

Assess and Assist: Capacity Building Program in Enhancing the Numeracy Skills of Senior High School Students

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ABSTRACT: This action research evaluated the Assess and Assist Program, a school-based capacity-building intervention designed to improve the numeracy skills of Senior High School (SHS) students in a public school in San Pablo City, Philippines. Guided by low national and international numeracy performance indicators, the program combined a diagnostic exam, teacher training through the School Learning Action Cell, contextualized instructional materials, and a Concrete-Representational-Abstract instructional approach delivered to students identified as emergent or non-numerate. Using a quasi-experimental, one-group pretest-posttest design, 196 student-respondents were assessed before and after an intervention period spanning August 2024 to February 2025. Results showed a statistically significant improvement in numeracy scores from pretest to posttest, $t(195) = -20.80, p < .001$, with a large effect size (Cohen's $d = 1.49$). The proportion of non-numerate students dropped from 3% to 0%, while the proportion of above-average numerate students rose from 12% to 65%. Findings support integrating similar targeted, teacher-led numeracy interventions for SHS students and inform future research using experimental designs to isolate the contribution of individual program components.

KEYWORDS: numeracy skills, senior high school, capacity-building program, action research, mathematics intervention, Philippine public schools

I. INTRODUCTION

Numeracy, defined as the ability to understand and effectively apply mathematical concepts across various domains, is a basis of personal and career growth. Numeracy entails using mathematical concepts in different areas, as it plays a significant role in critical thinking, problem-solving, and decision-making (Bynner & Parsons, 2005). Highly competent individuals in numeracy have better employment opportunities, increased income potential, and the ability to function effectively in daily life (World Bank, 2018). Globally, countries with high levels of numeracy tend to be more economically advanced and have a higher quality of life. For example, economies led by strong mathematics education systems usually experience higher rates of innovation and economic development (OECD, 2019). In contrast, nations struggling with numeracy often face economic stagnation and reduced global competitiveness.

Developing numeracy skills among students in the Philippines is important to enable them to contribute to economic progress and compete globally in the job market. Nevertheless, international assessments in mathematics education have shown systematic problems that demand urgent attention. This research examines the current status of numeracy skills among SHS Filipino learners, reviews local literature, identifies research gaps, and proposes a school-based intervention to address this timely and relevant concern.

The country's performance in an international examination highlights the persistent problem in numeracy skills. In the 2018 Program for International Student Assessment (PISA), as administered by the Organization for Economic Co-operation and Development (OECD), the Philippines ranked lowest among 79 participating countries in mathematical literacy. This was participated in by 15-year-old learners, who earned an average score of 353, below the global average of 489 (OECD, 2019). Likewise, the Trends in International Mathematics and Science Study (TIMSS) 2019 showed that Filipino students from Grade 4 and Grade 8 scored below the international benchmark of 500, receiving scores of only 297 and 288, respectively (Mullis et al., 2020). These scores indicate that the country faces challenges in mastering basic mathematical concepts.

The National Achievement Test (NAT), conducted annually by the Department of Education (DepEd), provides further evidence of weak numeracy skills. In particular, the 2019 NAT results indicated that only 19.4% of Grade 6 students and 14.2% of Grade 10 students achieved proficiency in mathematics, highlighting a persistent challenge across educational levels (DepEd, 2019). According to Albert et al. (2018), contributing factors to low numeracy included outdated teaching methods, inadequate teacher training, and limited instructional materials or resources. This trend persists into the SHS level, where students are expected to demonstrate higher-order thinking skills but often lack foundational numeracy competencies (Mamolo, 2019).

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The Philippine government has introduced several initiatives to strengthen mathematics education. Under the K-12 curriculum, the Mathematical Modeling (MatMod) framework was developed to enhance STEM education by emphasizing critical thinking and problem-solving in elementary and secondary schools (DepEd, 2016). This is complemented by professional development programs for teachers that focus on content knowledge, pedagogy, and technology integration. More recently, the National Math Program (NMP), launched in August 2024, targets elementary and junior high school students with tailored interventions to improve numeracy (DepEd, 2024). While these efforts show potential, their impact remains limited by inconsistent implementation, resource constraints, and a lack of focus on the SHS level.

Local literature highlights additional interventions. For instance, Ubiña and Magulod (2020) documented the effectiveness of contextualized math instruction in improving student engagement in rural schools, though scalability remains a challenge. Similarly, Li and Ma (2010) explored technology-aided instruction and found modest gains in numeracy among junior high students. However, these studies predominantly focus on lower educational levels, leaving a noticeable gap in research and programming for SHS students.

