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Bridging the Numeracy Gap Through Project Numeracy Skills Observation (NSO) Among Key Stage 1 Learners

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ABSTRACT

This study evaluated the efficiency of Project Numeracy Skills Observed (NSO) in bridging numeracy gaps among Key Stage 1 learners across 18 public elementary schools in the Schools Division of Santa Rosa City during School Year 2025–2026. Employing a mixed-method research design, the study analyzed quantitative assessment data from the Beginning of School Year (BOSY) and End of School Year (EOSY) Rapid Math Assessment (RMA) across a total cohort of 2,264 learners (Grades 1–3). Additionally, a validated survey was administered to Key Stage 1 teachers to evaluate teacher perceptions regarding intervention content, delivery, learner engagement, and outcomes, as well as to gather qualitative information on effective features, challenges, and support needs. Findings indicated remarkable learner progress: the percentage of proficient and highly proficient ("At Grade Level") learners expanded from 17.58% (398 learners) at BOSY to 53.09% (1,202 learners) at EOSY. In comparison, non-proficient ("Emerging") learners dropped significantly from 22.44% (508 learners) to 1.68% (38 learners). Teachers expressed consistently positive perceptions across all evaluated domains, agreeing that the program's content (Mean = 3.34), delivery (Mean = 3.18), learner engagement (Mean = 3.28), and overall outcome impact (Mean = 3.24) were highly beneficial. Hands-on manipulatives, concrete visual aids, learner-centered differentiated instruction, and structured feedback routines were identified as key instructional drivers. Major operational bottlenecks included instructional time constraints, shortages of individual learning tools, extreme learner diversity, chronic absenteeism, and limited home support. The study determined that Project NSO is a highly effective intervention for accelerating foundational mathematical performance. It is recommended that the program be institutionalized and scaled, accompanied by the timely provision of standardized learning toolkits from the Curriculum Implementation Division (CID), continuous pedagogical coaching for early grade Math teachers, schedule optimization, and structured parental engagement activities.

Keywords: *Numeracy Skills, Numeracy Gap, Key Stage 1, Project Numeracy Skills Observed, Rapid Math Assessment*

INTRODUCTION

Numeracy skills are critical to being functionally literate, achieving academic success, and developing lifelong skills important for acquiring, processing, analyzing, and applying data in daily life situations. (Grotlüschen et al., 2020, pp. 127-137) Numeracy skills are the ability to apply, interpret, and communicate mathematical knowledge to solve practical issues. These include the capacity to comprehend addition, subtraction, multiplication, and division in basic math. More sophisticated numeracy abilities

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of Education, Research, and Innovation Perspectives
Volume 2 Issue 8 (August 2026)

include the application of algebraic, statistical, spatial, and graphical concepts as well as the capacity to analyze data and apply it to real-world scenarios (Team, 2026).

In the Philippines, education is always in the headlines because of the status of graduates. According to the Functional Literacy Education and Mass Media Study (FLEMMS) of the Philippine Statistics Authority, in their periodic study, about 18.9 million Filipinos from 2019 to 2024 who completed secondary education are considered "functionally illiterate" (Staff, 2025)

Although there are many efforts by the Department of Education (DepEd), they focus on improving instructional delivery, teacher training, and early language literacy and numeracy. Though there are many studies about Early Numeracy, most are from foreign countries; here in the Philippines, there are very few. Most efforts focus on literacy, including reading in both English and Filipino. Early numeracy remains unexplored in the field of research. (Igarashi & Suryadarma, 2023)

As mentioned in the Commentary on McNeil et al, (2025) by Libertus, M., Arithmetic fluency (Numeracy Skills) is crucial to guarantee learners' success in math. It is up to education leaders, policymakers, teachers, and parents to act on developing learners' fullest potential by strengthening early mathematics foundations, sensemaking, and the home environment to support success in mathematics.

Additionally, this study employs a mixed-method research design to examine the outcomes of rapid math assessments, identify existing gaps, and observe learners' numeracy skills. The findings aim to inform strategies that support teachers in enhancing their students' numeracy skills.

The results of this study are intended to assist the Schools Division of Santa Rosa City, through the Curriculum Implementation Division, in addressing numeracy gaps among public schools and contributing to broader community development.

