SMART-ARAL Program: A Mathematics Intervention for Senior High School Learners

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ABSTRACT

This action research evaluated the effectiveness of the SMART-ARAL Program as a math intervention for Grade 11 non-numerate learners at Luis Y. Ferrer Jr. Senior High School. The objectives were to measure proficiency before and after the intervention, assess improvement, identify challenges, and suggest program improvements. A quasi-experimental pretest–posttest design was used. Twenty-six learners were purposively selected from the TVL and HUMSS strands. The six-week intervention used modules, peer tutoring, guided practice, and weekly tests. Quantitative data were analyzed using means, standard deviations, and paired-sample t-tests. Qualitative data from focus group discussions were analyzed thematically. Results showed mean scores rose from 6.96 (pretest) to 19.85 (posttest). Statistical analysis confirmed a significant increase in the score, with a large effect size (Cohen's d = 3.13), reflecting improved numeracy. Challenges included time constraints, limited resources, inconsistent attendance, learning gaps, and external barriers. The study concludes that SMART-ARAL is an effective, structured mathematics remediation program. The following recommendations are made: (1) Implement the SMART-ARAL program at all grade levels where students require mathematics remediation; (2) Increase the length and number of intervention sessions to address learning gaps more thoroughly; (3) Provide additional funding for instructional materials and professional development for teachers involved in the program; (4) Integrate interactive and adaptive teaching methods, such as technology-assisted lessons and individualized practice, to cater to diverse learner needs; and (5) Conduct future studies using larger participant groups and track students' progress over extended periods to strengthen the evidence on program efficacy.

Keywords: Mathematics Intervention, Learning Recovery, Numeracy Skills, Mathematics Education, Remediation

INTRODUCTION

Education systems worldwide are assessed through International Large-Scale Assessments (ILSAs) such as PISA and TIMSS, which emphasize problem-solving, critical thinking, and the application of knowledge in real-life contexts. In PISA (2018, 2022) and TIMSS (2019), Filipino students scored well below the OECD average, particularly in math and science, ranking among the lowest globally. This reflects issues with curriculum alignment, teacher preparation, and resources. The National Achievement Test (NAT) also indicates a continued decline in math proficiency, highlighting weak basic skills, low confidence, and limited practice in higher-order thinking. Despite reforms such as the ARAL Program under Republic Act No. 12028, low scores suggest schools require targeted interventions. This global-to-local view underscores the need for classroom action research, such as the SMART-ARAL Program, to strengthen basic numeracy, foster problem-solving and critical thinking, and promote lifelong learning and competitiveness.

Moreover, the Second Congressional Commission on Education (EDCOM II) has described Philippine education as being at a "critical juncture," calling for a decade of sustained reforms. Its recommendations emphasize improving teacher quality, strengthening assessment practices, and addressing "mass promotion" policies that compromise learning standards. These findings reveal a research gap: while national reforms are being proposed, there is limited classroom-based evidence on effective remediation strategies that directly address learners' mathematics difficulties. Investigating and documenting classroom-level interventions to improve mathematics learning is urgently needed to inform and enhance ongoing reforms.

At the school and classroom level, teachers face the immediate challenge of addressing diverse learner needs in mathematics. Diagnostic tools such as the Division Numeracy Assessment (DNA) reveal that 491 out of 2021 learners are considered non-numerate, which implies that 24.29% of grade 11 learners of Luis Y. Ferrer Jr. Senior High School lack mastery of basic numeracy skills, hindering their ability to engage with advanced concepts. Current remediation programs often rely on generic approaches, yet there is a lack of contextualized, evidence-based action research demonstrating how targeted interventions can close learning gaps. The SMART-ARAL Program, designed as a structured remediation strategy, provides an opportunity to test and evaluate a localized intervention that directly responds to learners' needs.

Although national programs like ARAL offer a plan for learning recovery, there is little clear proof about how well school-based, tailored approaches work to close math skill gaps. Few studies have carefully examined how active learning, peer collaboration, and step-by-step support affect high school students' math performance. This study fills that gap by checking how well the SMART-ARAL Program improves math skills, student involvement, and teacher views. By providing evidence from schools, the research adds to the discussion on how local efforts can support national recovery programs and help the Philippines do better in future International Large-Scale Assessments (ILSAs).

