and valuing/application dimensions. However, creative reading skills remain underdeveloped, indicating limited ability to generate imaginative and original responses from texts.

Despite students' relatively strong reading comprehension performance, respondents demonstrated poor ability in solving mathematical word problems across all stages of Newman's Error Analysis. The findings indicate that students experience serious difficulties in understanding mathematical situations, transforming verbal information into mathematical representations, applying solution procedures, and communicating final answers.

The weak and mostly non-significant relationships between reading comprehension dimensions and mathematical problem-solving performance suggest that reading comprehension skills are not automatically transferred to mathematical contexts.

Furthermore, female students demonstrated significantly higher performance than male students across all reading comprehension dimensions, indicating that sex influences reading comprehension performance. In contrast, academic programs showed limited influence on most reading dimensions, except inferential comprehension, which differed significantly across programs.

Overall, the study concludes that there is a critical need for integrated literacy–numeracy instruction that explicitly connects reading comprehension processes with mathematical problem-solving strategies. Strengthening inferential and creative reading skills, mathematical representation, and metacognitive problem-solving strategies is essential in improving students' academic performance and preparing future educators for effective teaching.

Based on the findings and conclusions of the study, the following recommendations are offered:

1. Teacher education institutions should develop and implement an integrated literacy–numeracy course that explicitly connects reading comprehension and mathematical problem-solving processes. The course should incorporate structured frameworks such as Newman's Error Analysis to systematically address students' difficulties.

2. Mathematics instructors should adopt literacy-based instructional strategies such as think-aloud protocols, guided problem analysis, graphic organizers, contextualized learning activities, and scaffolded translation of verbal statements into mathematical equations.
3. Greater emphasis should be placed on strengthening inferential and creative reading skills, particularly through open-ended questions, reflective activities, collaborative learning, and problem-posing tasks that promote imagination and higher-order thinking.
4. Instruction should focus on improving transformation skills, since this emerged as the most critical weakness among respondents. Students should be trained to identify relevant information, formulate equations, interpret relationships, and use visual representations such as diagrams and flowcharts.
5. Teachers should employ differentiated and gender-responsive instructional approaches to address variations in students' reading comprehension and learning needs. Additional support and scaffolding should be provided to students with lower literacy proficiency.
6. Diagnostic and formative assessments based on Newman's framework should be regularly administered to monitor students' progress and identify specific areas requiring intervention.
7. Future researchers may conduct longitudinal and intervention-based studies to further examine the relationship between reading comprehension and mathematical problem-solving and to determine the long-term effects of integrated literacy–numeracy instruction. Future studies may also focus on validating and evaluating the effectiveness of the proposed strategic course plan in improving students' reading and mathematical problem-solving competencies. Moreover, researchers are encouraged to involve larger and more balanced samples across different academic disciplines and institutions to strengthen the generalizability, reliability, and consistency of the findings.

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CONFLICT OF INTEREST

The researcher declares that there is no conflict of interest regarding the conduct, implementation, analysis, and publication of this study. No financial, personal, professional, or institutional relationships influenced the research process, interpretation of data, or presentation of findings. The study was carried out objectively and independently to ensure the integrity, credibility, and reliability of the research outcomes. Furthermore, the authors confirm that no external entity provided support that could improperly influence the results or conclusions of this research.

DECLARATION OF AI USE

All concepts, interpretations, data analysis, conclusions, and final content of the study remain the original work and responsibility of the researchers. The researchers carefully reviewed, edited, and validated all AI-assisted outputs to ensure accuracy, academic integrity, and compliance with institutional research standards. AI tools were not used to fabricate data, generate results, or replace critical scholarly judgment in the conduct of the research.

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