Literature Review

Foundations of Early Numeracy and Key Interventions

Early numeracy skills constitute an essential basis for a child's scholastic progression, making the elimination of early learning gaps paramount to longitudinal educational success. (Getenet, 2023) According to Garma (2024), adequately addressing numeracy gaps in kindergarten requires executing targeted strategies from an early age. These essential interventions include: Early identification of learning challenges; play-based and bespoke learning approaches; family involvement and neighborhood support; real-life applications and participatory learning technologies; focused professional development for educators; and positive reinforcement strategies. Proactively identifying and addressing these factors during early childhood establishes a solid foundation that empowers children to develop solid mathematical capabilities.

Local Context and Practical Use

Building upon the significance of early intervention, Bustos (2022) and Palomar (2023) emphasize the immediate need to enhance the mathematical skills of Key Stage 1 learners. Results from international assessments disclose that Filipino learners consistently lag, a problem whose roots begin in early childhood. Cultivating mathematical comprehension early in life directly translates to better performance both in school and in daily living. In particular, Palomar (2023) stresses that numeracy is essential for applying mathematical concepts—such as basic arithmetic, problem-solving, and data interpretation—throughout various practical situations.

The Role of the Home Environment and Language Development

Beyond classroom instruction, the home environment plays a vital role in nurturing early mathematical competence. Zippert et al. (2020) highlight that active parental involvement—demonstrated by exposing children to home-based math activities, emphasizing spatial concepts and numerical patterns, and sustaining high expectations for children's math explanations—significantly improves early literacy

ISSN: 3116-3475
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of Education, Research, and Innovation Perspectives
Volume 2 Issue 8 (August 2026)

and numeracy skills. Furthermore, King et al. (2021) demonstrate that success in direct numeracy activities strongly predicts a child's math language acquisition, which in turn directly reinforces early numeracy proficiency.

Differentiating Numeracy from Abstract Mathematics

Although reading is currently a primary focus in early childhood education, Guhl (2019) asserts that early math proficiency is a stronger predictor of overall scholastic achievement through primary school. Consequently, understanding how early arithmetic skills develop and how to teach them effectively is vital for academic success. To improve these instructional strategies, however, it is necessary to distinguish between abstract mathematics and concrete numeracy. As Brown (2015) points out, while both domains are connected, mathematics involves abstract concepts and canonical, simplified problems aimed at finding single correct answers. In contrast, numeracy is concrete and grounded in daily life; it represents the capacity, fluency, and self-assurance to apply mathematical knowledge and procedural skills to open-ended, real-world tasks.

Extended Horizons: Computational and Socioeconomic Impacts

The wider value of numerical reasoning goes beyond early childhood into cutting-edge technological applications and global economic development. Inside computational fields, Haoyang et al. (2025) note that while Large Language Models (LLMs) excel at natural language understanding and generation, they continue to struggle with numerical reasoning problems such as basic arithmetic and magnitude comparison. This limitation occurs because LLMs commonly rely on superficial statistical patterns rather than comprehending numbers as continuous magnitudes, highlighting a need for benchmarks that measure real-world numerical reasoning alongside verbal capability.

On a social level, Liu et al. (2022) illustrate the economic impact of mathematical engagement. Their study shows that a 5% increase in women's wages positively correlates with a one-unit increase in women's engagement in numeracy activities across several middle-income countries. Ultimately, these findings stress the broader significance of enhancing gender equality in skills development to achieve Sustainable Development Goals (SDGs) 4 and 5

Interventions Across Instructional Settings and Learner Needs

To establish an in-depth understanding of mathematical interventions, Svane et al. (2023) conducted a systematic review analyzing randomized controlled math interventions spanning two decades (2001–2021). Their review categorized interventions across the educational spectrum—from early childhood to high school—while examining different targets, such as purely mathematical skills versus integrated academic skills. Ultimately, their work reveals existing knowledge gaps and gives insights into how upcoming interventions can be optimized for skill development throughout diverse settings. Building upon broader instructional settings, research has also focused on focused interventions for specific sub-populations. Focusing on primary school students (ages 5 to 12) with intellectual disabilities, Schnepel and Aunio (2021) systematically reviewed 20 studies. Their findings demonstrated that systematic and explicit instruction—when paired with constructive feedback and manipulatives—yielded high effectiveness.