Despite DepEd's efforts, a critical research and intervention gap exists at the SHS level. The National Math Program, for example, excludes SHS students, who face unique challenges as they transition to higher education or the workforce. At this stage, numeracy is not only foundational but also essential for advanced STEM courses and technical-vocational tracks (Padernal, 2024). The lack of targeted programs for SHS students is particularly concerning given their poor performance in prior assessments, which suggests that foundational deficits persist into later years. Local studies, such as that of Jaudinez (2019), note that SHS teachers often lack specialized training in mathematics pedagogy, further exacerbating the issue. Yet empirical research evaluating school-based interventions designed to enhance numeracy among SHS students in public schools remains limited.

To address this gap, the current research proposes a capacity-building program tailored for SHS students in Philippine public schools. This school-based intervention integrates teacher training, contextualized learning materials, and peer-assisted learning to enhance numeracy skills. The study tests the program's effectiveness through a quasi-experimental design, measuring improvements in students' mathematical proficiency via pre- and post-intervention assessments. By focusing on SHS, this research seeks to fill the void in local literature and provide actionable insights for policymakers and educators.

This initiative is timely and relevant. Strengthening numeracy at the SHS level is vital for equipping Filipino youth with the skills needed to thrive in a competitive global economy. Without targeted interventions, the Philippines risks perpetuating a cycle of educational and economic disadvantage.

II. RESEARCH QUESTIONS

This research aims to determine the effectiveness of the Assess and Assist program on the numeracy skills of SHS students. Specifically, it aims to answer the following questions:

1. What is the pretest score of the students in numeracy skills?
2. What is the post-test score of the respondents when exposed to the program?
3. Is there a significant difference between the pretest and post-test scores of students in numeracy skills after the intervention?
4. What is the effect size of the means between the test scores?

III. PROPOSED INNOVATION, INTERVENTION AND STRATEGY

To address the growing concern of declining numeracy skills among senior high school (SHS) students, an innovative intervention program is proposed (the Assess and Assist Program). Because the National Math Program is primarily mandated for elementary and junior high school levels, there is a clear need for innovative intervention programs to address the specific challenges senior high school students face in mathematics. Moreover, this initiative aims to significantly enhance students' mathematical abilities, especially in fundamental arithmetic, by offering contextualized and effective instruction. By implementing this program, the school strives to equip students with the essential mathematical knowledge and skills necessary for academic success and future endeavors. The intervention strategy involves a multi-faceted approach that combines traditional and innovative teaching methods. The figure below details the key components of the program.

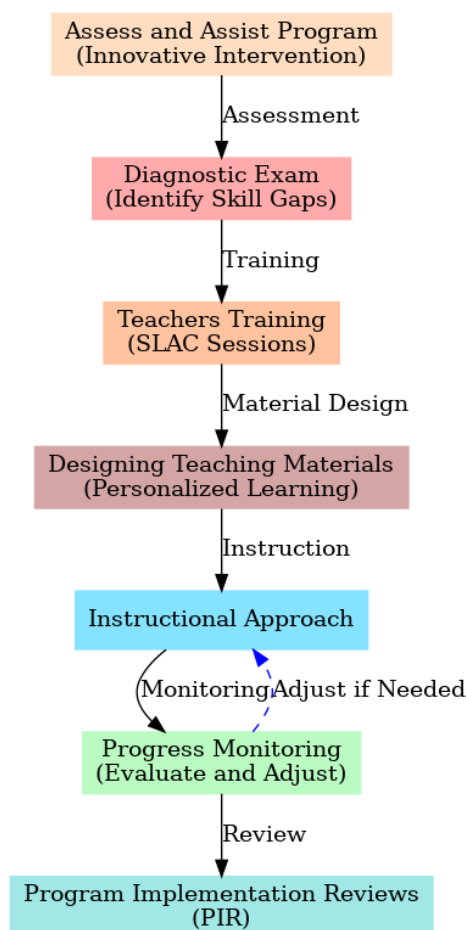


Figure 1. Assess and Assist Program Flow Diagram

A. *Diagnostic Exam*

Teachers administer numeracy assessments to evaluate students' current skills in counting, number sense, and basic operations, identifying where they may struggle. This standardized assessment helps instructors understand each student's learning needs and provides a baseline for targeted instruction. For example, the Victorian Department of Education (2022) notes that such assessments monitor students' understanding of mathematical concepts, helping identify support needs. In this program, teachers adopted the validated instrument from the division office. Consequently, students at the lowest levels of numeracy — non-numerate and emergent — were chosen to participate in the proposed program.

