Academic Recovery and Accessible Learning (Aral) Reading Program on Learners' Numeracy and Problem-Solving Skills

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ABSTRACT

This study examined the effect of the ARAL Reading Program on the learners' numeracy and problem-solving skills. A one-group pre-experimental research design was utilized with 15 ARAL learners. Pretest and posttest scores were gathered and analyzed using mean, standard deviation, paired samples t-test, and Pearson r.

Findings revealed a significant improvement in numeracy skills, with a mean increasing from 9.73 (Did not meet expectations) to 18.20 (Very Satisfactory). Similarly, problem-solving skills improved from a mean of 2.07 (Did not meet expectations) to 5.47 (Satisfactory). Both improvements were statistically significant at $p<0.01$, indicating the program's effectiveness. Moreover, Pearson r showed no relationship between numeracy and problem-solving skills in the pretest ($r = -0.202$, $p = 0.470$). However, a significant strong negative correlation was found in the posttest ($r = -0.779$, $p = 0.001$), suggesting an inverse relationship after the intervention.

Although this study had small sample size (N=15), it concludes that the ARAL Reading Program significantly enhances both numeracy and problem-solving skills. However, the unexpected negative correlation implies that improvement in numeracy does not necessarily translate to improved problem-solving skills. This suggests the need for more integrated instructional approaches that directly connect numeracy skills with problem-solving skills. It is also important to note that the outcomes may be influenced by other external or confounding variables like comprehension, thus, a call for another study.

Keywords: ARAL Reading Program, numeracy skills, problem-solving skills.

INTRODUCTION

Background of the Study

The improvement of numeracy and problem-solving skills is essential for academic achievement and continuous education, especially in STEM (Science, Technology, Engineering, and Mathematics) fields. The 2018 Programme for International Student Assessment (PISA) indicated that Filipino students aged 15 scored noticeably lower than the global average in mathematics and problem-solving, underscoring systemic challenges in basic numeracy (OECD, 2019). These shortcomings are exacerbated in the aftermath of the pandemic, where extended school closures and transitions to online learning have had a disproportionate impact on marginalized students, further widening existing skill gaps (UNESCO, 2021). In response, the Philippine Department of Education (DepEd) initiated the Academic Recovery and Accessible Learning (ARAL) Reading Program, a remedial effort aimed at literacy recovery. Nevertheless, its capacity to improve numeracy and problem-solving abilities—by using contextually relevant reading materials that incorporate mathematical concepts—remains inadequately explored.

The ARAL Reading Program, created to tackle learning losses caused by the pandemic, focuses on foundational literacy through organized, culturally relevant modules (Department of Education, 2021). Although its main emphasis is on reading comprehension, the program also includes numeracy aspects by integrating mathematical problems into narrative texts, such as figuring out quantities in stories or interpreting data from informational pieces. This interdisciplinary strategy is supported by global evidence indicating that combined literacy and numeracy interventions enhance both skill areas, particularly in low-resource environments (Grotlüschen, 2020). For instance, a study conducted in Southeast Asia revealed that reading materials that included mathematics problems significantly improved problem-solving skills by 22% among Grade 7 students (SEAMEO, 2020). Even with these encouraging results, the ARAL program's framework does not place a clear emphasis on numeracy outcomes, which raises concerns about its effectiveness in addressing gaps in mathematical proficiency.

Worldwide, the link between literacy and numeracy is well-established. Proficient reading abilities allow students to understand mathematical word problems, interpret data, and utilize logical reasoning—an essential connection for effective problem-solving skills (Fuchs, Fuchs, & Malone, 2016). In the Philippines, however, literacy-centered initiatives such as ARAL often neglect this important relationship. A report from DepEd in 2022 revealed that 65% of Grade 7 students have difficulty converting textual information into mathematical expressions, highlighting the need for strategies that simultaneously enhance reading and numerical skills (Department of Education, 2022). The ARAL program's design, which emphasizes decoding and fluency, may unintentionally overlook the critical analytical skills necessary for tackling complex problems, thereby limiting its effectiveness in addressing multifaceted learning challenges.

Theoretical frameworks such as Vygotsky's sociocultural theory emphasize the role of scaffolded, context-rich learning environments in skill development (Vygotsky, 1978). Applied to ARAL, this suggests that integrating numeracy challenges within culturally resonant reading materials could enhance cognitive engagement. For instance, a module on traditional Filipino market practices might include exercises on budgeting or unit conversion, fostering real-world problem-solving skills. Such approaches align with DepEd's mandate for contextualized curricula. To advance numeracy outcomes, educators and policymakers should systematically implement and rigorously evaluate these practices in ARAL programs.

Despite the program's nationwide rollout, empirical studies on ARAL's effectiveness remain scarce, particularly regarding its secondary benefits for numeracy. Existing evaluations focus predominantly on literacy metrics, such as reading speed and comprehension levels, while neglecting the interdisciplinary potential of this field (SEAMEO, 2020). This gap is critical in the Philippine context, where 82% of the students lack proficiency in basic arithmetic operations (World Bank, 2023). Without a rigorous assessment of ARAL's role in numeracy development, policymakers risk perpetuating fragmented approaches to learning recovery.

This study sought to address this gap by evaluating the numeracy and problem-solving skills of students enrolled in the ARAL Reading Program. By analyzing pre-intervention and post-intervention performances, as well as the design of ARAL's modules, the research aimed to determine whether integrated literacy-numeracy strategies can enhance numeracy and problem-solving skills. The findings will inform DepEd's program refinement and contribute to global discourse on holistic, post-pandemic educational recovery.

Statement of the Problem

This study utilized the Academic Recovery and Accessible Learning (ARAL) Reading Program to enhance the numeracy skills and problem–solving skills of the ARAL learners at Bukidnon National School of Home Industries in the academic year 2025 -2026.

Specifically, it aimed to answer the following questions:

1. What is the numeracy skills level of the ARAL learners before and after exposure to the ARAL Reading Program?

2. What is the level of problem-solving skills of the ARAL learners before and after exposure to the ARAL Reading Program?
3. Is there a significant difference on the numeracy skills of the ARAL learners before and after exposure to the ARAL Reading Program?
4. Is there a significant difference on the problem-solving skills of the ARAL learners before and after exposure to the ARAL Reading Program?
5. Is there a relationship between the numeracy and problem-solving skills of the ARAL learners when exposed to the ARAL Reading Program?

Objectives of the Study

The primary purpose of this study was to improve the numeracy skills and problem–solving skills of students at Bukidnon National School of Home Industries in the school year 2025 – 2026. This study used the Academic Recovery and Accessible Learning (ARAL) Reading Program.

Specifically, it sought to:

1. ascertain the numeracy skills level of the ARAL learners before and after exposure to the ARAL Reading Program;
2. identify the level of problem-solving skills of the ARAL learners before and after exposure to the ARAL Reading Program;
3. determine if there is a significant difference in the numeracy skills of the ARAL learners before and after exposure to the ARAL Reading Program;
4. test if there is a significant difference in the problem-solving skills of the ARAL learners before and after exposure to the ARAL Reading Program; and
5. investigate if there is a relationship between the numeracy and problem-solving skills of the ARAL learners when exposed to the ARAL Reading Program.

Significance of the Study

The study's findings could be used to enhance mathematics instruction using the Academic Recovery and Accessible Learning (ARAL) Reading Program. This might be valuable and instructive for the educational community.

The information from this study might provide the curriculum designers with a foundation for creating or evaluating mathematical skills and crafting lesson plans that incorporate the appropriate ARAL reading for mathematics operations.

In addition, this study might provide school administrators and the teacher in charge of workload with insights into how much time should be allocated for mathematics and ARAL reading classes.

By developing contextualized instructional reading resources, mathematics teachers might gain awareness and benefit from strengthening their pedagogies and turning mathematical instruction into an interactive experience. This might also assist teachers in designing ARAL reading in mathematics lesson plans to improve numeracy skills and problem–solving skills in the classroom. Moreover, the findings of this study might inspire pre–service and novice teachers as they will devise their daily lesson plans to use ARAL reading mathematics lesson plans to improve students' numeracy skills and problem–solving skills.

Since reading is essential for acquiring 21st-century skills, this research might suggest ways to improve students' numeracy skills and problem–solving skills over time.

Furthermore, future scholars might learn more about integrating ARAL reading into mathematics lesson plans. This might guide them in developing new ideas, approaches, and instructional methods for the classroom, paving the way for further action research opportunities.

Scope and Delimitations of the Study

This research is focused on the Academic Recovery and Accessible Learning (ARAL) Reading Program concerning students' numeracy skills and problem–solving skills. The Bukidnon National School of Home Industries, Junior High School in Maramag, Bukidnon, was selected as the location for this study. The participants were the 15 ARAL learners identified as struggling readers based on School-based Phil-IRI results 2025-2026. From second quarter to fourth quarter of the school year 2025 – 2026, the ARAL Reading Program was implemented.

The topics include Numbers and Number Sense. These topics were aligned to the Matatag Curriculum Guide for Mathematics. Learners' numeracy skills were measured using a teacher–made numeracy test tool. The learners' problem–solving skills were evaluated using a teacher–made problem–solving skills test tool.

Definition of Terms

To thoroughly comprehend the research, the following concepts were defined theoretically and operationally and organized alphabetically.

ARAL Learners means Academic Recovery and Accessible Learning Learners. They are operationally defined as struggling readers who need help in reading and comprehension. In this study, these are learners whose reading skills based on Phil-IRI report, fell under the categories non-readers or frustration readers.

ARAL Reading Program means Academic Recovery and Accessible Learning Reading Program. It is the Philippine Department of Education's national learning recovery program designed to mitigate learning losses caused by the COVID-19 pandemic and other disruptions. It is focused on literacy and numeracy to help students catch up and accelerate their learning through targeted interventions and adjustments to the curriculum. In this study, this program was used as an intervention for ARAL learners pre-identified as struggling readers.

Numeracy skills are the foundational building blocks upon which students construct their mathematical competencies across different grade levels. Proficiency in numeracy skills includes the four fundamental operations, namely addition, subtraction, multiplication, and division. These skills are the bedrock of mathematical literacy, enabling students to tackle more advanced mathematical concepts and applications with confidence. The teacher created a pre–test and post–test.

Problem–Solving Skills pertain to students' capacity to resolve real–world problems. The teacher created a pre–test and post–test.

THEORETICAL FRAMEWORK

This chapter included a review of related literature and studies, the conceptual framework, research paradigm, and research hypothesis.

Review of Related Literature and Studies

Academic Recovery and Accessible Learning (ARAL) Reading Program

The Philippine Department of Education developed the DepEd Academic Recovery and Accessible Learning (ARAL) Reading Program as its national learning recovery initiative to address learning losses from educational

disruptions. The program centers on literacy and numeracy, helping students catch up and accelerate their learning with targeted interventions and curriculum adjustments.

Key Components of the ARAL Reading Program

1. Streamline the curriculum to emphasize essential learning competencies.
   a. Integrating socio-emotional learning (SEL) to support students' well-being and readiness to learn.
2. Targeted Interventions:
   a. Providing individualized or small-group support for students who are lagging behind.
   b. Using diagnostic assessments to identify specific learning gaps and tailor instruction accordingly.
3. Professional Development for Teachers:
   a. Training teachers on effective strategies for learning recovery and acceleration.
   b. Providing resources and support for implementing the ARAL reading program in the classroom.
4. Community and Parent Involvement:
   a. Engaging parents and the community in supporting students' learning at home and in school.
   b. Raising awareness about the importance of learning recovery and the ARAL reading program.

Primary Objectives of the DepEd ARAL Reading Program

1. Recovering Learning Losses: Addressing the learning gaps caused by school closures and other disruptions.
2. Improving Literacy and Numeracy: Enhancing students' foundational skills in reading, writing, and arithmetic.
3. Promoting Socio-Emotional Well-being: Supporting students' mental health and social-emotional development.
4. Building System Resilience: Strengthening the education system's ability to respond to future crises and ensure continuity of learning.