Furthermore, the authors emphasized that successful interventions are typically well-structured, adapted to individual achievement levels, and call for careful consideration of intensity, including duration and frequency. In a similar vein, Boateng (2024) investigated effective mathematics interventions specifically for low-attaining primary school students (ages 7 to 11) without identified disabilities. Analyzing randomized controlled trials from both the UK and the US, the study revealed that 80% of these interventions yielded positive effects on learning outcomes. These effective programs primarily targeted core competencies such as number sense, calculation fluency, and critical thinking skills, resulting in the identification of nine principal components key for designing successful interventions.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 8 (August 2026)

Specific Intervention Programs and Strategies

Moving from broad systematic reviews to concrete applications, recent literature explores specific strategies and program frameworks created to close numeracy gaps. For instance, Smith (2024) examined the Numeracy Intervention Project, an initiative specifically designed to detect gaps in a student's mathematical learning within a special education setting. Implemented over two weeks, the program utilized a scripted baseline assessment, hands-on manipulatives, and skill-specific activities to target areas of weakness. Complementing these well-structured program designs, a descriptive study explored classroom-level teaching techniques for struggling elementary learners, identifying that students frequently struggle with fractions, decimals, basic operations, and word problem-solving. The study showed that these difficulties frequently stem from weak foundational number sense and poor conceptual understanding. To address these gaps, educators effectively implemented strategies such as visual aids, manipulatives, gamified instruction, peer tutoring, and contextualized learning tasks—all of which greatly improved student involvement and comprehension (Effective educational methods to address numeracy gaps in struggling learners, n.d.).

The persistent existence of early numeracy gaps accentuates the necessity of structured, evidence-based intervention programs designed for individual learning trajectories. Broad systematic evidence confirms that focused interventions significantly improve mathematical outcomes when they combine explicit instruction with diagnostic assessment (Schenepel & Aunio, 2021; Svane et al., 2023). Rather than relying on generic remediation, effective models-such as Catch-Up Numeracy and localized intervention projects-diagnose specific domain deficits in number sense and place value, enabling short, high-frequency instructions customized to individual needs. (Dowker, 2016; Holmes & Dowker, 2013; Smith, 2024.

Research Questions

This study intends to address the numeracy gaps among key stage 1 learners through the project (NSO) Numeracy Skills Observed; specifically, it seeks to answer the following:

1. What are the numeracy skills of the learners before and after the implementation of project NSO?
2. What are the perceptions of the teachers in the implementation of the Intervention Program in terms of:
    a. Content and Materials (The Intervention Design)
    b. Implementation and Delivery
    c. Learner Engagement and Response
    d. Impact on Numeracy Gaps (The Outcomes)
3. What is the perceived most effective feature of Project NSO?
4. What are the perceived issues faced in the implementation of Project NSO?
5. Based on the findings, what recommendations can be proposed to enhance the implementation of Project NSO?

Scope and Limitations

This study focused on addressing the numeracy gaps among Key Stage 1 learners through Project NSO (Numeracy Skills Observed). The researcher used the data gathered during the conduct of BOSY and EOSY for the SY 2025-2026 Rapid Math Assessments to establish the progress in numeracy skills of the learners. The respondents of this study are the key Stage 1 teachers, composed of 40 or 37% Grade 1 teachers, 35 or 32.4% Grade 2 Teachers and 33 or 30.6% Grade 3 teachers; most of them have 11 years and above teaching experience in Key Stage 1 comprise of 73 or 67%, while 28 0r 25.7% have 4-10 years and 8 or 7.3% have 1-3 years teaching experience; and there are 71 0r 65.1% that handles 30-35 learners in the class, 18 or 16.5% have 36-40 learners and 20 or 18.3% handles 41 and above learners in their class.

Selecting an appropriate research design was critical to the success of this project, leading to the adoption of a mixed-method approach. This methodology facilitated the collection of quantitative data through survey questionnaires administered via Google Forms, as well as qualitative insights from teachers'

ISSN: 3116-3475
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of Education, Research, and Innovation Perspectives
Volume 2 Issue 8 (August 2026)

open-ended responses regarding the implementation of the intervention program. The study concentrated on Key Stage 1 learners, recognizing these years as foundational stages and predictors of future success in numeracy. Establishing a strong foundation in numeracy skills enables learners to acquire more advanced mathematical knowledge and competencies. (Ayuman & Jr., 2026, pp. 753-764)

METHODS

Sampling

The respondents of this research are the Key Stage 1 teachers at the school's division of Santa Rosa City from 18 Elementary schools with a total enumeration during the school Year 2025-2026, considering the administration of the Rapid Math Assessment and the implementation of the project NSO Numeracy Skills Observed.