This study aims to evaluate the effectiveness of the SMART-ARAL Program in improving the mathematical proficiency of grade 11 Senior High School students of Luis Y. Ferrer Jr. Senior High School. Specifically, it aims to answer the following questions:

1. What is the level of students' mathematical proficiency before and after the implementation of the SMART-ARAL intervention program?

2. Is there a significant improvement in students' mathematics performance after being subjected to the SMART-ARAL Program?

3. What challenges are encountered during the implementation of the intervention?

4. What improvements or adjustments can be recommended to strengthen the SMART-ARAL Program for future implementation?

The results of this study will provide useful ideas for school leaders, teachers, and policymakers. On a large scale, it will match global efforts to ensure fair learning recovery. On a smaller scale, the results will benefit the Department of Education's goal to improve math teaching and raise the Philippines' scores in International Large-Scale Assessments (ILSAs). At the school level, it will help Luis Y. Ferrer Jr. Senior High School use proven methods that build student confidence, strength, and lasting success in mathematics.

METHODOLOGY

Study design

This research used a quasi-experimental design. A pre-test and post-test were used to evaluate the effectiveness of the SMART-ARAL Program in improving mathematics proficiency among Grade 11 learners. Thus, a group of learners requiring remediation was purposively selected, and their performance was assessed before and after the intervention. This method permits evaluation of the causal effects of the SMART-ARAL Program on learner outcomes. Moreover, randomization may disrupt school schedules or prevent struggling students from receiving the support they need. The design is consistent with the repetitive cycle of action research: plan, act, observe, and reflect, facilitating improvement and generating evidence of effectiveness.

Participants of the Study

The intervention specifically targets learners with clear gaps in numeracy skills, who were considered non-numerate from the results of the division numeracy assessment given during the opening of the classes. A purposive sampling was used to select those most in need of support in mathematics. The participants were

composed of twenty-six (26) Grade 11 learners of Luis Y. Ferrer Jr. Senior High School from the TVL track and academic track under the HUMSS strand. These participants were identified as batch 1 and voluntarily consented by their guardians to attend the SMART-ARAL Intervention program from July 2025 to October 2025.

Data Gathering Procedure

The SMART-ARAL Program intervention was implemented for six (6) weeks to Grade 11 students identified as non-numerate in Mathematics. The program started with a diagnostic assessment using the division's Numeracy Assessment (DNA) to identify specific learning gaps. This was followed by weekly SMART-ARAL sessions focused on priority learning competencies identified. The sessions used simplified, contextually aligned modules aligned with the Department of Education's Most Essential Learning Competencies (MELCs). Peer tutoring and guided practice were also employed to promote collaborative learning and enhance student confidence. Formative assessments and feedback were provided to monitor progress and adjust instruction accordingly. A post-test was administered after the six-week program implementation.

The study used quantitative and qualitative data to identify learners' performance and engagement during the SMART-ARAL Program. For the quantitative data, a validated division numeracy assessment for pre-test was used to establish baseline proficiency. After six weeks of implementation, a post-test was given to measure improvement. Likewise, weekly formative assessments were given to monitor the learners' progress and to provide feedback. For the qualitative data, seven (7) teachers and five (5) selected learners participated in a focus group discussion to share insights into challenges they encountered during the implementation of the SMART-ARAL program.

Data collection followed an organized process consistent with established educational research practices (Creswell, 2018). First, participants were identified through the Division Numeracy Assessment (DNA) and were purposively selected for participation. A pre-test was administered to determine their initial proficiency levels. The SMART-ARAL Program was implemented over six weeks, during which weekly formative assessments and classroom observations were conducted to monitor learners' progress. After the intervention, a post-test was administered to measure changes in mathematical proficiency. Concurrently, a focused group discussion with teachers and selected learners was conducted to capture qualitative insights. All data was collected ethically, ensuring informed consent, confidentiality, and voluntary participation.

Data Analysis Plan

1. Quantitative Data Analysis

In determining the SMART-ARAL Program's effectiveness in improving mathematics proficiency, the study used descriptive and inferential statistics. Mean, percentage, and standard deviation were used to summarize learners' pre-test and post-test scores. A paired t-test was used to assess if the scores in the pretest and posttest were statistically significant. This test compared two related samples, the same learners before and after the intervention, to determine whether the program had a measurable impact. Statistical computations were done using the Jamovi application.

