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Effectiveness of a Rapid Math Assessment (RMA)-Based Intervention Program on the Numeracy Performance of Key Stage 2 Learners of Mahogany Integrated School, Lingig II District, Division of Surigao del Sur: A Quasi-Experimental Study

Mary Ann Morata-Portillo[1*], Rio S. Consigna[2,2] and Juliet C. Burgos[2,3]
[1]*Mahogany Integrated School, Lingig II District, Surigao del Sur Division,*
[2]*Andres Soriano Colleges of Bislig*
[*]*mary.portillo@deped.gov.ph*, [2]*rioconsign82@gmail.com*, [3]*consignajuliet122@gmail.com*

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ABSTRACT

This study determined the effectiveness of a Rapid Math Assessment (RMA)-Based Intervention Program on the numeracy performance of Key Stage 2 learners at Mahogany Integrated School, Lingig II District, Division of Surigao del Sur. It examined learners' performance before and after the intervention in number sense and place value, basic operations, fractions and decimals, and problem-solving skills, and identified the numeracy domain that showed the greatest improvement. The study used a quantitative quasi-experimental one-group pretest-posttest design. Sixty Key Stage 2 learners from Grades 4, 5, and 6 were included through total enumeration. The Rapid Mathematics Assessment served as the diagnostic and outcome measure. Data were analyzed using mean, standard deviation, paired samples t-test, and mean gain scores. Findings showed that learners' overall pretest Mean Percentage Score was 42.16, interpreted as Emerging/Low. After the intervention, the overall posttest Mean Percentage Score increased to 54.94, interpreted as Developing. The paired samples t-test showed a statistically significant improvement in numeracy performance, $t(59) = 5.06$, $p < .001$, with a moderate practical effect (Cohen's $dz = 0.65$). The greatest improvement was observed in Fractions and Decimals, with a gain of 18.71 percentage points, followed by Problem-Solving Skills with a gain of 15.05. However, Number Sense and Place Value remained the weakest domain and requires further targeted intervention. The study concluded that the Rapid Math Assessment-Based Intervention Program was effective in improving the numeracy performance of Key Stage 2 learners. The findings emphasize the value of assessment-based intervention, differentiated instruction, continuous numeracy monitoring, and sustained school support in addressing foundational mathematics learning gaps.

Keywords: *Rapid Math Assessment, numeracy performance, intervention program, Key Stage 2 learners, quasi-experimental study, mathematics intervention*

INTRODUCTION

Numeracy is a fundamental component of basic education because it enables learners to understand, interpret, and apply mathematical concepts in real-life contexts. It includes number sense, computation, reasoning, and problem-solving skills that support learning across grade levels and prepare learners for more advanced

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mathematical tasks. In elementary education, numeracy development is especially important because early gaps in foundational mathematics often become more difficult to address as learners progress to higher grade levels.

Despite its importance, numeracy remains a persistent challenge in many educational systems. International and local studies have reported that many elementary learners struggle with foundational mathematics, including number relationships, basic operations, fractions, decimals, and multi-step problem solving. These difficulties are linked with wider concerns in mathematics performance, learning poverty, and the need for sustained remedial support in schools (OECD, 2023; World Bank, 2022).

Diagnostic assessment has been widely recommended as a practical mechanism for identifying learners' strengths and weaknesses in mathematics. When teachers have timely information about learners' current competencies, they can design targeted remediation and intervention activities instead of using generic instruction. In this context, the Rapid Math Assessment (RMA) is useful because it provides quick information on learners' numeracy levels and helps teachers determine which mathematical competencies need focused support.

The need for assessment-based intervention is particularly relevant in Key Stage 2, which covers Grades 4, 5, and 6. At this level, learners move from basic arithmetic toward more complex concepts such as fractions, decimals, measurement, data interpretation, geometry, and problem solving. If learners fail to master foundational numeracy skills at this stage, they may continue to experience difficulty in later mathematics topics.