Data Collection

The standard numeracy assessment tool (Rapid Math Assessment) was utilized for Key Stage 1 learners, alongside a researcher-developed survey questionnaire for teachers, which was validated by experts in the field. Permission was obtained from the School Division Superintendent and school heads to administer the survey questionnaire via Google Forms.

Interpretation of the study results was based on comparative analyses of the BOSY and EOSY Rapid Math Assessment outcomes, as well as the survey responses from Key Stage 1 teachers.

Statistical analysis software (JAMOVI) was employed to examine the BOSY 2025–2026 and EOSY 2025–2026 assessment results, as well as the teacher survey data.

Ethical Issues

Permission was sought from the Schools Division Superintendent of Santa Rosa City, where the researcher is working, and from the school heads where the researcher conducted her study. Consent forms from the participants, their parents, and guardians were obtained because this is important to have access and rapport with the vulnerable individuals participating in the study. (Anderson & Spencer, 2002). The consent form included participants' right to withdraw from the study at any time, the main purpose of the study, and the procedures used for data collection. The researcher secured participants' permission for the audio and video recordings of the one-on-one interview conducted for accurate transcription of the responses.

RESULTS AND DISCUSSION

The study sought to understand how numeracy gaps among Key Stage 1 learners were addressed through the project (NSO) Numeracy Skills Observed. The findings are explained in the following:

Table 1. *Learners Assessed as Emerging (Not Proficient) at BOSY and EOSY 2025-2026 by Grade Level*

Grade level	Total enrollment	Beginning of school year (BOSY)	Beginning of school year (BOSY)	End of school year (EOSY)	End of school year (EOSY)
		n	%	*n*	%
Grade 1	725	118	16.28	1	0.14
Grade 2	840	196	23.33	33	3.93
Grade 3	699	194	27.75	4	0.57
Total	2,264	508	22.44	38	1.68

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 8 (August 2026)

Note. BOSY = Beginning of School Year; EOSY = End of School Year. n indicates the number of learners assessed in the Emerging (Not Proficient) performance category.

Table 1 illustrates a considerable fall in the number of non-proficient learners across all Key Stage 1 grade levels following the implementation of Project NSO. At the Beginning of the School Year (BOSY), 22.44% (508 learners) of the total cohort were categorized as Emerging (Not Proficient). By the End of the School Year (EOSY), this figure dropped dramatically to 1.68% (38 learners), showing a total reduction of 20.76 percentage points.

These outcomes indicate that the targeted, diagnostic-driven strategies of Project NSO were exceptionally effective in eliminating severe foundational numeracy deficits among early grade learners.

Table 2. *Learners Assessed as Emerging (Low Proficient) at BOSY and EOSY 2025–2026 by Grade Level*

Grade Level	Total Enrollment	Beginning of School Year (BOSY)	Beginning of School Year (BOSY)	End of School Year (EOSY)	End of School Year (EOSY)
		n	%	*n*	%
Grade 1	725	118	16.28	1	0.14
Grade 2	840	196	23.33	33	3.93
Grade 3	699	194	27.75	4	0.57
Total	2,264	508	22.44	38	1.68

Note. BOSY = Beginning of School Year; EOSY = End of School Year. n signifies the number of learners assessed in the Emerging (Low Proficient) performance category.

Table 2 outlines the progress of learners in the Emerging (Low Proficient) category. At BOSY, nearly one-third of the total cohort—31.85% (721 learners)—were performing at a low-proficiency level. By EOSY, this percentage was reduced to 7.95% (180 learners), representing a 23.90 percentage point decline.

This reduction confirms substantial upward mobility, as struggling learners moved out of low-proficiency categories and transitioned into higher stages of numeracy competence over the school year.

Table 3. *Learners Assessed as Developing (Nearly Proficient) at BOSY and EOSY 2025–2026 by Grade Level*

Grade level	Total enrollment	Beginning of School Year (BOSY)	Beginning of School Year (BOSY)	End of School Year (EOSY)	End of School Year (EOSY)
		n	%	*n*	%
Grade 1	725	251	34.62	187	25.79
Grade 2	840	189	22.50	175	20.83
Grade 3	699	197	28.18	120	17.17
Total	2,264	637	28.14	482	21.29

Note. BOSY = Beginning of School Year; EOSY = End of School Year. n indicates the number of learners assessed in the Developing (Nearly Proficient) performance category.