Numeracy Skills

Numeracy skills are the foundational building blocks upon which students construct their mathematical competencies across different grade levels. Proficiency in numeracy skills, including the four fundamental operations, namely, addition, subtraction, multiplication, and division, is paramount. These skills are the bedrock of mathematical literacy, enabling students to tackle more advanced mathematical concepts and applications with confidence.

Numeracy skills are critical for mathematical fluency. Without a solid grasp of numeracy, students may struggle to comprehend more complex mathematical concepts, making it difficult to progress in their mathematical journey.

In Malbug National High School, grade seven mathematics teachers conducted an entrance examination two weeks before the start of classes to assess and diagnose the prerequisite skills of incoming students. The aim was to equip them adequately for the challenges of their upcoming grade level. As part of their comprehensive examination, students faced a 40–item numeracy test. The outcomes revealed a notable trend among the 161 grade 7 students. A substantial majority, consisting of 124 students, successfully passed the test, earning them the classification of “numerates”. This designation implies their proficiency in fundamental mathematical operations, setting a positive tone for their academic journey. However, a smaller fraction, comprising 37 students, was categorized as “non-numerates” due to their inability to pass the numeracy test. This classification suggests a deficiency in basic mathematical skills, highlighting the need for substantial improvement in this foundational aspect of their education.

The prevalence of non-numeric skills among the students raises questions about the interventions in mathematics education. It is noted that many students struggle in mathematics due to the reliance on memorization without a deeper understanding of the underlying concepts. Mere rote learning of mathematical facts and procedures often falls short of fostering numeracy skills.

In the study of Wardono (2018), numeracy skills are associated with mathematics literacy. It is a wide range of knowledge, understanding, and appreciation of what mathematics can accomplish, rather than implying knowledge of various branches of mathematics or complex mathematical formulas. In the Journal of Physics: Conference Series, mathematics literacy is the ability to understand and apply basic knowledge of mathematics in everyday life. This entails comprehending and combining mathematical core concepts, terminologies, facts, and skills in response to the external situations' requirements of the real world.

However, despite the different advantages of learning mathematics, many, if not all, students find it extremely difficult to learn mathematics. This was supported by Garoof & Karukkan (2015), which states that 88% of students in a 51–person random sample dislike mathematics due to difficulty in understanding the subject matter, and teacher or instructional-related factors. This, on the other hand, contributes to a poor level of mathematics literacy among students across the country. Filipino students are not exempt from this poor level of numerical competence. In fact, the PISA 2018 indicated that the Philippines placed 78 out of 79 participating nations worldwide. The Philippines scored 353 in Mathematics, which means below the average of participating OECD countries. This merely implies that the Filipino students' mathematics abilities are really poor. However, students' attitude towards mathematics, poor study habits, or the excessive utilization of technologies might be the explanation for their continued underperformance in mathematics. To address this pressing concern, the Department of Education has been undertaking several interventions to increase the Filipino students' mathematics literacy who are having difficulty learning mathematics concepts. In the previous school year, the Division of Bukidnon had implemented the BUKMATHIX program to help increase the scores of Bukidnon learners in the National Achievement Test. In school year 2022 – 2023, the Northern Mindanao overall Mathematics mean percentage scores are the following: problem–solving is 36.82, information literacy is 36.87, and critical thinking is 35.96. All of these fell under low proficiency levels. At this level, students can only identify strategies in solving problems, differentiate, and organize information. Moreover, the Bukidnon National School of Home Industries Grade 10 students' overall Mathematics mean percentage scores in NAT 2022 – 2023 were the following: problem–solving is 28.96, information literacy is 32.19, and critical thinking is 33.99. These all fell under low proficient levels (25 – 49). This means that despite the full implementation of the BUKMATHIX program, there is still a need to further enhance the interventions to improve the mathematics literacy of the learners. Hence, the realization of the ARAL reading program is implemented.

In the study of Legal & Legal (2024), the numeracy skills of the grade seven students were classified as Transforming, Developing, Emerging, Anchoring, and Needs Major Support. It was measured through the Malbug NHS Numeracy Assessment Tool (MalNAT).

In their study, it was found that the pre-test numeracy skills scores of the grade 7 learners before using remedial activities in teaching numeracy were 33.17, which fell under the "Needs Major Support" category. Specifically, there are no students who fell into the "Transforming" and "Developing" categories. However, there were 18.18% were classified as "Emerging" with scores of 48 to 50 over 60. Moreover, there were 30.30% among the students that belonged to the "Anchoring" category with scores 45 to 47, over 60 signifying they struggled with basic numeracy concepts. These students faced challenges when solving problems, especially those involving critical or more significant numbers. They needed specific interventions and extra support to build a solid foundation in fundamental operations. A staggering 60.61% of the students fell in the category "Needs Major Support," with scores ranging from 0 to 44. This group of students had a limited grasp of the fundamental operations.

Additionally, it was found that the post-test numeracy skills scores of grade 7 learners after using remedial activities in teaching numeracy are 56.03, which fell in the "Transforming" category. Hence, the intervention enhanced the students' numeracy skills. There were 87.88% of the 36 grade seven students initially identified as non-numerates who demonstrated substantial progress. Their scores were 54 to 60, meaning "Transforming".

The goal is that the students will become highly capable of solving problems, managing and communicating accurate information, and analyzing and evaluating data to create or formulate ideas. At present, the division is implementing another program named ARAL to further increase the mathematics performance scores in standardized tests.

Interventions Used on Numeracy Skills

In the previous school years, the Department of Education – Division of Bukidnon implemented the BUKMATHIX program to address the decreasing mathematics scores in the National Achievement Test. One of the focuses of the program is on improving the numeracy skills of the students. All mathematics teachers, both Junior and Senior High School, are required to give remediation classes and adapt and utilize innovations, interventions, and pedagogies that will help increase students' numeracy skills. Moreover, non-mathematics major teachers were required to integrate numeracy in all their classes. The implementation of numeracy in their classes must be visible from their submitted lesson plans with annotations. Examples of this are students focusing on analyzing data related to population density in different regions of the Philippines; creating bar graphs using data retrieved from reliable websites, emphasizing the importance of understanding population density and its effects on resource distribution.

Layug (2021) examined interventions used by teachers to improve numeracy skills among Grade 7 students at Baguio City National High School (BCNHS). The interventions included conferences with parents, one – on – one tutorials, redoing activities, home visits, supplementary materials, and remedial classes. The effectiveness of these interventions ranged from moderately effective (2.51 to 3.25) to highly effective (3.26 – 4.00), helping at-risk learners succeed in mathematics (Layug, 2021).

Her data revealed that 10 out of 10 teachers used the first intervention: conferences with parents and students to help students who were performing poorly in mathematics. This means that all of the teachers decided to involve parents in order to help their child with their difficulties in mathematics. She cited Seagreaves (2009) to support her claims that parent or student – teacher conferences provide benefits such as information sharing between teachers and parents to assist students in academic and social development, establishing a good relationship between the home and school, and facilitating face – to – face sessions in which teachers may clarify the meaning of grades and clear up any potential miscommunications. The students will value education more if their parents are actively involved in their children's academics. She added that students will tend to finish homework and other assignments more diligently.

Her data also showed that second intervention most commonly employed by the teachers is one – on – one tutorials and redo activities. This means that teachers adapt one – on – one tutorials to students' specific needs in order to help them overcome their difficulties in the topic. Teachers also provide students the opportunity to recover from their low scores by asking them to redo their low–scoring activities. She cited Cutler (2019) that if the process is carefully handled, giving students the opportunity to redo examinations and assignments can help them continue to strive for mastery.

The third most commonly employed intervention is home visitation, with 7 out of 10 teachers. This was followed by employing supplemental activities and materials, as well as lessening the number of items in an activity, with 6 out of 10 teachers. However, the least prevalent intervention is remedial lessons, with 5 out of 10 teachers.

Her data also revealed that none of the teachers employed peer tutoring or referred students to guidance counselors as interventions.

Layug's (2021) study also showed the effectiveness of the nine interventions used by teachers in developing students' numeracy skills. The descriptive rating ranges from 1 = Not Effective to 4 = Highly Effective.

Her data showed that the first intervention employed by the 10 teachers was moderately effective with a 75% effectiveness rate. The effectiveness rate of the second most commonly used interventions was: the one–on–one tutorials are highly effective with a 97.25% effectiveness rate, and the redo activities with low scores are moderately

effective with 72.25%. Home visitation, the third most common intervention employed by the teachers, is moderately effective with a 75% effectiveness rate. Moreover, the intervention: supplemental activities and materials implemented, is moderately effective with a 66.75% effectiveness rate. However, lessened activities and remedial classes are both said to be highly effective, with rates of 79.25% and 83.25%, respectively.

She concluded that among the nine interventions employed by the 10 teachers, the most effective intervention is one – on – one tutorials.

Another study from Legal & Legal (2024) conducted at Malbug National High School in Masbate Province assessed the effectiveness of remedial instruction in improving Grade 7 students' numeracy skills through pre-test scores and post test scores during the school year 2023 – 2024. Before the implementation of the remedial instruction, the pre-test scores fell into the "Needs Major Support" category, emphasizing the necessity for targeted interventions. However, the post-test scores revealed a remarkable improvement, which is 87.88% of initially non-numerate students achieving scores in the "Transforming" range.

The results showed a significant improvement in numeracy performance after the intervention, with a majority of initially non-numerate students achieving scores in the "Transforming" range. The study supports the need for tailored interventions and recommends sustaining remedial programs with regular assessments and teaching training.

Problem–Solving Skills

Problem-solving skills encompass the cognitive and behavioral processes individuals or groups employ to identify, analyze, and resolve challenges effectively. These skills involve a systematic approach to overcoming obstacles, making informed decisions, and achieving desired outcomes. Researchers defined problem-solving as not merely about finding answers; it involves understanding the nature of the problem, exploring potential solutions, and implementing the most appropriate course of action (Anderson, 2010; Davidson & Sternberg, 2003; Hayes, 1989; Jonassen, 2000). There are key components in problem–solving.

- **Problem Identification:** Recognizing and defining the nature of the problem or challenge at hand.
- **Analysis**: Systematically examining the problem to understand its underlying causes and contributing factors.
- **Solution Generation**: Brainstorming and developing a range of potential solutions or strategies to address the problem.
- **Decision-Making:** Evaluating the potential solutions and selecting the most appropriate course of action based on feasibility, effectiveness, and potential impact.
- **Implementation:** Putting the chosen solution into action and monitoring its progress.
- **Evaluation:** Assessing the effectiveness of the implemented solution and making adjustments as needed to achieve the desired outcome.

Problem-solving skills are essential in various aspects of life, including education, work, and personal relationships. They enable individuals to adapt to changing circumstances, overcome obstacles, and achieve their goals.

Filipino students' problem–solving skills have been studied across subjects and educational levels, revealing systemic challenges and promising interventions. Filipino mathematics teachers' constructivist beliefs about problem–solving often clash with their instructional practices. While most teachers prioritize higher–level problem–solving tasks, classroom observations reveal a reliance on lower–level tasks (e.g., rote memorization) due to time constraints and curriculum demands. This gap between beliefs and practices limits students' exposure to complex problem-solving scenarios.

Critical findings found in related studies. Teachers in public science high schools often lack strategies to foster flexibility in problem-solving (e.g., exploring multiple solution pathways). Students struggle with translating real-

world problems into mathematical models and validating solutions. There were also mixed results in Physics Education interventions. A study testing Diminishing Problem-Solving Prompts (DPP) in physics found no significant difference in post-test scores between DPP and traditional methods. However, qualitative analysis revealed that high-performing students in the DPP group exhibited expert-like problem-solving behaviors, such as systematic planning and self-correction. This implied that tailored interventions may benefit advanced learners but fail to address gaps among struggling students. Also, a strong correlation between conceptual understanding and problem-solving skills underscores the need for integrated teaching approaches.