At Mahogany Integrated School in Lingig II District, Division of Surigao del Sur, classroom observations and school-based assessments indicated that several Key Stage 2 learners needed additional support in essential numeracy domains. In response, this study examined the effectiveness of a Rapid Math Assessment-Based Intervention Program designed to address identified learning gaps through targeted instructional activities.

The study specifically aimed to determine the learners' numeracy performance before and after the implementation of the intervention program, determine whether there was a significant difference between pretest and posttest scores, and identify the numeracy domain that showed the greatest improvement. The null hypothesis stated that there was no significant difference between the pretest and posttest numeracy performance of Key Stage 2 learners after the implementation of the intervention program.

Literature Review

Numeracy Performance and Foundational Mathematics

Numeracy refers to the ability to understand and use mathematical ideas in academic and real-life situations. It includes the ability to reason quantitatively, compute accurately, interpret mathematical information, and solve problems. In elementary education, numeracy is commonly assessed through number sense and place value, basic operations, fractions and decimals, and problem-solving skills. These domains represent the foundational competencies that learners must acquire before they can succeed in higher-level mathematics.

Number sense and place value are central to mathematical understanding because they allow learners to recognize number relationships, determine magnitude, decompose numbers, and understand the value of digits within the number system. Powell and Nelson (2021) emphasized that learners with strong number sense are more capable of estimating, reasoning, and solving mathematical problems. Diagnostic assessments in this domain help teachers identify misconceptions that may limit learners' progress in computation and problem solving (Fuchs et al., 2021). Basic operations are equally important because addition, subtraction, multiplication, and division serve as the foundation for later mathematics learning. Weakness in these skills may affect learners' ability to work with fractions, decimals, measurement, algebraic reasoning, and word problems. Studies in mathematics education emphasize that computational fluency should be supported by conceptual understanding rather than simple memorization of procedures (Gersten et al., 2021; Rittle-Johnson et al., 2021).

Fractions and decimals are often considered among the most difficult topics in elementary mathematics. Learners must understand part-whole relationships, equivalence, magnitude, and the connection between fractions, decimals, and operations. Previous research has shown that learners who lack conceptual understanding in this area often struggle with proportional reasoning and later algebraic concepts (Lamon, 2020; Siegler et al., 2020). Problem-solving skills require learners to apply mathematical concepts to unfamiliar situations. This

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domain involves reading comprehension, reasoning, selection of strategies, and interpretation of results. Schoenfeld (2020) noted that mathematical problem solving develops when learners are given opportunities to reason, explain, and apply concepts meaningfully. Therefore, intervention programs should not only focus on computation but also on mathematical reasoning and application.

Diagnostic Assessment and RMA-Based Intervention

Diagnostic assessment is essential in mathematics instruction because it allows teachers to determine what learners already know and which skills require remediation. Fuchs, Fuchs, and Malone (2021) explained that diagnostic mathematics assessments help identify specific learning difficulties and guide targeted intervention. Assessment-based instruction ensures that remediation is aligned with actual learner needs rather than assumptions about class performance.

The Rapid Mathematics Assessment supports this purpose by providing teachers with quick evidence of learners' numeracy levels. DepEd Memorandum No. 373, s. 2024, emphasizes the administration of RMA as a mechanism for identifying foundational mathematics competencies and guiding appropriate remediation. In the Philippine context, this aligns with DepEd's broader efforts to strengthen foundational literacy and numeracy and address learning gaps among elementary learners (Department of Education, 2022).

Research in Southeast Asia also supports the use of assessment-based interventions. Ng and Lee (2022) found that formative assessment improved learners' understanding of mathematics in Singapore classrooms, while Putri, Zulkardi, and Hartono (2021) showed the value of contextualized mathematics instruction in improving number operations. SEAMEO and UNICEF (2020) likewise emphasized that early identification of learning gaps is critical for improving foundational learning in the region.