Table 3 presents the proportion of learners classified as Developing (Nearly Proficient). Overall, this group decreased from 28.14% (637 learners) at BOSY to 21.29% (482 learners) at EOSY.

In longitudinal intervention tracking, a moderate decrease in a middle-tier category indicates positive progression. As non-proficient learners (from Tables 1 and 2) moved into the Developing stage, learners previously in the Developing stage advanced into the proficient and highly proficient categories.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 8 (August 2026)

Table 4. *Learners Assessed as Transitioning (Proficient) at BOSY and EOSY 2025–2026 by Grade Level*

Grade level	Total enrollment	Beginning of School Year (BOSY)	Beginning of School Year (BOSY)	End of School Year (EOSY)	End of School Year (EOSY)
		n	%	*n*	%
Grade 1	725	64	8.83	119	16.41
Grade 2	840	100	11.90	222	26.43
Grade 3	699	82	11.73	93	13.30
Total	2,264	246	10.87	434	19.17

Note. BOSY = Beginning of School Year; EOSY = End of School Year. n indicates the number of learners assessed in the Transitioning (Proficient) performance category.

Table 4 displays a steady expansion in the number of learners achieving full proficiency (Transitioning). Across Key Stage 1, the proportion of proficient learners nearly doubled, moving from 10.87% (246 learners) at BOSY to 19.17% (434 learners) at EOSY.

This steady upward shift demonstrates that regular practice, explicit instruction, and manipulative-based activities helped learners solidify core mathematical ideas and reach standard proficiency levels.

Table 5. *Learners Assessed as At Grade Level (Highly Proficient) at BOSY and EOSY 2025–2026 by Grade Level*

Grade level	Total enrollment	Beginning of School Year (BOSY)	Beginning of School Year (BOSY)	End of School Year (EOSY)	End of School Year (EOSY)
		n	%	*n*	%
Grade 1	725	70	9.66	319	44.00
Grade 2	840	57	6.79	307	36.55
Grade 3	699	25	3.58	142	20.31
Total	2,264	152	6.71	768	33.92

Note. BOSY = Beginning of School Year; EOSY = End of School Year. n indicates the number of learners assessed in the At Grade Level (Highly Proficient) performance category.

Table 5 shows the most prominent accomplishment of Project NSO, showing a more than five-fold increase in the number of learners performing at high proficiency (At Grade Level). At BOSY, only 6.71% (152 learners) were classified as At Grade Level. By EOSY, this figure soared to 33.92% (768 learners).

These results show that Project NSO was effective not only as a remedial tool for struggling students, but also as an enrichment mechanism that accelerated average learners to high levels of mathematical mastery.

The data in Tables 1 to 5 reveal considerable learner progress from the Beginning of School Year (BOSY) to the End of School Year (EOSY) across a total enrolment of 2,264 learners across three cohort groups. The percentage of learners performing at grade level increased dramatically, while non-proficient levels dropped significantly.

The major gain in Proficiency levels of At Grade Level (Highly Proficient) grew more than five times, from 6.71% (152 learners) at the beginning of the school year to 33.92% (768 learners) at the end of the school year. Looking at the combined proficient learners (Proficient and Highly Proficient), which expanded from 17.58% (398learners) at the Beginning of the School Year to 53.09% (1202 learners) at the end of the school year.

If we compare the results of each grade level, Grade 1 learners had the strongest performance by the end of the school year, achieving 44.00% at the Grade level (Highly Proficient) and leaving almost no learners in the Not Proficient level (0.14%). While Grade 2 showed the largest growth in the Proficient

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 8 (August 2026)

level, rising from 11.90% to 26.43% alongside a jump to 36.55% at Grade Level. There is also a reduction in non-proficiency, effectively from 27.75% down to 0.57%, with a higher relative clustering in the Nearly Proficient Level (Developing) compared to Grade 1 and Grade 2.