B. *Teachers' Training*

The School Learning Action Cell (SLAC) for numeracy is a training program in which teachers engage in regular collaborative sessions to learn how to integrate numeracy into their teaching practices across and within the curriculum. Implemented by the Department of Education in the Philippines (DepEd Order No. 35, s. 2016), this initiative aims to equip teachers with the skills needed to address numeracy challenges in their classrooms.

The training includes topics such as understanding what numeracy entails, identifying opportunities to incorporate numeracy skills across various subjects, and developing strategies for effective teaching. Teachers also learn to design lessons that embed numeracy and assess student progress, ensuring a holistic approach to numeracy education.

C. *Designing Teaching Materials*

After the teacher training and assessment results, the researchers designed teaching materials, including activity sheets and available workbooks from educational sources, to address the numeracy deficit. Additionally, the program implementers ensured that the self-made materials aligned with the content standards of the numeracy assessment.

D. *Instructional Approach*

The intervention program began in the second week of August 2024 and continued until the first week of February 2025. A total of 196 respondents fell within the emergent and non-numerate levels. They were given a parental consent form before the start of the sessions, explaining that they would be extending time for an hour each session per week. The instructional approach employed the Concrete-Representational-Abstract (CRA) instructional model, a research-based practice that integrates concrete materials, visual

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representations, and abstract symbols to build deep numeracy understanding. This model, also used by Garforth (2014), progresses from hands-on experiences to abstract thinking and is particularly beneficial for students with low-level mathematics skills.

During the concrete stage, teachers used manipulatives to represent fractions and percentages — for example, fraction tiles, paper cutouts, or pizza slices to demonstrate fractions, and 100-grid charts or coins to represent percentages (e.g., shading 25 colored squares out of 100 to represent 25%). This was followed by drawing pie charts and graphs for the representational stage. Lastly, in the abstract phase, students demonstrated their understanding by converting between fractions, decimals, and percentages, and eventually solved word problems independently.

E. Progress Monitoring

The researchers used an easy-to-use school form to monitor student-respondent progress, which was essential for identifying difficulties and skill gains and making data-informed adjustments to further support students.

During the midyear report, the school indicated the percentage of non-numerate students, highlighting the ongoing need for further improvements and adjustments to enhance the program's effectiveness. Likewise, to ensure the proper implementation of the program, the school consistently conducted Program Implementation Reviews (PIR) with the participation of personnel from the division office, administrative staff, parents, and students.

By addressing the root causes of numeracy difficulties and providing targeted support, this intervention program has the potential to significantly improve the mathematical numeracy of SHS students.

IV. ACTIONABLE RESEARCH METHODS

A. Participants

This study aims to enhance students' numeracy skills through a school-based program grounded in an action research design. The San Pablo City Schools Division was involved in the conduct of the program during the first and second semesters of the academic year 2024-2025. All strands from Crecencia Drucila Lopez Senior High School were involved in the pretest, as mandated by the division office. The researchers adopted DepEd's assessment tool to determine students' numeracy levels during the first phase. Students in the emergent and non-numerate levels were selected to participate in the program.

The researchers used stratified random sampling to select respondents for the intervention program. As defined by Creswell (2014), stratified sampling involves dividing the population into distinct subgroups or strata based on specific characteristics, from which a random sample is drawn to ensure proportional representation in the overall sample. In this context, the strata were students belonging to the emergent and non-numerate levels, since these groups represented the same characteristic of interest. This sampling technique reduces sampling error and improves the sample's representativeness. This study and program aimed to contribute to the development of students' numeracy skills.

B. Data Gathering Methods

The division office-mandated instrument was adopted for the pretest exam. Mathematics teachers were assigned to different sections and grade levels to properly administer the tools. The pretest was conducted over two days to ensure all students were accommodated appropriately. The examination lasted an hour, followed by the checking and evaluation of student output. Results were tallied and tabulated to determine students' numeracy skill levels.

Students from the two lowest levels were advised to attend the program. Before implementation, the researchers sought approval from the Division Office and the parents of the student-respondents, an important step in ensuring adherence to ethical guidelines and institutional protocols.

C. Data Analysis Plan

To analyze students' numeracy skills, the researchers used the mean, standard deviation, frequency, and percentage. The dependent-sample t-test was also applied to determine whether there was a statistically significant difference in students' numeracy skills before and after the intervention. This approach aligns with Creswell's (2014) recommendation to use statistical tests to analyze quantitative data and identify significant differences between scores.

Lastly, Cohen's d was applied to measure the effect size, indicating the magnitude of the difference between the two means, commonly interpreted as small ($d = 0.2$), medium ($d = 0.5$), or large ($d = 0.8$).