There were also studies about deficits in Teacher Preparation Programs. Prospective elementary teachers (PETs) in Northern Philippines demonstrated unsatisfactory problem-solving performance, particularly in algebra and probability. Only PETs who preferred mathematics achieved satisfactory results, highlighting the impact of subject-specific confidence. With this case, recommendations such as introducing problem-solving courses in teacher education curricula, addressing PETs' mathematics anxiety through remedial programs, and hands-on workshops were done.

There were also studies about the success of Problem-Based Learning (PBL). A PBL intervention in high school chemistry significantly improved problem-solving skills compared to traditional methods. Students exposed to PBL showed enhanced ability to identify relevant data and apply concepts to real-world scenarios, and increased use of visual aids and logical reasoning. The key strategies used were structured problem-solving matrices that guide students through goal-setting, data analysis, and solution validation.

There were also studies about the Effectiveness of Manipulative Materials in Elementary Math that improve learners' problem–solving skills. Using manipulative materials (e.g., blocks, puzzles) in problem-solving enrichment activities led to higher math achievement scores among Grade 2 pupils. The tactile approach helped students visualize abstract concepts like fractions and measurement.

Hands-on activities bridge the gap between theoretical knowledge and practical application, especially in rural classrooms with limited resources. However, there were persistent barriers like resource limitations that many schools lack tools for interactive problem-solving (e.g., digital simulations, lab equipment). Another is curriculum overload, where teachers prioritize content coverage over deep problem-solving skill development.

Despite these, there were also recommendations for improvement like teacher training workshops on integrating higher-order tasks and fostering student autonomy in problem-solving. Another is curriculum reform, wherein there is a need to allocate time for open-ended, cross-disciplinary problem-solving tasks. And policy support, like funding community-based programs that provide manipulative materials and PBL resources to underserved schools.

This research underscores the need for context-specific, student-centered interventions to elevate students' problem-solving skills in the Philippines.

Interventions Used on Problem–Solving Skills

It has always been true that students should approach mathematics as a science to improve their problem-solving skills. It is the core of studying mathematics. It emphasizes the growth of thinking abilities in addition to the study of the subject. Because students can apply their knowledge and problem-solving abilities in everyday situations, the procedures involved in solving a mathematics problem are comparable to those involved in addressing a general problem.

Students' performance in mathematics will suffer if they are not particularly good at solving problems. In a study that investigated the role of mothers' attitudes towards shaping students' mathematical problem-solving abilities in performing fraction multiplication and division, it was found out that students had poor problem-solving abilities in multiplying and dividing fractions in pre – test (Marwati, 2021). It was mentioned that the kid struggled to come up with a plan of action. Furthermore, Day-ongao & Tan's (2021) study revealed that grade 7 pupils' problem-solving

abilities were quite low, with a mean percentage score of 51.46% on the pre-test. According to their research, before learning about the Vedic Mathematics Technique (VMT), which uses the 4A paradigm in lesson design, 50 out of 63 (792%) grade 7 students had extremely poor problem-solving abilities. According to Istiqomah & Prabawanto (2019) qualitative study that aimed to identify the learning difficulties faced by fifth-grade students in solving fraction word problems using Newman's method, students struggled with word problems involving fractions because (1) they had trouble understanding the question and turning it into a mathematical sentence; (2) they had trouble figuring out the operation used in the word problems; and (3) they were not used to writing the conclusion, so they would either forget to write it or write it without the unit in every answer.

CONCEPTUAL FRAMEWORK

This study investigated the effect of the Academic Recovery and Accessible Learning (ARAL) Reading Program on the learners' numeracy and problem-solving skills. The theoretical framework integrated the Integrated Model of Numerical Development, Dual Coding Theory, Constructivist Learning Theory, and the principles of Culturally Responsive Teaching.

Integrated Model of Numerical Development (IMND)

The IMND explained numerical competence through interconnected cognitive systems. It emphasized the interplay between language, visual-spatial processing, and working memory. Numerical understanding is built upon both symbolic and non-symbolic representations. The model suggested that proficiency in one area enhances overall numerical skills. IMND highlighted the importance of integrating different cognitive processes for effective numerical learning (Dowens & Gobel, 2021).

The ARAL program integrated literacy and numeracy through narratives with quantitative problems. Reading materials require students to interpret numerical data within story contexts. Activities bridge literacy and numeracy, strengthening connections between reading and numerical reasoning. This approach fostered the integration of symbolic and non-symbolic numerical representations. The program enhanced language-based reading comprehension and numerical reasoning simultaneously.

By fostering the integration of numerical representations, the ARAL program enhanced students' overall numerical competence. Improved numerical competence leads to better numeracy and problem-solving skills. The program's design supported the development of a strong foundation in both literacy and numeracy. This integration could lead to significant academic gains. And students become more proficient in applying numerical concepts across various contexts.

Dual Coding Theory (DCT)

Dual Coding Theory proposed two distinct cognitive systems: verbal and non-verbal (imagery). Information is processed and stored in both systems for enhanced recall. Activating both codes strengthens memory and understanding. Verbal codes handle language, while non-verbal codes manage visual and sensory information. The theory suggested that using both systems improves cognitive processing (Richter & Christmann, 2021).

The ARAL program presented mathematical concepts through textual explanations and visual aids. Diagrams, graphs, and illustrations accompany written definitions to enhance understanding. When teaching numbers and number sense, the program included visual representations. This dual approach engaged both verbal and non-verbal processing. Students benefit from seeing and reading about mathematical concepts.

Engaging both verbal and non-verbal processing created a robust understanding of mathematical concepts. This deeper understanding improved students' ability to apply concepts in problem-solving. The ARAL program enhanced memory and retention through dual coding. Students are better equipped to recall and use mathematical knowledge. This approach leads to improved numeracy and problem-solving skills.

Constructivist Learning Theory

Constructivist Learning Theory advocates that learners actively construct knowledge through experiences. Learning involves building on prior knowledge and creating new understandings. Interaction with the environment is crucial for knowledge construction. Learners create meaning through exploration and discovery. This theory emphasizes active engagement over passive reception of information (Fox, 2021).

The ARAL program promoted constructivist learning through hands-on activities. Collaborative projects and real-world problem-solving tasks encouraged active participation. Students explored mathematical concepts through practical application. They worked together to design budgets or analyze community survey data. This approach fostered a deeper understanding of numeracy.

Providing opportunities for active engagement fostered a more meaningful understanding of numeracy. Students developed enhanced problem-solving skills through practical application. The ARAL program encouraged critical thinking and knowledge construction. This approach leads to greater retention and application of mathematical concepts. Students become active participants in their own learning process.

Culturally Responsive Teaching (CRT)

Culturally Responsive Teaching incorporates students' cultural backgrounds into learning. It aims to create an inclusive and equitable learning environment. CRT values diversity and promotes understanding of different perspectives. Teaching methods are adapted to reflect students' cultural experiences. This approach enhances engagement and academic achievement (Gay, 2022).

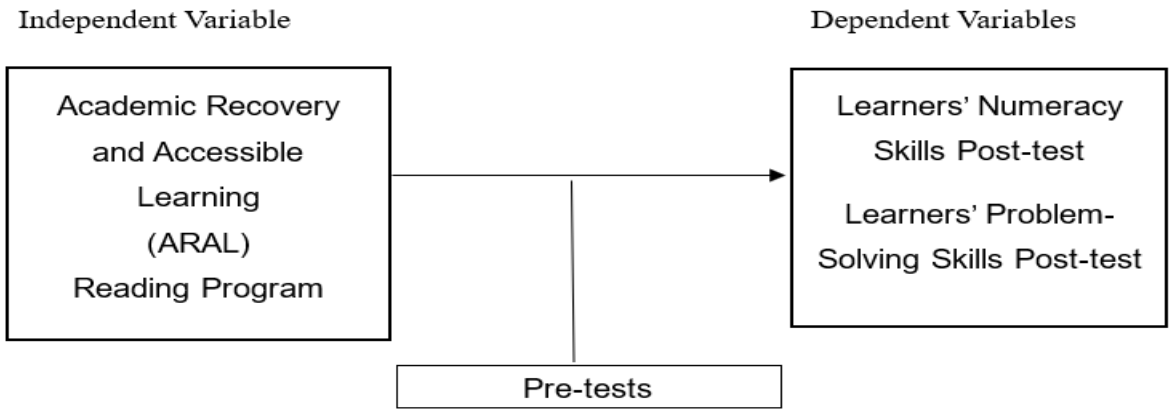
The ARAL program used reading materials that reflect the cultural diversity of students. Mathematical problems were relevant to students' lives and communities. Stories about different cultural traditions incorporated mathematical concepts. Real-world scenarios were used to connect learning to students' backgrounds. This approach made learning more meaningful and relatable.

Making learning relevant to students' cultural backgrounds increases engagement and motivation. The ARAL program enhanced academic achievement in numeracy and problem-solving. Students felt valued and understood in the learning environment. This approach promoted a sense of belonging and cultural pride. Also, students were more likely to succeed academically.

With these, the IMND explained numerical competence development, while DCT highlighted the importance of dual representations. Constructivist Learning Theory emphasized active engagement, and CRT ensured cultural relevance. Integrating these theories created a comprehensive approach to improving skills. The ARAL program enhanced learners' text comprehension and mathematical knowledge application. This holistic approach supported the students' academic growth effectively.

Research Paradigm

Figure 1. Schematic Model of the Study about Academic Recovery and Accessible Learning (ARAL) Reading Program on Numeracy and Problem-Solving Skills



Hypotheses of the Study

Based on the research questions, the following null hypotheses were tested at the 0.05 level of significance, two-tailed test.

H_{01}: There is no significant difference in numeracy skills of struggling readers before and after implementation of the Academic Recovery and Accessible Learning (ARAL) Reading Program.

H_{02}: There is no significant difference in the problem–solving skills of struggling readers before and after implementation of the Academic Recovery and Accessible Learning (ARAL) Reading Program.

H_{03}: There is no significant relationship between the numeracy skills and problem–solving skills of struggling readers before and after implementation of the Academic Recovery and Accessible Learning (ARAL) Reading Program.

METHODOLOGY

This chapter covered the procedures for collecting and evaluating data. It detailed the research design, study locale, participants, instrumentation, data gathering procedures, and statistical techniques.

Research Design

This study utilized a one-group pre-test/post-test pre-experimental research design to evaluate the effectiveness of the ARAL Reading Program. Data were gathered in a class taking all 15 ARAL learners identified as struggling readers. It is important to note that this design lacks both a control group for comparison and randomization of participants.

The level of numeracy skills was measured through a validated teacher-made numeracy skills test tool before exposure to the Academic Recovery and Accessible Learning (ARAL) Reading Program until 2 months after exposure of the program. The validated teacher-made numeracy test tool undergone a reliability test to one grade 10 section enrolled in the same school year which resulted to a Cronbach alpha of 0.756.

The problem–solving skills were measured using a validated teacher–made summative test tool from before exposure to the ARAL program until 2 months after exposure to the program. The validated teacher-made problem-solving skills test tool undergone a reliability test to the same one grade 10 section enrolled in the same school year which resulted to a Cronbach alpha of 0.707.

Locale of the Study

This study was conducted at the Bukidnon National School of Home Industries, located at Purok 2A, North Poblacion, Maramag, Bukidnon. This technical–vocational school offers classes for students in grades 7 through 12. Within the Maramag I District, it is the only public high school. It is a mega–school with more than 6,000 students, 170 teachers, and 31 non-teaching personnel. There are sixteen (16) junior high school mathematics teachers, separated into four (4) grade levels, ranging from seventh to tenth. Two (2) master teachers are in charge of them.