In the Philippines, numeracy intervention is increasingly important due to persistent challenges in mathematics achievement. The PISA 2022 results highlighted continuing concerns in mathematical literacy among Filipino learners (OECD, 2023). Similarly, studies on learning loss and learning poverty in the Philippines point to the need for stronger school-based interventions, teacher support, and sustained monitoring of foundational competencies (Orbeta et al., 2021).

Synthesis

The reviewed literature consistently shows that foundational numeracy skills are essential for learners' academic progress. Number sense, basic operations, fractions and decimals, and problem-solving skills are interconnected domains that require continuous assessment and targeted instruction. Diagnostic tools such as the Rapid Math Assessment provide teachers with evidence for designing interventions that address specific learning gaps. However, local evidence on the effectiveness of RMA-based intervention programs remains limited, especially in geographically isolated or rural school settings. This study addresses this gap by examining the effect of an RMA-based intervention on the numeracy performance of Key Stage 2 learners at Mahogany Integrated School.

METHODS

Research Design

This study employed a quantitative quasi-experimental research design, specifically the one-group pretest-posttest design. This design was appropriate because the study measured the numeracy performance of the same group of learners before and after the implementation of the Rapid Math Assessment-Based Intervention Program. A control group was not used because the study was conducted within an authentic school setting and involved all learners in the identified grade levels.

The pretest determined the baseline numeracy performance of the learners. Based on the pretest results, the intervention program was implemented to address identified learning gaps. The posttest was then administered to determine changes in numeracy performance. The difference between the pretest and posttest scores served as the basis for determining the effectiveness of the intervention program.

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Research Locale

The study was conducted at Mahogany Integrated School, located in Sitio Mahogany, Lingig II District, Municipality of Lingig, Surigao del Sur, Caraga Region, Philippines. The school was selected because of the observed need to strengthen numeracy competencies among Key Stage 2 learners and because it provided a relevant setting for implementing a school-based mathematics intervention program.

Figure 1. *Map showing the location of Surigao del Sur in the Philippines*

Figure 2. *Map showing the Municipality of Lingig in Surigao del Sur*

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Respondents and Sampling Technique

The respondents consisted of 60 Key Stage 2 learners from Grades 4, 5, and 6 of Mahogany Integrated School. Total enumeration sampling was used because the population was relatively small and the study intended to include all learners from the identified grade levels. The respondents included 20 Grade 4 learners, 28 Grade 5 learners, and 12 Grade 6 learners.

Table 1. *Distribution of Respondents by Grade Level*

Key Stage 2	Population	Sample Size
Grade 4	20	20
Grade 5	28	28
Grade 6	12	12
Total	60	60

Research Instrument

The primary research instrument was the Rapid Mathematics Assessment (RMA), a diagnostic assessment tool used to determine learners' foundational numeracy competencies. The RMA measured performance in number sense and place value, basic operations, fractions and decimals, and problem-solving skills. It was administered as a pretest before the intervention and as a posttest after the intervention.

Data Collection Procedure

The researcher secured permission from the school and coordinated the implementation of the assessment and intervention activities. The RMA pretest was administered to determine baseline numeracy performance. The results were analyzed to identify learning gaps and served as the basis for the RMA-Based Intervention Program. After the intervention sessions, the same group of learners took the RMA posttest. The pretest and posttest scores were recorded, organized, and analyzed. Learner information was treated confidentially and used only for research purposes.

Data Analysis

Mean and standard deviation were used to describe the pretest and posttest numeracy performance of the learners. A paired samples t-test was used to determine whether there was a significant difference between pretest and posttest scores. Mean gain scores were computed to identify which numeracy domain showed the greatest improvement. The hypothesis was tested at the 0.05 level of significance.

Ethical Consideration

The study observed ethical procedures by securing permission from the school and ensuring that the gathered data were used solely for academic and research purposes. Learners' identities and scores were treated with confidentiality. The intervention was educational in nature and was designed to support, rather than disadvantage, the participating learners.