The persistent existence of early numeracy gaps underscores the necessity of structured, evidence-based intervention programs designed for individual learning trajectories. Broad systematic evidence confirms that focused interventions significantly improve mathematical outcomes when they combine explicit instruction with diagnostic assessment (Schenepel & Aunio, 2021; Svane et al., 2023). Rather than relying on generic remediation, effective models-such as Catch-Up Numeracy and localized intervention projects-diagnose specific domain deficits in number sense and place value, enabling short, high-frequency instructions customized to individual needs. (Dowker, 2016; Holmes & Dowker, 2013; Smith, 2024.

Table 6. *Teacher Perceptions of Implementation in Terms of Content and Materials (Intervention Design)*

Indicator	M	Verbal interpretation
1. The intervention materials are highly aligned with the KS1 mathematics competencies.	3.33	Agree
2. The activities and worksheets are age-appropriate for my learners.	3.38	Agree
3. The visual aids, manipulatives, or supplementary materials provided are engaging and easy to use.	3.31	Agree
4. The instructions in the intervention guide are clear and easy for teachers to follow.	3.34	Agree
General mean score	3.34	Agree

Note. M = Mean. KS1 = Key Stage 1.

Table 6 presents the teachers' evaluation regarding the content and materials of the Program Numeracy Skills Observed intervention design. Overall, the program received a favorable assessment with a General Average of 3.34 (Agree). All four indicators scored within the "Agree" range (3.31 to 3.38), demonstrating that the intervention materials are well-aligned with teacher needs and classroom reality. The highest mean score was recorded for the age-appropriateness of activities and worksheets (3.38), indicating that the learning tasks successfully fit the target demographic. Additionally, teachers found the guide easy to execute (3.34) and the content closely aligned with required KS1 competencies (3.33). The visual and manipulative materials were deemed user-friendly and engaging (3.31).

This evidence implies that the intervention's physical and conceptual design provides a solid, practical foundation for improving learner numeracy skills. These results show that the intervention design is well-crafted and ready for continued implementation. To capitalize on this success, future iterations could concentrate on expanding the variety of interactive or hands-on manipulatives, as this area had the largest opportunity for further improvement despite its already positive rating.

Moving from broad systematic reviews to concrete applications, recent literature explores specific strategies and program frameworks created to close numeracy gaps. For instance, Smith (2024) examined the Numeracy Intervention Project, an initiative specifically designed to detect gaps in a student's mathematical learning within a special education setting. Implemented over two weeks, the program utilized a scripted baseline assessment, hands-on manipulatives, and skill-specific activities to target areas of weakness. Complementing these structured program designs, a descriptive study explored classroom-level teaching strategies for struggling elementary learners, identifying that students frequently struggle with fractions, decimals, basic operations, and word problem-solving. The study highlighted that these difficulties often stem from weak foundational number sense and poor conceptual understanding. To address these specific gaps, educators effectively implemented strategies such as visual aids, manipulatives, gamified instruction, peer tutoring, and contextualized learning tasks—all of which significantly enhanced

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 8 (August 2026)

student engagement and comprehension (Effective teaching strategies to address numeracy gaps in struggling learners, n.d.)

Table 7. *Teacher Perceptions of Implementation in Terms of Implementation and Delivery*

Indicator	M	Verbal interpretation
1. The daily/weekly time allotment for the intervention is sufficient.	3.21	Agree
2. The intervention easily integrates into my regular classroom schedule without causing major disruptions.	3.12	Agree
3. I received adequate training or orientation from the CID prior to implementing this intervention.	3.09	Agree
4. The school administration and CID provide ongoing support for the program's execution.	3.30	Agree
General mean score	3.18	Agree

Note.M = Mean. CID = Curriculum Implementation Division

Table 7 outlines teachers' evaluations regarding the implementation and delivery of the Program Numeracy Skills Observed. Overall, respondents agreed on all evaluated parameters, yielding a General Mean Score of 3.18 (Agree). The highest mean score was obtained for ongoing administrative and CID support (3.30), demonstrating robust leadership backing throughout the execution phase. Adequate time allotment also recorded a high agreement score (3.21), followed by ease of classroom schedule integration (3.12). Conversely, prior orientation and training conducted by the CID garnered the lowest mean score (3.09).

These results demonstrate that while overall program delivery is smooth and well-supported, strengthening initial teacher capacity building before future program cycles will maximize implementation fidelity.

To optimize future iterations of the program, organizers should consider expanding pre-implementation professional development workshops to ensure teachers enter the implementation stage with even greater confidence and technical preparation.