V. ACTION RESEARCH WORK PLAN AND TIMELINES

After the student-respondents were determined, they were advised to attend two sessions per week as part of the intervention program. Four mathematics teachers were assigned to introduce basic mathematical concepts. The first four groups of students began the program during the first semester of 2024-2025, and another set of students was assigned during the second semester of the same school year.

The figure below details additional information about the intervention program's timeline.

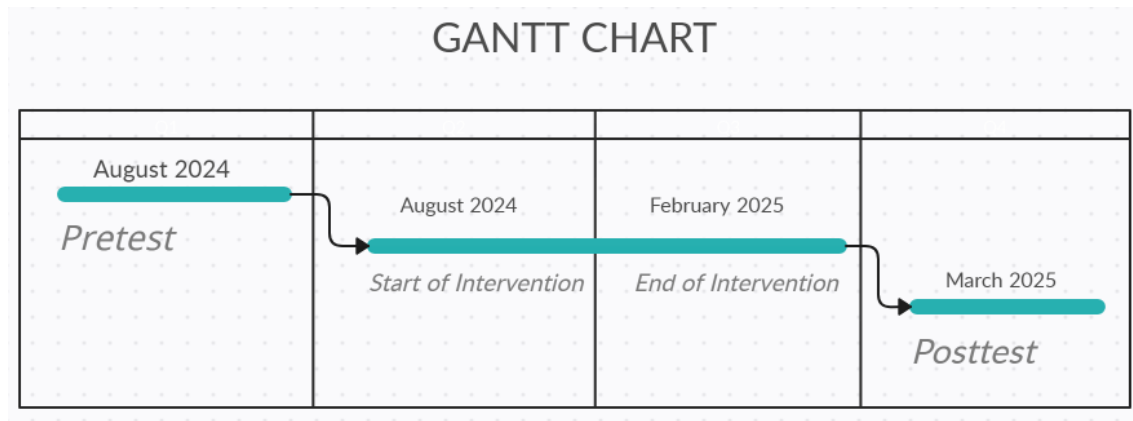


Figure 2. Gantt Chart of the Assess and Assist School-Based Program

The Gantt chart shows the timeline of the school-based intervention program. Before the intervention, activities included preparing and disseminating materials, followed by administering the pretest exam in the first week of August 2024. The following week, data were analyzed, and learners were categorized as non-numerate, emergent, average, or above-average. Learners identified for the intervention provided informed consent in the third week of the same month.

The intervention phase began on August 19, 2024, and continued for two semesters, concluding on February 10, 2025. Posttest materials were disseminated on March 10, 2025, and the post-test was administered on March 12, 2025. The researchers completed data interpretation by March 18, 2025. This systematic timeline ensured that learners' progress could be effectively assessed and evaluated through comparative analysis of pretest and post-test results.

VI. PLANS FOR DISSEMINATION AND UTILIZATION

The researchers are committed to sharing the study's results with participants upon its completion. This ethical commitment ensures that participants are informed about the study's outcomes and their contributions, demonstrating transparency and accountability in conducting the study and upholding participants' rights and well-being.

The study's goal is to evaluate the effectiveness of the school-based program in enhancing senior high school students' numeracy skills. The results may serve as a basis for future research and school policy on students' numeracy skills, as the authors' major objective was to help educators develop such skills.

VII. RESULTS AND DISCUSSION

This section presents the results, analysis, and interpretation of data. The data were examined, analyzed, and organized based on the research questions.

Table I. Frequency Distribution of Pre-Test Scores in Numeracy Exam

Levels	Frequency	Percentage
Above Average Numerate (AAN)	207	12%
Average Numerate (AN)	1395	78%
Emergent (E)	131	7%
Non-Numerate (NN)	65	3%
Total	1798	100%

Legend: AAN (31-40), AN (21-30), E (11-20), NN (0-10)

Before the intervention program, the researchers administered the pretest exam in August 2024. As shown in the table, 207 students, or about 12% of both Grade 11 and Grade 12, belonged to the above-average numerate (AAN) level. For average numerate (AN), 1,395 individuals, or around 78% of the sample, belonged to this category. Lastly, 131 and 65 students were in the emergent and non-numerate levels, respectively, comprising about 10% of the targeted sample.

This result formed the basis for the researchers to conduct the school-based program in hopes of enhancing the numeracy level of respondents who fell under the emergent and non-numerate categories, in line with the studies of UNESCO (2021) and Brown et al. (2022), wherein the two lowest levels of numeracy were used as the basis for the targeted sample in implementing the school-based program.