Sampling Technique

This study used purposive sampling. As specified on Academic Recovery and Accessible Learning (ARAL) Reading Program guidelines, only 10 – 15 students pre-identified as struggling readers will be taught by a qualified tutor. The teacher–researcher undergone seminar-workshop on the implementation of ARAL Reading Program and was qualified as a tutor in an ARAL Reading class. Due to small sample size (N=15), the findings were limited in their

ability to establish strict causal relationships, thus, generalization of results may be restricted. Consider also other external or comfounding variables.

In the implementation of the ARAL Reading Program, the selected students was exposed to the intervention to improve students' numeracy skills and problem–solving skills. Pre-intervention and post-intervention assessments, aligned with the program's literacy–numeracy integration, such as solving word problems embedded in reading activities, was administered to all students. Ethical protocols, including parental consent and student assent, was prioritized to maintain inclusivity.

Participants of the Study

The participants of the study consisted of 15 ARAL learners pre-identified as struggling readers based on Phil-IRI results, enrolled in the school year 2025 – 2026.

Research Instruments

The validated teacher-made numeracy skills and problem–solving tests served as the two research tools. To ensure the validity of the two research tools, they were checked and reviewed by master teacher of the BNSHI Math Department. Reliability testing was also done on the BNSHI grade 10 students enrolled in S.Y. 2025 – 2026. The DepEd Order No. 8, series of 2015, served as the scale to assess the numeracy skills and problem–solving skills.

Data Gathering Procedure

Numeracy Mean Score	Problem–Solving Mean Score	Percentage Score	Transmuted Grade	Descriptive Rating
20.00 – 25.00	6.40 - 8.00	80.00 - 100.00	90 – 100	Outstanding
17.50 – 19.99	5.60 - 6.39	70.00 - 79.99	85 – 89	Very Satisfactory
15.00 – 17.49	4.80 – 5.59	60.00 - 75.99	80 – 84	Satisfactory
12.50 – 14.99	4.00 – 4.80	50.00 - 59.99	75 – 79	Fairly Satisfactory
0.00 – 12.99	0.00 – 3.99	0.00 - 49.99	74 and below	Did not meet the expectation

The researcher filed a formal written request through the Secondary School Principal of the Bukidnon National School of Home Industries to the Superintendent of the Schools Division of the Division of Bukidnon. Participants in the study were the ARAL learners identified as struggling readers from Bukidnon National School of Home Industries, enrolled in the school year 2025 – 2026. A letter indicating their participation in the study was given to each participant, who then signed it. The participants received the letter and the principal's approval notice for the study's conduct. Additionally, ethical statements were given to each study participant by the researcher. Before the distribution of the ethical statement and permission to conduct the study, it was shown to the Superintendent and the principal. The researcher personally distributed the ethical declarations together with the approval notice and letter of authorization that were attached. A copy of the consent forms and ethical declarations was also supplied to the participants' adviser.

In this study, two (2) pre–post tests were carried out. These were used to ascertain their numeracy skills and problem – solving skills of the ARAL learners before and after 2 months of implementation of the ARAL program.

Implementation of ARAL Program in Mathematics Class

The researcher provides his master teacher with his daily class schedule for ARAL reading program. For School

Year 2025 – 2026, the ARAL Reading Program did not prescribed a fixed number of sessions, as it was designed to be flexible, continuous intervention implemented throughout the school year. However in this study, the ARAL reading program classes was done in two 45 minutes (or 90 minutes) in a week, specifically every Tuesday and Thursday. This was approved by the school principal. It started on the second quarter and ended at the fourth quarter in school year 2025 – 2026. Since ARAL reading program was implemented nationwide, the researcher adapted the instructional materials such as reading passages with sample math problems to be used inside the class.

The researcher also submitted Numeracy Skills tool and Problem – Solving Skills tool. These two test tools were subjected for content validity, face validity and reliability testing. After passing the three testing, were used as pre – test and post – test.

Before implementing the intervention, the researcher conducted two pre – tests. This was to ascertain the levels of numeracy skills and problem – solving skills of the struggling readers before exposure to ARAL reading program classes.

In the implementation of the ARAL reading program, the teacher adapted the contextualized reading materials as prescribed by the Department of Education. The students were asked to read, performed indicated operations and solved mathematical problems. This allowed teachers to ascertain the levels of numeracy skills and problem – solving skills in Mathematics classes. The teachers provided guide questions to arrive correct solutions and answers. Lower order thinking and higher order thinking questions were emphasized. This was done in 2 months after the conduct of pre – tests.

After 2 months, the researcher conducted the two post – tests. These ascertained the levels of numeracy skills and problem – solving skills of students after exposure to Academic Recovery and Accessible Learning (ARAL) Reading Program classes.

Statistical Techniques

All of the data that were needed to be gathered from the respondents were combined, and SPSS was used to analyze it. The frequency, mean (in %) and standard deviation of descriptive statistics were used to ascertain the levels of students' numeracy skills and problem-solving skills. Paired samples t-test was performed to determine whether there are significant differences on the students' numeracy skills and problem-solving skills in terms of post-tests. Pearson r was performed to determine whether there will be significant relationship between the students' numeracy skills and their problem–solving skills before and after 2 months exposure to Academic Recovery and Accessible Learning (ARAL) Reading Program.

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

The data collected from the participants was analyzed and interpreted in this chapter to test the study's hypotheses. This chapter also included tables to provide easy-to-read assessments of the data. The presentation was done in the order that the study's objectives were listed.

Numeracy Skills of ARAL Learners

Numeracy skills are vital in comprehending more complex mathematical concepts. The research started by ascertaining the numeracy skills level of the ARAL learners before and after exposure to the ARAL Reading Program.

Levels of Numeracy Skills of ARAL Learners Before and After Exposure to the Intervention

The Table 1 displayed the numeracy skills pretest-posttest results for the ARAL learners.

Table 1. Level of Numeracy Skills of the ARAL Learners Before and After Exposure to the Intervention

SCORE	PRETEST		POSTTEST		QUALITATIVE DESCRIPTION
	f	%	f	%	
20.00 – 25.00	0	0	3	20	Outstanding
17.50 – 19.99	0	0	6	40	Very Satisfactory
15.00 – 17.49	3	20	5	33	Satisfactory
12.50 – 14.99	1	7	1	7	Fairly Satisfactory
0.00 – 12.49	11	73	0	0	Did not meet the expectation
Total	15	100	15	100	
	Mean		**SD**		**Qualitative Description**
Pretest	**9.73**		**3.369**		**Did not meet the expectation**
Posttest	**18.20**		**2.513**		**Very Satisfactory**

Table 1 showed a clear improvement in the numeracy skills of ARAL learners before and after the intervention. During the pretest, most learners (73%) fell within the "Did not meet the expectation" range (scores between 0.00–12.49), with a mean score of 9.73 and standard deviation (SD) of 3.369, indicating relatively low and dispersed performance. Only a small fraction (27%) reached the "Fairly Satisfactory" or "Satisfactory" levels, and none achieved the higher categories.

After exposure to the intervention, the posttest mean increased to 18.20 (SD = 2.513), corresponding to a "Very Satisfactory" performance. Learners showed a strong upward shift: 20% of them scored in the "Outstanding" and 40% scored "Very Satisfactory", while none remained below expectations. This distribution implies that the intervention was successful in significantly raising numeracy proficiency and reducing performance gaps among learners. The reduction in standard deviation also suggests greater consistency in learners' numeracy performance after the program.

Statistically and pedagogically, this improvement indicates that targeted learning interventions—likely involving enrichment, contextual activities, and scaffolding—can effectively enhance numeracy skills, especially among initially low-performing learners.

Belleza's study found that after exposure to enhanced mathematics learning kits with parental involvement, students' numeracy levels improved from low to high, showing significant differences between pretest and posttest scores—paralleling the gains observed in Table 1a.

The quasi-experimental study of Miña & Caballes (2023) reported a significant improvement in learners' numeracy post-assessment scores after an 8-week intervention program, demonstrating the effectiveness of structured remedial numeracy programs in addressing learning gaps.

Munda, Endrinal & Nequinto (2024) found that Project COUNTS yielded significant gains in learners' numeracy performance based on pretest–posttest comparisons, supporting the idea that context-based and scaffolded interventions contribute to sustained numeracy improvement.

Problem-Solving Skills of ARAL Learners

Problem-solving skills includes understanding the problem to devising a plan. This research started in identifying the level of problem-solving skills of the ARAL learners before and after exposure to the intervention.

Levels of Problem-Solving Skills of ARAL Learners Before and After Exposure to the Intervention

The Table 2 displayed the problem-solving skills pretest-posttest results for the ARAL learners.

Table 2. Level of Problem-Solving Skills of the ARAL Learners Before and After Exposure to the Intervention

SCORE	PRETEST		POSTTEST		QUALITATIVE DESCRIPTION
	f	%	f	%	
6.40 - 8.00	0	0	4	27	Outstanding
5.60 - 6.39	0	0	4	27	Very Satisfactory
4.80 – 5.59	0	0	2	13	Satisfactory
4.00 – 4.80	3	20	3	20	Fairly Satisfactory
0.00 – 3.99	12	80	2	13	Did not meet the expectation
Total	15	100	15	100	
	Mean		**SD**		**Qualitative Description**
Pretest	**2.07**		**1.335**		**Did not meet the expectation**
Posttest	**5.47**		**1.642**		**Satisfactory**

Table 2 presented the level of problem-solving skills of ARAL learners before and after exposure to the intervention. The results clearly show a substantial improvement in learners' performance after the intervention.

Before the intervention (pretest), the majority of learners (80%) fell under the "Did not meet the expectation" category, with only 20% reaching the "Fairly satisfactory" level. The mean score of 2.07 (SD = 1.335) further confirms that learners initially had very low problem-solving skills.

After the intervention (posttest), there was a marked shift in performance levels. Only 13% remained in the lowest category, while a significant number of learners moved to higher levels: 27% reached Outstanding, 27% reached Very Satisfactory, and 13% reached Satisfactory.

The mean score increased to 5.47 (SD = 1.642), described as Satisfactory, indicating a substantial improvement in overall problem-solving ability.

This shift suggests that the ARAL Reading Program was effective in enhancing learners' numeracy and problem-solving skills, as evidenced by both the increase in mean scores and the movement of learners into higher performance categories.

Bailey, Fuchs, Gilbert, & Geary (2018) found that early mathematics interventions significantly improved students' computation and problem-solving skills over time, supporting the improvement seen in your posttest results.

Nelson & McMaster (2019) meta-analysis reported a moderate positive effect (g = 0.64) of numeracy interventions, confirming that structured programs like ARAL can significantly enhanced learners' mathematical abilities.

Jay, Rose, & Simmons (2018) highlighted that parental involvement is positively associated with improved mathematics achievement, which aligned with interventions that include home-based or guided learning components.

Piper, Zuilkowski, Dubeck, Jepkemei, & King (2018) study confirmed that structured interventions and learning materials significantly improved numeracy outcomes, supporting the effectiveness of your intervention.

Comparison of the Numeracy Skills of the ARAL Learners Before and After Exposure to the Intervention

Table 3 presented the comparison of the numeracy skills of the ARAL learners before and after exposure to the ARAL Reading Program using a paired samples t-test.

Table 3. Comparison of ARAL Learners Numeracy Skills

Group		N	Mean	SD	t-value	p-value
Numeracy Skills	Pretest	15	9.73	3.369	-16.435	.000**
	Posttest	15	18.20	2.513		

**highly significant at p<0.01

The results showed that the mean score significantly increased from 9.73 (SD = 3.369) in the pretest to 18.20 (SD = 2.513) in the posttest. This indicated a substantial improvement in learners' numeracy skills after exposure to the intervention.

The computed t-value of -16.435 with a p-value of .000** ($p < 0.01$) indicated that the difference between pretest and posttest scores is highly significant. This means that the observed improvement is not due to chance, but rather can be attributed to the effectiveness of the intervention.

The decrease in standard deviation (from 3.369 to 2.513) also suggests that learners' scores became more consistent after the intervention, indicating that the program helped not only improve performance but also reduce variability among learners.