2. Qualitative Data Analysis

Qualitative data were gathered from focused group discussions and were analyzed thematically. The data was coded to identify patterns, themes, and categories related to learner engagement, instructional challenges, and teacher perceptions. The analysis used Braun and Clarke's (2006) six-phase approach: familiarization, generating codes, searching for themes, reviewing themes, defining themes, and reporting.

RESULTS AND DISCUSSION

The data gathered to answer research questions 1 and 2 were presented in Table 1 and discussed in the text. The data gathered to answer research questions 3 and 4 were clustered into themes.

Table 1. Pretest and Posttest Results of the recipients in the SMART-ARAL Program

	N	Mean (M)	Standard Deviation (SD)	Cohen's d	Two-Tailed (df = 25, α = 0.05)	
					test statistic	P-value
Pretest	26	6.96	1.51	3.13	-16.0	< 0.001
Posttest	26	19.85	4.10			

Table 1 presents learners' performance on the pretest and posttest before and after the SMART-ARAL program. The mean pretest result of 6.96 is significantly low for a 40-item test, which led to classifying them as non-numerates. The post-test mean score of 19.85 suggested a learner's improvement in mathematics after attending the intervention program. The standard deviation for pre-test and post-test was 1.51 and 4.10, respectively, which indicates that a greater variability in learners' performance was observed after the intervention. This may indicate that while most learners benefited, individual differences in learning pace and comprehension became more evident. Furthermore, the paired-samples t-test exhibits a test statistic of -16.0 with 25 degrees of freedom. The associated p-value was less than 0.001. This result shows a statistically significant difference between pretest and posttest scores at the 0.05 level. Moreover, the effect size, Cohen's d = 3.13, is very large by accepted criteria (Cohen, 1988). These results implied that the intervention conducted for non-numerate learners indicated an improvement in their mathematics proficiency level. The result of the SMART-ARAL intervention program conducted was supported by the study conducted by Munda, Endrinal, and Nequinto (2024). The findings demonstrate that structured mathematics intervention programs can effectively improve numeracy skills and overall academic performance.

Challenges encountered in the implementation of the SMART-ARAL Program.

Based on the qualitative data gathered from focused group discussions, the following themes were identified:

Time and scheduling constraints

This theme reflects the limited duration of sessions, overlapping academic demands, and tight schedules that hindered full participation and comprehension.

As mentioned by Lecturer 1, "One of the main challenges encountered during the implementation of Project SMART-ARAL was that the sessions needed more time." Student 3 shared, "Naging hamon sa akin ang kakulangan sa oras dahil may iba pang school activities." Lecturer 2 also mentioned, "During the implementation of SMART-ARAL, some challenges encountered included limited time to complete activities and difficulty in maintaining active participation among all members." Student 5 agreed, "Well, based on what I remember, it's just probably the time management since we had online class and also need to attend to that SMART program."

Resource limitations

These challenges experienced by the lecturers include the lack of instructional materials, budget, manpower, and classroom availability, which affect the consistency and quality of delivery. Lecturer 3 emphasized, "The challenge was limited resources, including time, budget, and manpower. Likewise, Lecturer 4 added, "The challenges I encountered during the implementation of Project SMART-ARAL were the availability of the room."

Student engagement and attendance

This theme captures the issues such as absenteeism, inconsistent participation, and reluctance to join, often influenced by perceptions of the program as an added burden. Lecturer 5 shared, "Absenteeism of the identified recipients, instructional materials, availability of classrooms, shifting schedules of students and lecturers." Student 2 also observed, "The students weren't consistent in attending the SMART." Lecturer 4 also mentioned the same challenge about "the willingness of the learners to attend the program." Lecturer 7 added that "The

participation of the student, they don't want to join the intervention, they see as an extra task to be accomplished, despite the good intentions of the teachers to help the learners."

Learning gaps and academic challenges

This highlights the diverse mathematical backgrounds of learners, making it difficult to address foundational gaps and maintain differentiated pacing. According to Lecturer 6, "Varied learning gaps, pacing, and differentiation are the challenges that I believe I have encountered during the implementation of SMART-ARAL. Due to a diverse learning environment and sometimes multiple foundational gaps in their mathematical learning, it is challenging to address all needs simultaneously." Student 4 also stated, "Mahirap lang dahil pumapasok kami para dito at matuto ng mga hindi namin naiintindihang lessons."