RESULTS AND DISCUSSION

Profile of Learners Included in the Analysis

The analysis was based on 60 matched Key Stage 2 learners from Grades 4, 5, and 6. Learners were matched using their Learner Reference Number, and scores were converted to Mean Percentage Score to allow fair comparison across grade levels.

Table 2. *Profile of Learners Included in the Analysis*

Grade Level	Number of Learners
Grade 4	20
Grade 5	28
Grade 6	12
Total	60

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Pretest Numeracy Performance of Key Stage 2 Learners

Before the implementation of the intervention program, learners had generally low numeracy performance. The overall pretest MPS was 42.16 with a standard deviation of 14.96, interpreted as Emerging/Low. Among the domains, Problem-Solving Skills obtained the lowest MPS of 38.45, indicating difficulty in applying mathematical concepts to word problems, reasoning tasks, and practical situations. Fractions and Decimals obtained an MPS of 42.24, while Number Sense and Place Value and Basic Operations obtained 45.83 and 45.93, respectively. These results show that learners needed remediation in both computation and conceptual understanding.

Table 3. *Pretest Numeracy Performance of Key Stage 2 Learners by Domain*

Numeracy by Domain	Pretest MPS	SD	Interpretation
Number Sense and Place Value	45.83	23.45	Emerging/Low
Basic Operations	45.93	23.90	Emerging/Low
Fractions and Decimals	42.24	25.60	Emerging/Low
Problem-Solving Skills	38.45	18.03	Emerging/Low
Overall	42.16	14.96	Emerging/Low

Posttest Numeracy Performance of Key Stage 2 Learners

After the implementation of the Rapid Math Assessment-Based Intervention Program, learners' overall numeracy performance increased to 54.94 MPS with a standard deviation of 14.73, interpreted as Developing. The strongest posttest domain was Fractions and Decimals with an MPS of 60.95, followed by Basic Operations with 58.71 and Problem-Solving Skills with 53.50. These results indicate that the intervention helped learners improve in computational procedures, fraction and decimal concepts, and applied problem-solving tasks. However, Number Sense and Place Value remained low with an MPS of 40.97, suggesting the need for more focused reinforcement in number relationships and place value concepts.

Table 4. *Posttest Numeracy Performance of Key Stage 2 Learners by Domain*

Numeracy by Domain	Posttest MPS	SD	Interpretation
Number Sense and Place Value	40.97	36.86	Emerging/Low
Basic Operations	58.71	21.10	Developing
Fractions and Decimals	60.95	21.00	Developing
Problem-Solving Skills	53.50	17.63	Developing
Overall	54.94	14.73	Developing

Distribution of Learners by RMA Proficiency Level

The proficiency distribution showed a clear positive movement after the intervention. Before the intervention, 25 learners, or 41.7%, were in the two emerging categories. After the intervention, only 3 learners, or 5.0%, remained in the Emerging (Low Proficient) level, and no learner remained in the Emerging (Not Proficient) level. The number of learners in the Transitioning (Proficient) level increased from 2 to 13, while 2 learners reached the At Grade Level (Highly Proficient) category.

Table 5. *Distribution of Learners by RMA Proficiency Level*

RMA Proficiency Level	Pretest F	Pretest %	Posttest F	Posttest %
Emerging (Not Proficient)	6	15.0%	0	0.0%
Emerging (Low Proficient)	16	26.7%	3	5.0%
Developing (Nearly Proficient)	33	55.0%	42	70.0%
Transitioning (Proficient)	2	3.3%	13	21.7%
At Grade Level (Highly Proficient)	0	0.0%	2	3.3%
Total	60	100.0%	60	100.0%

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Significant Difference Between Pretest and Posttest Performance

The paired samples t-test showed a statistically significant increase in numeracy performance after the implementation of the RMA-Based Intervention Program, $t(59) = 5.06$, $p < .001$. Since the p-value was below the 0.05 level of significance, the null hypothesis was rejected. The mean gain of 12.78 percentage points indicates that learners' numeracy performance improved after the intervention. The effect size, Cohen's $dz = 0.65$, suggests a moderate practical effect.