The ARAL intervention was highly effective in improving numeracy skills, as evidenced by the significant increase in mean scores and the statistically significant difference between pretest and posttest results.

Kim, Jang, & Cho (2018) study found that training in numerical cognition leads to improvements in math achievement, supporting the significant gain observed in the posttest.

Piper, Zuilkowski, Dubeck, Jepkemei, & King (2018) study reported that well-designed instructional interventions significantly improved numeracy outcomes, aligning with the highly significant results in Table 3.

Beverly, Hastings, & Hughes (2018) findings showed significant improvements (p<.05) in numeracy skills after intervention, reinforcing that structured program effectively enhanced learners' performance.

Bailey, Fuchs, Gilbert, & Geary (2018) study confirmed that students exposed to math interventions show significantly higher achievement, supporting the effectiveness of the ARAL program.

Comparison of the Problem-Solving Skills of the ARAL Learners Before and After Exposure to the Intervention

Table 4 presented the comparison of the problem-solving skills of the ARAL learners before and after exposure to the ARAL Reading Program using a paired samples t-test.

Table 4. Comparison of ARAL Learners Problem-Solving Skills

Group		N	Mean	SD	t-value	p-value
Problem-Solving Skills	Pretest	15	2.07	1.334	-7.830	.000**
	Posttest	15	5.47	1.642		

**highly significant at p<0.01

The results showed a notable increase in mean scores, from 2.07 (SD = 1.334) in the pretest to 5.47 (SD = 1.642) in the posttest. This indicated that learners' problem-solving skills improved significantly after exposure to the intervention.

The computed t-value of -7.830 with a p-value of .000** ($p < 0.01$) revealed that the difference between pretest and posttest scores is highly significant. This means that the improvement in problem-solving skills is statistically significant and not due to chance, but rather attributed to the effectiveness of the intervention.

Although the standard deviation slightly increased (from 1.334 to 1.642), this suggested that while most learners improved, there was slight variation in the degree of improvement, which is common in educational interventions.

The ARAL Reading Program was highly effective in enhancing learners' problem-solving skills, as evidenced by the significant increase in mean scores and the highly significant t-test result.

Lee-Post (2019) study found that targeted instructional interventions led to higher exam performance and improved problem-solving and numeracy competencies, supporting the significant improvement observed in Table 4.

Xiao, Barnard-Brak, Lan, & Burley (2019) study revealed that individuals with higher numeracy skills tend to demonstrate better problem-solving abilities, reinforcing the improvement seen after the intervention.

Albay (2019) study confirmed that teaching through problem-solving significantly improved students' mathematical performance and skills, supporting the effectiveness of the ARAL intervention.

Bryant, et. al. (2019) results showed that learners who received intervention performed significantly better than those who did not, supporting the significant gains as observed in Table 4.

Correlation of Numeracy and Problem-Solving Skills of the ARAL Learners Before and After Exposure to the Intervention

The tables below showed the significant relationship between the numeracy and problem-solving skills of the ARAL learners before and after exposure to the ARAL Reading Program.

Table 5a. Pearson r on Numeracy and Problem-Solving Skills of ARAL Learners Before Exposure to the ARAL Reading Program

Correlations[a]

		NUMERACYSKILLS_PRETEST	PROBLEMSOLVINGSKILLS_PRETEST
NUMERACYSKILLS_PRETEST	Pearson Correlation	1	-.202
	Sig. (2-tailed)		.470
PROBLEMSOLVINGSKILLS_PRETEST	Pearson Correlation	-.202	1
	Sig. (2-tailed)	.470	

a. Listwise N=15

Table 5a presented the Pearson correlation (r) between numeracy skills and problem-solving skills of ARAL learners before exposure to the ARAL Reading Program. The computed correlation coefficient is r = –0.202 with a p-value = 0.470 (N = 15).

The value of r = –0.202 indicated a weak negative correlation between numeracy skills and problem-solving skills. This means that as numeracy skills slightly increase, problem-solving skills tend to slightly decrease; however, the relationship is very minimal and practically negligible. In general, correlation values between 0 and ±0.3 were considered weak relationships (Turney, 2022).

Moreover, the p-value of 0.470 is greater than 0.05, indicating that the relationship is not statistically significant. This implied that the observed weak negative correlation may had occurred by chance, and there is no sufficient evidence to conclude a meaningful relationship between numeracy and problem-solving skills prior to the intervention.

This finding suggested that, before exposure to the ARAL Reading Program, learners' numeracy skills were not significantly associated with their problem-solving abilities. This lack of relationship may indicated that students had not yet developed the ability to integrate basic numerical understanding with higher-order problem-solving processes.

This result is supported by recent studies. For instance, Indefenso & Yazon (2020) found that while numeracy and problem-solving skills could be related, the strength of their relationship varies and may not always be significant depending on learners' level and context. Similarly, Rellon (2024) reported that problem-solving performance is influenced by multiple factors beyond basic skills, suggesting that weak or insignificant correlations may occur when foundational competencies were not yet fully developed.

Table 5b. Pearson r on Numeracy and Problem-Solving Skills of ARAL Learners After Exposure to the ARAL Reading Program

Correlations[a]

		NUMERACYSKILLS_POSTTEST	PROBLEMSOLVINGSKILLS_POSTTEST
NUMERACYSKILLS_POSTTEST	Pearson Correlation	1	-.779**
	Sig. (2-tailed)		.001
PROBLEMSOLVINGSKILLS_POSTTEST	Pearson Correlation	-.779**	1
	Sig. (2-tailed)	.001	

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

a. Listwise N=15

Table 5b presented the Pearson correlation (r) between numeracy skills and problem-solving skills of ARAL learners after exposure to the ARAL Reading Program. The results showed a correlation coefficient of r = –0.779 with a p-value = 0.001 (N = 15), which is marked significant at the 0.01 level.

The value r = –0.779 indicated a moderate to strong negative correlation between numeracy skills and problem-solving skills. This means that as numeracy skills increase, problem-solving skills tend to decrease, and vice versa. Unlike Table 5a, this relationship is statistically significant since the p-value (0.009) is less than 0.01, suggesting that the relationship is unlikely due to chance.

This result implied that after exposure to the ARAL Reading Program, there is a significant inverse relationship between the two variables. While this may seemed counterintuitive—since numeracy is typically expected to support problem-solving—it may indicate that learners developed these skills unevenly or that improvements in one domain did not translate to gains in the other. It could also suggest the presence of intervening factors such as cognitive load, instructional focus, or learner differences that influenced the development of each skill differently.

Supporting literature generally showed that numeracy and problem-solving were positively related under typical conditions. For example, a study by Xiao et al. (2019) found that individuals with higher numeracy skills tend to demonstrate higher levels of problem-solving ability, emphasizing that foundational mathematical skills are essential for solving complex tasks. The contrast between this established positive relationship and the present study's significant negative correlation suggested that the intervention (ARAL program) may had affected how these skills interact, possibly due to differences in instructional emphasis or learner adaptation.

Additionally, Lee-Post (2019) highlighted that improvements in numeracy and problem-solving require simultaneous and balanced instructional support, as both cognitive and affective factors influence skill development. If one skill was emphasized more than the other, it may lead to disparities similar to the inverse relationship observed in this study.

Overall, Table 5b indicated that after the ARAL Reading Program, numeracy and problem-solving skills are significantly but inversely related, suggesting that the ARAL Reading Program may had influenced the development of these skills in different ways. This highlighted the need for integrated instructional approaches that simultaneously strengthened both numeracy and problem-solving abilities. However, it is important to note that the findings were limited in the ARAL learners' abilities to establish strict causal relationship, as changes in outcomes may not be entirely attributed solely to the ARAL Reading Program, ruling out the potential influence of other external or confounding variables. Also, generalization of results may be restricted due to small and specific sample size (N=15).

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presented the summary, conclusions and recommendations on the ARAL Reading Program on Learners Numeracy and Problem-Solving Skills.

Summary of Findings

The summary of findings below was done in the order of the study's objectives.

The results in Table 1 showed a clear improvement in the numeracy skills of the ARAL learners after exposure to the intervention. Before the intervention (pretest), the majority of learners (73%) did not meet the expected numeracy level, with a mean score of 9.73 (SD = 3.369), described as "Did not meet the expectation." Only a small proportion of learners reached the lower satisfactory levels, and none achieved "Very Satisfactory" or "Outstanding" performance. After the intervention (posttest), there was a marked shift in performance distribution. No learners remained in the "Did not meet the expectation" category. Instead, 20% achieved "Outstanding," 40% reached "Very

Satisfactory," and 33% attained "Satisfactory" levels. The mean score increased significantly to 18.20 (SD = 2.513), described as "Very Satisfactory," indicating both improved performance and more consistent scores among learners.

Table 2 presented the level of problem-solving skills of ARAL learners before and after the intervention. Before the intervention (pretest), the learners showed very low problem-solving skills. The majority (80%) were categorized as "Did not meet the expectation," while only 20% reached "Fairly Satisfactory." The mean score was 2.07 (SD = 1.335), described as "Did not meet the expectation," indicating weak baseline problem-solving ability among the learners. After the intervention (posttest), a notable improvement was observed. The proportion of learners who did not meet expectations dropped significantly to 13%. Meanwhile, 27% achieved "Outstanding," another 27% reached "Very Satisfactory," and 13% attained "Satisfactory." The mean score increased to 5.47 (SD = 1.642), described as "Satisfactory," showing substantial improvement in overall performance. These results indicated that the intervention positively influenced the learners' problem-solving skills, shifting them from low to moderate and high performance levels.

Table 3 presented the comparison of ARAL learners' numeracy skills before and after exposure to the intervention using a paired samples t-test. The results showed a substantial increase in learners' numeracy performance from pretest (M = 9.73, SD = 3.369) to posttest (M = 18.20, SD = 2.513). The computed t-value of -16.435 with a p-value of .000 indicated that the difference between pretest and posttest scores is statistically significant at $p < 0.01$. This means that the improvement in numeracy skills is not due to chance but is strongly associated with the intervention. The reduction in standard deviation in the posttest also suggests more consistent performance among learners after the intervention.

Table 4 presented the comparison of ARAL learners' problem-solving skills before and after exposure to the intervention using a paired samples t-test. The results revealed a marked improvement in problem-solving skills from pretest (M = 2.07, SD = 1.334) to posttest (M = 5.47, SD = 1.642). The computed t-value of -7.830 with a p-value of .000 indicated that the difference is statistically significant at $p < 0.01$. This means that the improvement observed in learners' problem-solving skills is statistically significant and strongly associated with the intervention. The increase in the posttest mean also reflects better overall performance after the intervention.

The results of Table 5a showed a weak negative correlation between numeracy skills pretest and problem-solving skills pretest ($r = -0.202$, $p = 0.470$, $N = 15$). This indicated that as numeracy skills slightly increase, problem-solving skills tend to slightly decrease; however, the relationship is very weak and not statistically significant at the 0.05 level. This means that there is no sufficient evidence of a meaningful relationship between learners' numeracy skills and their problem-solving skills at the pretest stage. On the other hand, the results revealed a strong negative correlation between numeracy skills posttest and problem-solving skills posttest ($r = -0.779$, $p = 0.001$, $N = 15$). This relationship is statistically significant at the 0.01 level, indicating a strong and reliable association between the two variables after the intervention. However, the direction of the relationship is negative, meaning that as numeracy skills increase, problem-solving skills tend to decrease, or vice versa. It is also important to note that the findings were limited as changes in outcomes may be influenced by other external or confounding variables.

CONCLUSIONS

Based on the summary of findings in this study, the following conclusions were drawn.

The ARAL learners initially demonstrated low numeracy skills prior to the intervention, with most failing to meet expected competencies. The intervention significantly improved learners' numeracy performance, as evidenced by the increase in mean scores and the shift toward higher qualitative descriptions. The reduction in standard deviation from pretest to posttest indicates more consistent learning outcomes among participants after the intervention. The intervention can be considered effective in enhancing numeracy skills among ARAL learners.