External and contextual barriers

This theme encompasses transportation difficulties, parental resistance, and other school activities that compete with SMART sessions. Student 3 revealed, "Minsan din nagkakaroon ng problema sa pamasahe papunta school kaya nahihirapan akong makasabay agad sa mga Gawain." Similarly, Lecturer 7 stated "Some parents don't allow the learners, they even argue that why is their child should join the project smart." Student 1 also emphasized this challenge: "Overlapping with other school activities."

Improvements and adjustments to strengthen the SMART-ARAL Program for future implementation.

The focus group discussion identified the need for improvements and adjustments to better address learners' requirements.

Interactive and engaging instruction

The major finding from the data gathered is the need for more interactive and engaging teaching. Participants in the FGD suggest using games, group work, hands-on activities, and technology like math software and video lessons. Lecturer 2 said, "Create actively captivating activities for the students," and Student 2 said, "Make the class more interactive." These comments show that learners believe active participation is crucial for effective learning. This fits with constructivist ideas, which say that people learn best through direct involvement and social interaction (Vygotsky, 1978). Using a variety of teaching methods in Project SMART could improve student understanding and motivation.

Improved time allocation and scheduling

Time constraints were a major challenge. Participants said the remediation period was too short. Lecturer 1 said, "More time for execution of the remediation. I think once a week is not enough to implement the project." This shows the need for longer, flexible schedules. Effective time management helps learners master material and avoid overload (Bloom, 1968). Adjusting schedules could improve attendance and learning.

Orientation, clarity, and consistency

Participants want clear instructions and consistent teaching. Lecturer 3, "Provide clearer instructions and proper orientation before starting the project." Student 1 noted a drop in teaching quality at the end: "I just hope they teach more good from first to last." These comments highlight that strong orientation and steady teaching are important throughout the program. Clear guidelines and consistent delivery reduce confusion, build learner confidence, and ensure fair experiences (Biggs & Tang, 2011).

Resource provision and infrastructure

Adequate resources and infrastructure are essential to improving Project SMART. Suggestions include increasing the budget, staff, and materials, and securing dedicated classrooms. Lecturer 4 stated, "Providing adequate resources and support, such as sufficient time, budget, and manpower…" This shows educational

programs require system-wide support. When resources are available, teachers can focus on teaching instead of logistics, which helps sustain the program (Fullan, 2007).

Student motivation and inclusion

Student motivation and inclusion appeared as a major theme. Participants recommended inviting guest speakers, adapting activities to accommodate different learning styles, and making the program mandatory. For example, student 3 said, “May we invite lecturers, if possible,” and Lecturer 5 observed, “Since learners have multiple intelligences…” These statements highlight the need for inclusive, motivating, and contextually relevant interventions. Using motivational strategies and varied instruction increases engagement and fairness (Gardner, 2011).

CONCLUSION

Based on the results of the study, the following conclusions were drawn:

1. Before the implementation of the SMART-ARAL Program, the learners showed a below-average level of performance in the division's numeracy assessment, categorizing them as non-numerate.

2. After the implementation of the SMART-ARAL Program, the learners exhibited significant improvement in their mathematics performance.

3. The study clearly showed that learners improved significantly after the intervention, with a large effect size (Cohen’s d = 3.13) and meaningful gains in post-test scores.

4. The SMART-ARAL Program significantly improved learners’ mathematics proficiency, showing that localized, structured interventions can effectively close numeracy gaps.

5. School-based remediation, supported by adequate resources and active engagement, can effectively complement national reforms to facilitate student learning recovery.

RECOMMENDATION

Based on the conclusion of the study, the following recommendations were drawn:

1. Make the SMART-ARAL program a regular part of math support, given its impact on test scores.

2. Increase the number of days for implementation and duration of help sessions, create flexible schedules, and ensure adequate materials, funding, and staffing.

3. Provide a clear introduction for students and parents outlining specific goals, expected benefits, and measurable results.

4. Advise monitoring attendance and progress, and recommend motivational strategies such as praise, certificates, and timely feedback to encourage sustained participation.

5. Make lessons interactive and student-focused by incorporating group problem-solving, games, real-life tasks, and technology.

6. Conduct long-term studies to measure skill growth over time.

7. Use larger or comparison groups to strengthen the results.

8. Expand the program to additional grade levels and increase student participation.

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