Table 6. *Paired Samples t-Test on Pretest and Posttest Numeracy Performance*

Test	N	Mean MPS	SD
Pretest	60	42.16	14.96
Posttest	60	54.94	14.73
Mean Gain	60	12.78	19.55

Table 7. *Hypothesis Test Result*

Statistical Test	Value
t-value	5.06
df	59
p-value	< .001
Cohen's dz	0.65
Decision	Reject H0

Improvement in Numeracy Performance by Domain

The domain with the greatest improvement was Fractions and Decimals, with a gain of 18.71 percentage points. This implies that the intervention was particularly effective in strengthening learners' understanding of fraction and decimal concepts. Problem-Solving Skills ranked second with a gain of 15.05, indicating improved ability to apply mathematical concepts to practical and reasoning-based tasks. Basic Operations improved by 12.78 points. However, Number Sense and Place Value decreased by 4.86 points, indicating that this area requires further targeted intervention.

Table 8. *Improvement in Numeracy Performance by Domain*

Numeracy by Domain	Pretest MPS	Posttest MPS	Gain	Rank
Fractions and Decimals	42.24	60.95	18.71	1
Problem-Solving Skills	38.45	53.50	15.05	2
Basic Operations	45.93	58.71	12.78	3
Number Sense and Place Value	45.83	40.97	-4.86	4

Overall, the findings support the use of diagnostic assessment as a basis for mathematics intervention. The RMA helped identify specific numeracy gaps, while the intervention provided targeted support. The significant improvement in overall performance demonstrates that assessment-based remediation can help strengthen foundational numeracy. However, the weak result in Number Sense and Place Value suggests that some foundational domains require longer intervention, more concrete materials, and repeated practice.

CONCLUSION

The Key Stage 2 learners had low numeracy performance before the implementation of the Rapid Math Assessment-Based Intervention Program. Their overall pretest performance was interpreted as Emerging/Low, with Problem-Solving Skills as the weakest domain. The learners' numeracy performance improved after the implementation of the intervention program. The overall posttest performance increased from 42.16 to 54.94 MPS,

moving from Emerging/Low to Developing. The paired samples t-test confirmed that the improvement in numeracy performance was statistically significant. Therefore, the Rapid Math Assessment-Based Intervention Program was effective in improving learners' numeracy performance. Fractions and Decimals showed the greatest improvement, followed by Problem-Solving Skills and Basic Operations. However, Number Sense and Place Value remained weak and requires further intervention.

The findings affirm the importance of using assessment results to guide instruction. Continuous assessment and targeted intervention are necessary to address learners' specific numeracy gaps and improve mathematics learning outcomes.

Recommendations

Teachers should continue using the Rapid Math Assessment as a diagnostic tool to identify learners' numeracy difficulties, plan intervention activities, group learners according to needs, and monitor progress.

The Rapid Math Assessment-Based Intervention Program should be sustained and strengthened because it helped improve learners' numeracy performance.

More focused intervention should be provided for Number Sense and Place Value. Teachers may use manipulatives, number lines, place value charts, flashcards, mathematical games, and repeated practice to strengthen learners' understanding of number relationships.

Differentiated instruction should be used because learners have different numeracy levels. Struggling learners should receive guided practice, while learners who are improving may be given enrichment activities.

Problem-solving activities should be integrated regularly in mathematics lessons through word problems, situational tasks, and real-life mathematical applications.

School heads should support numeracy intervention programs by providing instructional materials, time for intervention, teacher training, and monitoring mechanisms. Learning Action Cell sessions may also be used to help teachers share strategies and best practices.

Parents and guardians should be encouraged to support numeracy learning at home through simple activities involving counting money, measuring, telling time, comparing quantities, and solving everyday mathematical problems.

Future researchers may conduct similar studies with larger samples, longer intervention periods, additional grade levels, or a control group to strengthen evidence on the effectiveness of RMA-based intervention.

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