The ARAL learners initially exhibited poor problem-solving skills prior to the intervention, with most falling under

the lowest performance category. The intervention significantly improved learners' problem-solving abilities, as reflected in the increase in mean scores and the shift toward higher qualitative descriptions. The presence of learners in "Outstanding" and "Very Satisfactory" categories after the intervention indicates that higher-level cognitive skills were developed. Although improvement was evident, some learners still remained in the lower categories, suggesting that not all learners benefited equally from the intervention.

There is a significant difference between the pretest and posttest numeracy skills of ARAL learners. The intervention had a highly positive effect on improving learners' numeracy skills. Learners showed not only higher mean scores after the intervention but also more consistent performance. The null hypothesis stating that there is no significant difference between pretest and posttest scores is rejected.

There is a significant difference between the pretest and posttest problem-solving skills of ARAL learners. The intervention significantly improved the learners' problem-solving abilities. The increase in mean scores shows that learners developed better analytical and reasoning skills after the intervention. The null hypothesis stating that there is no significant difference between pretest and posttest problem-solving skills is rejected.

Based on the pretest scores on Table 5a, numeracy skills and problem-solving skills are not significantly related at the initial assessment. Learners' ability in numeracy does not necessarily predict or influence their problem-solving performance before the intervention. Other factors (such as comprehension, reasoning strategies, or instructional exposure) may have a stronger influence on problem-solving skills than numeracy alone at this stage. On the other hand, there is a significant relationship between numeracy skills and problem-solving skills after the intervention. The relationship is strong but inverse, suggesting an unexpected pattern between the two skills at the posttest stage. The results imply that improvement in numeracy skills alone does not automatically lead to improved problem-solving skills; instead, there may be other influencing factors such as strategy use, comprehension, or instructional approach. The negative correlation may also suggest a possible misalignment in skill application, where learners improved in computation but struggled in applying these skills to problem-solving tasks.

RECOMMENDATIONS

Based on the conclusions of this study, the following recommendations may be considered.

The numeracy intervention should be continued and institutionalized as a support program for ARAL learners due to its demonstrated effectiveness. Teachers should integrate similar structured and targeted numeracy interventions in regular instruction to sustain learner progress. Additional enrichment activities should be provided for learners who reached "Satisfactory" and "Very Satisfactory" levels to further develop mastery toward higher-level competencies. Follow-up assessments should be conducted over a longer period to determine retention of numeracy skills and long-term impact of the intervention. Future studies may explore scaling the intervention to a larger population to validate its effectiveness across different learner groups.

The problem-solving intervention should be continued and strengthened, as it has proven effective in improving learner outcomes. Teachers should incorporate regular problem-solving tasks and real-life application activities to further enhance learners' analytical thinking skills. Additional support or remediation should be provided for learners who remained in the "Did not meet the expectation" and "Fairly Satisfactory" levels after the intervention. Differentiated instruction strategies should be implemented to address varying learner abilities and ensure inclusive improvement. Future interventions may include longer implementation periods or more intensive scaffolding to achieve more uniform gains across all learners. Further research may explore which specific components of the intervention most strongly contributed to improvements in problem-solving skills.

The numeracy intervention should be maintained and institutionalized as an effective instructional strategy for ARAL learners. Schools should consider integrating similar intervention programs into regular mathematics instruction to improve foundational numeracy skills. Teachers should continue using structured, step-by-step

numeracy activities to sustain and further enhance learner performance. Additional enrichment programs should be provided to help learners achieve and maintain higher proficiency levels such as "Very Satisfactory" and "Outstanding." Future studies may explore the long-term retention of numeracy skills after exposure to the intervention. It is recommended to replicate the study in other schools or larger populations to validate the effectiveness of the intervention across different learning contexts.

The problem-solving intervention should be continued and strengthened due to its proven effectiveness in improving learners' skills. Teachers should consistently integrate problem-solving activities into daily instruction to further enhance learners' reasoning and critical thinking abilities. Remedial and enrichment activities should be provided to support learners who still struggle in problem-solving tasks. Instruction should emphasize real-life application of problem-solving skills to promote deeper understanding and retention. Future studies may examine which specific instructional strategies within the intervention contributed most to learners' improvement. The intervention may be replicated in other grade levels or schools to validate its broader effectiveness.

If numeracy and problem-solving skills pretest scores were low, teachers may integrate targeted instruction that explicitly connects numeracy concepts to problem-solving strategies to help bridge the gap between the two skills. Teachers may use contextualized and real-life problem-solving activities to strengthen the application of numeracy skills. Conduct further studies with a larger sample size to better examine the relationship between numeracy and problem-solving skills. Consider exploring other variables such as reading comprehension, mathematical anxiety, or cognitive strategies that may better explain problem-solving performance. Implement diagnostic interventions early to strengthen foundational skills before advancing to complex problem-solving tasks.

To increase numeracy and problem-solving skills posttest scores, teachers may emphasize the integration of numeracy and problem-solving instruction, ensuring that computational skills are consistently applied in contextual problems. Instruction may include higher-order thinking activities that require analysis, reasoning, and strategy development, not just computation. A review of instructional methods and assessment design is recommended to determine why an inverse relationship emerged after the intervention. Provide learners with guided problem-solving frameworks (e.g., Polya's steps) to help bridge numeracy and reasoning skills. Further research should be conducted to investigate the causes of the negative correlation, possibly including variables such as learning strategies, teaching approach, or student engagement. Future studies should consider a larger sample size to validate and strengthen the findings.

REFERENCES

1. Adanza, R. E., & Penalosa, J. R. (2020). Problem-Solving Performance in Mathematics of Grade 11 Students in Selected Schools in Leyte, Philippines. 15(3), em0598. International Electronic Journal of Mathematics Education. Retrieved September 05, 2025, from https://www.researchgate.net/publication/339047422_Problem-Solving_Performance_in_Mathematics_of_Grade_11_Students_in_Selected_Schools_in_Leyte_Philippines
2. Albay, E. (2019). Analyzing the effects of the problem-solving approach to the performance and attitude of first-year university students. Social Sciences & Humanities Open, 1(1), 100006. doi:https://doi.org/10.1016/j.ssaho.2019.100006
3. Alegre, A. L., & Capistrano, F. M. (2022). Diminishing Problem-Solving Prompts and Students' Problem-Solving Skills in Physics. DLSU Research Congress Proceedings. Retrieved September 05, 2025, from https://www.dlsu.edu.ph/wp-content/uploads/pdf/conferences/research-congress-proceedings/2022/LLI/LLI-I-003.pdf
4. Ancho, I., & Park, J. (2023). Contextualizing Philippine education: Challenges and innovations post-COVID. 24(1), 45-67. Journal of Southeast Asian Education. doi:https://doi.org/10.1080.14586845.2023.1234567

5. Anderson, J. R. (2010). Cognitive Psycholosy and its implications. (7th edition). Worth Publishers. Retrieved September 05, 2025
6. Asparin, A. A., & Tan, D. A. (2018). Students' Problem Solving Skills in Enhanced Gradual Released of Responsibility Instruction Model. Asian Academic Research Journal of Multidisciplinary. 5(3), 121-128.
7. Bailey, D. H., Fuchs, L. S., Gilbert, J. K., & Geary, D. C. (2018). Prevention: Necessary but insufficient? A two-year follow-up of an effective first-grade mathematics intervention. 91(2), 382–400. doi:https://doi.org/10.1111/cdev.13175
8. Bangoy, R. M. (2023, June). Reading Comprehension in relation to Problem-Solving Skills. 6th International Conference in Research, Education, Management, and the Social Sciences, 27. Retrieved November 26, 2025
9. Basa, R. (2022). Effectiveness of project COUNTS in improving students' numeracy skills. 15(1), 27-36. International Electronic Journal of Elementary Education. doi:https://doi.org/10.26822/iejee.2023.239
10. Belleza, M. J. (2022). Numeracy level of non-numerate learners through enhanced mathematics learning kits with parental involvement at homes. ejournals.ph, 3(4). Retrieved May 1, 2026, from https://scimatic.org/show_manuscript/453
11. Beverley, M., Hastings, R. P., & Hughes, J. C. (2018). Improving essential numeracy skills in primary schoolchildren using a brief fluency-building intervention: A randomized control trial. 20(1), 114–134. doi:https://doi.org/10.16922/wje.20.1.7
12. Bryant, D. P., Pfannenstiel, K. H., Bryant, B. R., Roberts, G., Fall, A.-M., Nozari, M., & Lee, J. (2019). Improving the mathematics performance of second-grade students with mathematics difficulties through an early numeracy intervention. Behavior Modification, 45(1),99-121. doi:https://doi.org/10.1177/0145445519873651
13. Bullen, K., Ainsley, K., & Davison, K. (2020). Evaluating the numeracy skills of pharmacy students in multiple choice questions and free-text answer assessments and their perception of numeracy in clinical practice. 12(6), 671-677. Currents in Pharmacy Teaching and Learning. doi:https://doi.org/10.1016/j.cptl.2020.01.028
14. Callanta, R. R., & Cruz, I. R. (2017). Mathematical Problem-Solving Performance of Prospective Elementary Teachers. Ateneo de Manila University Loyola School Faculty Publications. Retrieved September 05, 2025, from https://www.ateneo.edu/ls/sos/mathematics/faculty-publication/mathematical-problem-solving-performance-prospective
15. Cambaya, E. J., & Tan, D. A. (2021, December). Enhancing Students' Problem-Solving Skills And Engagement In Mathematics Learning Through Contextualized Instruction.
16. Cañales, R. (2021). Learner independence and educational strategies. Educational Insights.
17. Celemin, E. (2022). Enahncing Numeracy Skills of Grade 3 Students Through Authentic Performance Tasks. 5(11), 640-649. International Journal of Research and Innovation in Social Science. Retrieved November 26, 2025, from https://semanticscholar.org/paper/Enhancing-Numeracy-Skills-of-Grade-3-Students-Tasks-Celemin/5a07325117686997495e2d5839c000ed9791a0fd
18. Cutler, D. (2019, May 28). Tips for allowing test retakes. Edutopia. Retrieved September 05, 2025, from https://www.edutopia.org/article/tips-allowing-test-retakes
19. Davidson, J. E., & Sternberg, R. J. (2003). The psychology of problem solving. Cambridge University Press. Retrieved September 05, 2025
20. Day-ongao, Y. L., & Tan, D. A. (2021). Effects of Vedic Mathematics Technique (VMT) on Students' Problem-solving Skills and Motivation Towards Mathematics. Maramag, Bukidnon. Retrieved September 05, 2025
21. Department of Education. (2021). ARAL Reading Program: Operational guidelines. DepEd Philippines. Retrieved September 17, 2025
22. Department of Education. (2022). ARAL Program Guideline. Philippines: DepEd. Retrieved September 05, 2025
23. Department of Education. (2022). DepEd Order No. XX, s. 2022: Implementation of the ARAL Program. Retrieved September 05, 2025