Table II. Frequency Distribution of Post-Test Scores in Numeracy Exam

Levels	Frequency	Percentage
Above Average Numerate (AAN)	1055	65%
Average Numerate (AN)	543	33%
Emergent (E)	26	2%
Non-Numerate (NN)	0	0%
Total	1624	100%

Legend: AAN (31-40), AN (21-30), E (11-20), NN (0-10)

After the consistent intervention program and midyear report, the researchers administered the posttest in the first week of March 2025. The second table demonstrates a significant shift in the frequency distribution across numeracy levels. Notably, 1,055 students, or approximately 65% of the sample, scored between 31 and 40, indicating an above-average numerate level. Meanwhile, 543 learners, representing 33% of the sample, scored between 21 and 30, placing them in the average numerate category. Only 26 students, accounting for 2% of the sample, received scores between 11 and 20, identifying them as emergent numerates. Remarkably, no students were classified as non-numerate in the posttest results, consistent with OECD (2023).

Table III. Test of Difference Between The Pre-Test and Post-Test Scores of the Respondents in Numeracy Exam

Pair	Mean Diff.	Std. Dev.	Std. Error Mean	95% CI Lower	95% CI Upper	t	df	Sig. (2-tailed)
Pretest - Posttest	-12.38776	8.33729	.59552	-13.56224	-11.21327	-20.802	195	.000

Legend: $p\text{-value (Sig)} < 0.05$ = significant; $p\text{-value (Sig)} > 0.05$ = not significant

The paired-samples t-test results indicate that the school intervention program significantly enhanced students' numeracy skills. The mean difference of -12.39, with a 95% confidence interval ranging from -13.56 to -11.21, suggests a substantial improvement in posttest scores compared to pretest scores. The t-value of -20.80, with 195 degrees of freedom, and a highly significant p-value ($p < .001$) provide strong evidence against the null hypothesis and support the intervention's effectiveness. These findings suggest that the program had a meaningful impact on student learning, likely addressing key numeracy challenges and promoting skill development. The large effect size implied by the t-statistic also highlights the practical significance of the results, which is particularly important for educational decision-making.

Such outcomes align with previous studies demonstrating the effectiveness of targeted educational interventions in enhancing student learning outcomes. For instance, research by Dowker (2009) emphasizes that numeracy interventions, particularly those focusing on foundational arithmetic skills, can significantly improve student performance. Additionally, interventions that incorporate interactive and individualized learning approaches tend to yield better results (Steenbergen-Hu & Cooper, 2013). The substantial gains observed in the current study suggest that the intervention was well-structured and responsive to students' needs. The results further indicate a notable improvement, with a mean difference of 12.39 points. This suggests a practically significant effect, with Cohen's d calculated at approximately 1.49. According to Cohen (1988), an effect size of 0.8 or higher is considered large, further supporting the program's effectiveness. This finding is consistent with prior meta-analyses of mathematics interventions, which report effect sizes ranging from 0.5 to 1.5 for programs targeting foundational numeracy skills (Hattie, 2009; Slavin & Lake, 2008). These results reinforce the intervention's role in enhancing numeracy competence among students, particularly those initially identified as emergent and non-numerate.

VIII. CONCLUSIONS

The following statements summarize the salient findings of this study relative to its research goals.

1. The Assess and Assist Program was successfully implemented by the teachers and administrators through assessing students' level of numeracy skills, training teachers, providing reliable learning materials, and conducting continuous progress monitoring.
2. Most student-respondent scores were under the average numerate level at pretest and shifted to the above-average numerate level at posttest.
3. Students' numeracy skills significantly increased after the intervention program, as evidenced by the dependent-sample t-test result, with a value less than 0.05 on a two-tailed test.
4. The effect size was large, with a Cohen's d value of approximately 1.49.

IX. RECOMMENDATIONS

Based on the salient findings of the study, the following recommendations are drawn.

1. The success of the Assess and Assist Program suggests that schools should consider integrating similar interventions into their curricula, particularly for students struggling with numeracy. Regular pre- and post-assessments can help monitor progress and adjust instructional strategies.
2. The results support assistive programs, especially in early education, where foundational numeracy skills predict later academic success. Policymakers could use this evidence to advocate for funding such initiatives.
3. While the t-test shows a significant improvement, it does not identify which components of the program (e.g., assessment, tutoring, or materials) drove the change. Future studies could use experimental designs (e.g., control groups) or qualitative methods to explore these factors.
4. The researchers recommend developing competency-based assessment tools and learning materials for SHS.
5. Further research could explore longitudinal methods to observe long-term retention of numeracy skills and investigate the program's impact on different demographic groups to refine and enhance its effectiveness.

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