24. Department of Education. (2022). National learning recovery and continuity plan. DepEd Philippines. Retrieved September 17, 2025
25. Desli, D. &. (2025). Exploring the relationship between computational estimation and problem-solving in Year 2 and Year 4 children. 5(1), em 073. Journal of Mathematics and Science Teacher. doi:https://doi.org/10.29333/math sci teacher/159
26. Dowens, M., & Gobel, S. M. (2021). Linking language and number: How linguistic skills relate to children's symbolic number knowledge. 7(2), 188-205. Journal of Numerical Cognition. Retrieved September 23, 2025
27. Esmeralda, L. (2024). Utilizing Manipulatives Materials in Enhancing Problem-Solving Skills in Mathematics. 11(1), 2349-5138. International Journal of Research and Analytical Reviews. Retrieved September 05, 2025, from https://www.ijrar.org/papers/IJRAR10013317.pdf
28. Fox, R. (2021). Constructivism examined. 18(5), 1-12. Journal of University Teaching & Learning Practice. Retrieved September 23, 2025
29. Fuchs, L. S., Fuchs, D., & Malone, A. S. (2016). The taxonomy of intervention intensity. Teaching Exceptional Children. 48(6), 257-264. doi:https://doi.org/10.1177/0040059916662702
30. Fulop, E. (2021). Developing Problem-Solving Abilities by Learning Problem-Solving Strategies: An Exploration of Teaching Intervention in Authentic Mathematics Classes. 1197-1212. Scandinavian Journal of Educational Research. Retrieved November 26, 2025, from https://doi.org/10.1080/00313831.2020.1869070
31. Garzon, J. (2023). Correlates of problem-solving difficulties among Ibarra NHS learners: Towards an evidenced-based project IMPACT. 15(6), 588-596. Psych Educ. doi:https://doi.org/10-5281/zenodo.10255604
32. Gay, G. (2022). Culturally responsive teaching: Theory, research, and practice. (4th). Teachers College Press. Retrieved September 23, 2025
33. Grotlüschen, A. e. (2020). Numeracy and literacy: A cross-national perspective. 70(3), 245-264. Adult Education Quarterly. doi:https://doi.org/10.1177/0741713620911473
34. Gueta, M., & Janer, S. (2021). Distance learning challenges on the use of self-learning module. 2(7), 58-64. UIJRT-United International Journal for Research & Technology.
35. Hayes, J. R. (1989). The complete problem solver. Lawrence Earlbaum Associates. Retrieved September 05, 2025
36. Indefenso, E. E., & Yazon, A. D. (2020). Numeracy level, mathematics problem skills, and financial literacy. Universal Journal of Educational Research, 8(10), 4393–4399. doi:https://doi.org/10.13189/ujer.2020.081005
37. Istiqomah, M. N., & Prabawanto, S. (2019, June). THE DIFFICULTIES OF FIFTH GRADE STUDENTS IN SOLVING MATHEMATIC FRACTIONS WORD PROBLEMS. AL-ASASIYYA Journal Of Basic Education, 3(2), 152. doi:10.24269/ajbe.v3i2.1835
38. Jay, T., Rose, J., & Simmons, B. (2018). Why is parental involvement in children's mathematics learning hard? 8(2). doi:https://doi.org/10.1177/2158244018775466
39. Kim, N., Jang, S., & Cho, S. (2018). Testing the efficacy of training basic numerical cognition and transfer effects to improvement in children's math ability. 9, 1775. doi:https://doi.org/10.3389/fpsyg.2018.01775
40. Kirkpatrick, D. L., & Kirkpatrick, J. D. (2006). Evaluating training programs: The four levels. Berrett., oehler Publishers. Retrieved September 05, 2025
41. Layug, G. D. (2021, August 6). Teachers' Interventions in Improving Numeracy Skills of Grade 7 Students in Baguio City National High School. Baguio City, Baguio, Philippines: Proceedings of the 4th International Conference on Advanced Research in Teaching and Education. doi:10.33422/4th.icate.2021.08.74
42. Lee-Post, A. (2019). Developing numeracy and problem-solving skills by overcoming learning bottlenecks. 11(3), 398–414. doi:https://doi.org/10.1108/JARHE-03-2018-0049
43. Legal, P. M., & Legal, G. A. (2024, February 01). Improving Numerical Performance in Grade-7 Students through Effective Remedial Instruction. 2(1). International Journal of Multidisciplinary Educational Research and Innovation. doi:https://doi.org/10.17613/71xs-8z75

44. Lopez-Pederson, A., Mononen, R., Aunio, P., Scherer, R., & Melby, L. (2023). Improving numeracy skills in first garders with low performance in early numeracy: A randomized controlled trial. 44(2), 98-110. Learning Disability Quarterly. doi:https://doi.org/10.1177/07419325221102537
45. Marwati, A. (2021). How Mathematics Attitude of Mothers in Rural Areas Affects Their Children's Achievement. Journal of Physics. Retrieved September 05, 2025
46. Miña, C. M., & Caballes, D. G. (2023). Evaluation of the implementation of the 8-week learning recovery curriculum in numeracy of Grade 3 learners of Legazpi City. 17(3), 59–69. doi:https://doi.org/10.30574/wjarr.2023.17.3.0355
47. Munda, N. P., Endrinal, J. R., & Nequinto, M. C. (2024). Effectiveness of Project COUNTS in improving students' numeracy skills. 4(1), 22–41. doi:https://doi.org/10.53378/353038
48. Nelson, G., & McMaster, K. L. (2019). The effects of early numeracy interventions: A meta-analysis. 111(6), 1001–1022. doi:https://doi.org/10.1037/edu0000334
49. OECD. (2018). Teaching for the future: Effective classroom practices to transform education. OECD Publishing. doi:https://doi.org/10.1787/9789264293243-en
50. OECD. (2019). PISA 2018 results: Philippines. OECD Publishing. doi:https://doi.org/10.1787/9789264547890-en
51. OECD. (2023). PISA 2022 results (Volume I and II) - Country notes: Philippines. Retrieved November 21, 2025, from https://www.oecd.org/en/publications/2023/11/pisa-2022-results-volume-i-and-ii-country-notes_2fca04b9/philippines_dbf92b65.html
52. Patterson, M. (2020). PIAAC Numeracy Skills and Home Use among Adult English Learners. 2(1), 22-40. Adult Literacy Education.
53. Piaget, J. (1977). The development of thought: Equilibration of cognitive structures. Viking Press. Retrieved September 06, 2025
54. Piper, B., Zuilkowski, S. S., Dubeck, M., Jepkemei, E., & King, S. J. (2018). Identifying the essential ingredients to literacy and numeracy improvement. 106, 324–336. doi:https://doi.org/10.1016/j.worlddev.2018.01.018
55. PISA. (2018). Statement on the Philippines' ranking in the 2018 PISA results. Retrieved September 05, 2025, from https://www.deped.gov.ph/wp-content/uploads/2019/12/PISA-2018-Philippine-National-Report
56. Ramiro, M. (2023). Problem-solving skills in mathematics among learners in West I District, Cagayan de Oro City. 5(3). Instabright Gazette. Retrieved November 21, 2025, from https://www.instabrightgazette.com/blog/problem-solving-skills-in-mathematics-among-learners-in-west-i-district
57. Rellon, L. R. (2024). Teacher variables and problem-solving difficulties in college algebra among teacher education students in Davao City. Indonesian Journal of Science and Mathematics Education, 8(2). doi:https://doi.org/10.24042/ijsme.v8i2.26163
58. Renbarger, R., Rivera, G., & Sulak, T. (2019). What predicts literacy, numeracy, and problem solving for incarcerated individuals? A PIAAC examination. Journal of Offender Rehabilitation, ournal of Offender Rehabilitation, 58(3), 199–219. doi:https://doi.org/10.1080/10509674.2019.1582575
59. Richter, T., & Christmann, U. (2021). The dual coding theory of multimedia learning: Assumptions, strengths, and weaknesses. 33(3), 1119-1138. Educational Psychology Review. Retrieved September 23, 2025
60. Samia, J. (2024). Pupils' Reading and Numerical Literacy in the Pre-COVID-19 Pandemic and During the Pandemic with Modular and Face-to-Face Instructions. 3(3), 59-68. Multidisciplinary International Journal of Research and Development.
61. Saxena, S., & Saxena, S. (2020). Framework as to the role of teachers during the pandemic. In E-learning strategies for STEM education during global crises, pp. 249-264. doi:https://doi.org/10.1007/978-981-15-4814-7_15
62. Seagreaves, P. (2009). The effectiveness of parent - teacher conferences for reporting student progress in a suburban Pennsylvania school district. ProQuest Dissertations and Theses. Western University. Retrieved September 05, 2026, from https://search.proquest.com/dissertations-theses/effectiveness-parent-teacher-conferences/docview/305140965/se-2?accountid=13042

63. SEAMEO. (2020). Integrated learning approaches in Southeast Asia. SEAMEO Regional Center for Educational Innovation and Technology. Retrieved September 18, 2025
64. Silagan, I. K., & Tan, D. A. (2024). 5E Embedded Lesson Plan on Students' Engagement, Computational and Problem-solving Skills.
65. Turney, S. (2022). Pearson correlation coefficient (r): Guide and examples. Retrieved May 1, 2026, from https://www.scribbr.com/statistics/pearson-correlation-coefficient/
66. UNESCO. (2021). Education post-COVID-19: Actionable solutions for recovery. UNESCO. Retrieved September 18, 2025, from https://unesdoc.unesco.org/ark:/48223/pf0000379474
67. Villagonzalo, M. J., Biyo, J. C., & Janson, N. A. (2022). Effects of Problem-Based Learning Strategy in Chemistry Problem-Solving Skills and Attitudes. 15(2). Philippines Journal of Science. Retrieved September 05, 2025, from https://philjournalsci.dost.gov.ph/images/pdf/pjs_pdf/vol151no2/effects_of_problem_based_learning_strategy_in_chemistry.pdf
68. Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Harvard University Press. Retrieved September 18, 2025
69. Wardono, S. M. (2018). The analysis of mathematics literacy on PMRI learning with media schoology of junior high school students. 983. Journal of Physics: Conference Series. doi:https://doi.org/10.1088/1742-6596/983/1/012107
70. World Bank. (2023). Philippines education public expenditure review. World Bank Group. doi:https://doi.org/10.1596/978-1-4648-1999-9
71. Xiao, F., Barnard-Brak, L., Lan, W., & Burley, H. (2019). Examining problem-solving skills in technology-rich environments as related to numeracy and literacy. International Journal of Lifelong Education, 38(3), 327–338. doi:https://doi.org/10.1080/02601370.2019.1598507
72. Yamashita, T., Punk Sungka, W., Narine, D., Helsinger, A., Kramer, J., Karam, R., & Cummins, P. (2020). Adult numeracy skill practice by STEM and non-STEM workers in the USA: An exploration of data using latent class analysis. 39(1), 1-18. International Journal of Lifelong Education. doi:https://doi.org/10.1080/02601370.2020.1825034
73. Yang, D.-C. (2019). Performance of fourth graders when judging the reasonableness of a computational result. 17(1), 197-215. International Journal of Science and Mathematics Education. doi:https://doi.org/10.1007/s10763-017-9862-y

Appendix G. Validated Teacher – made Numeracy Skills Test Tool

Read the questions carefully and encircle the letter of the correct answer.

1. What is the sum of 4,356 and 7,789?
   a) 12,115 b) 11,935 c) 12,145 d) 12,125

2. If you subtract 5,670 from 9,850, what is the result?
   a) 4,180 b) 4,270 c) 3,650 d) 3,530

3. What is the result of 8,923 + 2,458 - 3,592?
   a) 6,789 b) 7,789 c) 8,789 d) 9,789

4. Which of the following is the result of 5,400 – 2,315?
   a) 3,165 b) 3,225 c) 3,085 d) 3,255

5. What is the value of 12,678 + 3,482?
   a) 16,170 b) 15,970 c) 16,180 d) 16,160

6. What is the sum of 34.58 and 12.93?
   a) 46.91 b) 47.91 c) 47.51 d) 45.91

7. What is 58.34 – 22.79?
   a) 36.55 b) 36.56 c) 35.55 d) 36.65

8. Which of the following is the result of 23.68 + 14.27?
   a) 37.95 b) 37.85 c) 37.75 d) 37.65

9. If you subtract 4.57 from 12.99, what is the result?
   a) 8.42 b) 8.62 c) 8.52 d) 8.72

10. What is 67.85 – 32.49?
    a) 35.46 b) 35.36 c) 35.26 d) 35.56

11. A box contains 853 apples. If 432 apples are sold, how many apples remain in the box?
    a) 42 b) 321 c) 421 d) 4215

12. In a class of 35 students, 18 are absent. How many students are present?
    a) 18 b) 17 c) 15 d) 19

13. A farmer harvested 2,500 kilograms of rice. He sold 1,750 kilograms. How many kilograms of rice does the farmer have left?
    a) 750 b) 800 c) 1,000 d) 950

14. A bookstore had 1,750 books in stock. It sold 532 books in a week. How many books are left in stock?
    a) 1,228 b) 1,220 c) 1,218 d) 1,200

15. A company received 4,825 orders in one month. If 2,250 orders were processed and delivered, how many orders are still pending?
    a) 2,575 b) 2,545 c) 2,535 d) 2,555

16. A student has ₱2,000 in her wallet. She spends ₱725 for school supplies and ₱350 for transportation. How much money does she have left?
    a) ₱925 b) ₱1,025 c) ₱1,925 d) ₱1,275
17. A person deposits ₱5,500 into a bank account. After 3 weeks, they withdraw ₱2,100. How much money is left in the account?
    a) ₱3,400 b) ₱3,500 c) ₱3,600 d) ₱3,700
18. Maria had 350 marbles. She gave 125 marbles to her friend. After that, she bought 50 more marbles. How many marbles does Maria have now?
    a) 175 b) 275 c) 280 d) 200
19. In a race, a runner completed 12.8 km on the first day and 15.6 km on the second day. How many kilometers did the runner cover in total?
    a) 28.2 km b) 27.4 km c) 28.4 km d) 29.4 km
20. An online shop had 9,000 orders in one month. The shop processed 7,350 orders by the end of the month. How many orders were not processed?
    a) 1,650 b) 1,600 c) 1,500 d) 1,700
21. Estimate the sum of 1,974 and 2,438 by rounding to the nearest hundred. What is the estimated sum?
    a) 4,400 b) 4,500 c) 4,300 d) 4,600
22. Estimate the difference between 6,854 and 3,672 by rounding to the nearest ten. What is the estimated difference?
    a) 3,100 b) 3,200 c) 3,000 d) 3,180
23. Estimate the sum of 2,587 and 1,394 by rounding to the nearest thousand. What is the estimated sum?
    a) 4,000 b) 3,000 c) 3,500 d) 3,400
24. Estimate the difference between 5,973 and 2,487 by rounding to the nearest hundred. What is the estimated difference?
    a) 3,500 b) 3,400 c) 3,000 d) 3,300
25. Estimate the sum of 3,455 and 1,999 by rounding to the nearest thousand. What is the estimated sum?
    a) 5,000 b) 4,500 c) 4,000 d) 5,500

--------END OF EXAMINATION--------

Prepared by: Checked and Reviewed by:

IAN KARLO C. SILAGAN **YVONNE C. REDONDO**

Teacher-researcher Master Teacher I

Appendix H. Validated Teacher–made Problem-Solving Skills Test Too

DIRECTIONS: Show your solutions to the following questions and equations. Write your solution and answer in the box provided for each number. Write all your answers in the lowest term.

1. Ana and Ben were given rice during pandemic time. Ana received 3 ½ sacks of red rice and Ben received 5 ¾ sacks of ordinary rice. How many sacks of rice did Ana and Ben received during the time of pandemic?

   SOLUTION:

2. Sam and Pat deposited the same amount in Landbank but with varied years. Sam was told that he got 5 ½ annual interest while Pat got 2 ¾. What is the total annual interest did Sam and Pat received?

   SOLUTION:

3. John bought 2 buko pies. He gave $3/5$ buko pie to his younger brother Mark. How many buko pie is left to John?

   SOLUTION:

4. Sara harvested 20 kg of rambutan. She sold 10 ¾ kg of rambutan to the market. How many kilograms of rambutan is left to Sara?

   SOLUTION:

5. Dan had deposited Php 2,000.00 to MACO with $^1/_{100}$ annual interest rate. How much did Dan's money gain in a year?

   SOLUTION:

6. Jed loaned Php 30,000.00 to XYZ Bank. He was told there will be $^1/_{10}$ monthly interest rate. How much is Jed's interest in a month?

   SOLUTION:

7. Luke harvested 100 sacks of corn. He needs to distribute $\frac{5}{2}$ sacks of corn to his relatives. How many relatives will be able to receive $\frac{5}{2}$ sacks of corn?

   SOLUTION:

8. Yesterday's fare increase was $^1/_{10}$ while today's fare increases $^3/_8$. What is the ratio of yesterday and today's fare hike?

   SOLUTION:

--------END OF EXAMINATION--------

Prepared by:

IAN KARLO C. SILAGAN

Teacher-Researcher

Checked and Reviewed by:

YVONNE C. REDONDO

Master Teacher I

Appendix I. Pilot-testing on Grade 10 Students

Appendix J. Reliability Test Analysis on Numeracy Skills

Case Processing Summary

		N	%
Cases	Valid	28	100.0
	Excluded[a]	0	.0
	Total	28	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.756	25

Item Statistics

	Mean	Std. Deviation	N
ITEM01	.9286	.26227	28
ITEM02	.9643	.18898	28
ITEM03	.9286	.26227	28
ITEM04	.9286	.26227	28
ITEM05	.9643	.18898	28
ITEM06	.9643	.18898	28
ITEM07	.8929	.31497	28
ITEM08	.9643	.18898	28
ITEM09	.8929	.31497	28
ITEM10	.9286	.26227	28
ITEM11	1.0000	.00000	28
ITEM12	1.0000	.00000	28
ITEM13	.8214	.39002	28
ITEM14	.9643	.18898	28
ITEM15	.8929	.31497	28
ITEM16	.7143	.46004	28
ITEM17	.9643	.18898	28
ITEM18	.7500	.44096	28
ITEM19	.8929	.31497	28
ITEM20	.9286	.26227	28
ITEM21	.8214	.39002	28
ITEM22	.6429	.48795	28
ITEM23	.7500	.44096	28
ITEM24	.5357	.50787	28
ITEM25	.2143	.41786	28

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
ITEM01	20.3214	8.374	.519	.737
ITEM02	20.2857	8.360	.765	.732
ITEM03	20.3214	8.374	.519	.737
ITEM04	20.3214	8.374	.519	.737
ITEM05	20.2857	8.360	.765	.732
ITEM06	20.2857	8.360	.765	.732
ITEM07	20.3571	8.534	.325	.746
ITEM08	20.2857	9.101	.084	.757
ITEM09	20.3571	8.905	.121	.759
ITEM10	20.3214	9.115	.030	.762
ITEM11	20.2500	9.231	.000	.757
ITEM12	20.2500	9.231	.000	.757
ITEM13	20.4286	8.106	.438	.737
ITEM14	20.2857	8.360	.765	.732
ITEM15	20.3571	7.794	.761	.718
ITEM16	20.5357	9.073	-.019	.777
ITEM17	20.2857	8.878	.282	.750
ITEM18	20.5000	9.444	-.150	.785
ITEM19	20.3571	7.794	.761	.718
ITEM20	20.3214	8.004	.781	.723
ITEM21	20.4286	9.513	-.180	.783
ITEM22	20.6071	8.025	.350	.745
ITEM23	20.5000	7.815	.496	.732
ITEM24	20.7143	8.878	.031	.776
ITEM25	21.0357	8.851	.083	.766

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
21.2500	9.231	3.03834	25

Appendix K. Reliability Test Analysis on Problem-Solving Skills

Case Processing Summary

		N	%
Cases	Valid	28	100.0
	Excluded[a]	0	.0
	Total	28	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.707	8

Item Statistics

	Mean	Std. Deviation	N
ITEM01	.2500	.44096	28
ITEM02	.2857	.46004	28
ITEM03	.4286	.50395	28
ITEM04	.0714	.26227	28
ITEM05	.1071	.31497	28
ITEM06	.2143	.41786	28
ITEM07	.2500	.44096	28
ITEM08	.0000	.00000	28

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
ITEM01	1.3571	2.460	.348	.691
ITEM02	1.3214	2.004	.707	.593
ITEM03	1.1786	2.078	.554	.637
ITEM04	1.5357	2.702	.423	.680
ITEM05	1.5000	2.778	.247	.706
ITEM06	1.3929	2.692	.197	.724
ITEM07	1.3571	2.164	.600	.626
ITEM08	1.6071	3.136	.000	.721

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
1.6071	3.136	1.77094	8

Appendix L. Conduct of Pre-test to ARAL Learners

Appendix M. Conduct of ARAL Reading Class

Appendix N. Data Analysis

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	NUMERACYSKILLS_PRETEST	9.7333	15	3.36933	.86996
	NUMERACYSKILLS_POSTTEST	18.8000	15	2.88345	.74450
Pair 2	PROBLEMSOLVINGSKILLS_PRETEST	2.0667	15	1.33452	.34457
	PROBLEMSOLVINGSKILLS_POSTTEST	5.4667	15	1.64172	.42389

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	NUMERACYSKILLS_PRETEST & NUMERACYSKILLS_POSTTEST	15	.671	.006
Pair 2	PROBLEMSOLVINGSKILLS_PRETEST & PROBLEMSOLVINGSKILLS_POSTTEST	15	.376	.167

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	NUMERACYSKILLS_PRETEST - NUMERACYSKILLS_POSTTEST	-9.06667	2.57645	.66524	-10.49346	-7.63988	-13.629	14	.000
Pair 2	PROBLEMSOLVINGSKILLS_PRETEST - PROBLEMSOLVINGSKILLS_POSTTEST	-3.40000	1.68184	.43425	-4.33137	-2.46863	-7.830	14	.000

Correlations[a]

		NUMERACYSKILLS_PRETEST	PROBLEMSOLVINGSKILLS PRETEST
NUMERACYSKILLS_PRETEST	Pearson Correlation	1	-.202
	Sig. (2-tailed)		.470
PROBLEMSOLVINGSKILLS_PRETEST	Pearson Correlation	-.202	1
	Sig. (2-tailed)	.470	

a. Listwise N=15

Correlations[a]

		NUMERACYSKILLS_POSTTEST	PROBLEMSOLVINGSKILLS _POSTTEST
NUMERACYSKILLS_POSTTEST	Pearson Correlation	1	-.779**
	Sig. (2-tailed)		.001
PROBLEMSOLVINGSKILLS_POSTTEST	Pearson Correlation	-.779**	1
	Sig. (2-tailed)	.001	

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

a. Listwise N=15

Appendix O. Sample Reading Passage with Sample Math Questions

NAME: _____ DATE: _____

General Instruction: Read and understand the reading passage. Answer the follow-up questions below.

Lina's Market Day

Lina woke up early to help her mother at the market. They sold fruits like bananas, mangoes, and oranges. Lina arranged the fruits neatly on the table.

That morning, they brought 12 bananas, 15 mangoes, and 10 oranges. After a few hours, many customers came.

A customer bought 5 bananas and 3 mangoes. Another customer bought 4 oranges. Lina carefully counted the remaining fruits.

Later, Lina's mother told her to group the fruits into equal sets for display. Lina made 3 equal groups of bananas. She also grouped the mangoes into 5 equal sets.

At the end of the day, Lina counted all the fruits left. She felt proud because she was able to help her mother while also practicing her math skills.

◆ Comprehension Questions

1. Who helped at the market?
   _____
2. What fruits did they sell?
   _____
3. Why did Lina group the fruits?
   _____
4. How did Lina feel at the end of the day?
   _____

◆ Math Problems

A. Basic Operations

1. How many fruits did they bring in total?
   _____
2. How many bananas were left after selling 5?
   _____
3. How many mangoes were left after selling 3?
   _____
4. How many oranges were left after selling 4?
   _____

B. Problem Solving

1. If Lina grouped 12 bananas into 3 equal groups, how many bananas are in each group?
   _____
2. If 15 mangoes are divided into 5 equal sets, how many mangoes are in each set?
   _____

C. Higher Thinking

1. How many total fruits were sold?
   _____
2. How many fruits remained at the end of the day?
   _____