The persistent existence of early numeracy gaps underscores the necessity of structured, evidence-based intervention programs tailored to individual learning trajectories. Broad systematic evidence confirms that targeted interventions significantly improve mathematical outcomes when they combine explicit instruction with diagnostic assessment (Schenepel & Aunio, 2021; Svane et al., 2023). Rather than relying on generic remediation, effective models-such as Catch-Up Numeracy and localized intervention projects-diagnose specific domain deficits in number sense and place value, enabling short, high-frequency instructions tailored to individual needs. (Dowker, 2016; Holmes & Dowker, 2013; Smith, 2024.

Table 8. *Teacher Perceptions of Implementation in Terms of Learner Engagement and Response*

Indicator	M	Verbal interpretation
1. The learners show enthusiasm and active participation during the intervention activities.	3.30	Agree
2. The intervention effectively holds the attention of learners with varied learning paces.	3.30	Agree
3. The activities encourage collaborative learning and peer support among students.	3.25	Agree
General mean score	3.28	Agree

Note.M = Mean

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 8 (August 2026)

Table 8 presents teacher perceptions regarding learner engagement and response during the Program Numeracy Skills intervention. Overall, the feedback reflects a highly encouraging classroom atmosphere, earning a general verbal interpretation of "Agree". Teachers agreed that the intervention successfully sparked student enthusiasm and active participation (3.30) while effectively maintaining attention across diverse learning paces (3.30). The program also promoted peer collaboration and support (3.25). This was reflected in an average mean score of 3.28.

These results demonstrate that the intervention's pedagogical design successfully captivates young learners and fosters a supportive environment for numeracy development.

To establish a comprehensive understanding of mathematical interventions, Svane et al. (2023) conducted a systematic review analyzing randomized controlled math interventions spanning two decades (2001–2021). Their review categorized interventions across the educational spectrum—from early childhood to high school—while examining different targets, such as purely mathematical skills versus integrated academic skills. Their work highlights existing knowledge gaps and offers insights into how future interventions optimized for skill development across diverse settings.

Table 9. *Teacher Perceptions of Implementation in Terms of Impact on Numeracy Gaps (Outcomes)*

Indicator	M	Verbal interpretation
1. The intervention has significantly improved my learners' basic number sense (number recognition, counting, ordering).	3.28	Agree
2. I have observed noticeable improvement in my learners' mastery of basic operations (addition and subtraction).	3.25	Agree
3. The intervention helps learners apply math concepts to simple, real-life problem-solving situations.	3.24	Agree
4. Overall, there is a visible reduction in the number of non-numerate learners in my class since the implementation began.	3.20	Agree
General mean score	3.24	Agree

Note.M = Mean.

Table 9 outlines teacher perceptions regarding the impact of Program Numeracy Skills Observed on bridging numeracy gaps (The Outcomes). Overall, the assessment yielded a General Mean Score of 3.24 (Agree), confirming that educators perceive tangible learning gains across all outcome measures. The highest-rated area was the improvement in foundational number sense (3.28), followed closely by enhanced mastery of addition and subtraction (3.25). Teachers also agreed that students became better at applying math to simple real-world scenarios (3.24) and noted a visible reduction in non-numerate learners (3.20). These outcome measures demonstrate that the intervention design and classroom execution successfully translated into measurable learning improvements for students.

The persistent existence of early numeracy gaps underscores the necessity of structured, evidence-based intervention programs tailored to individual learning trajectories. Broad systematic evidence confirms that targeted interventions significantly improve mathematical outcomes when they combine explicit instruction with diagnostic assessment (Schenepel & Aunio, 2021; Svane et al., 2023). Rather than relying on generic remediation, effective models-such as Catch-Up Numeracy and localized intervention projects-diagnose specific domain deficits in number sense and place value, enabling short, high-frequency instructions tailored to individual needs. (Dowker, 2016; Holmes & Dowker, 2013; Smith, 2024.

Most Effective Feature of the Project NSO

Hands-On Manipulatives and Concrete Visual Aids

Teachers frequently cited the use of concrete objects—such as counters, blocks, beads, card drills, and visual charts—as the single most impactful component of the program.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 8 (August 2026)

For Key Stage 1 learners who are still operating at concrete-operational stages of cognitive development, physical manipulatives bridge the gap between abstract mathematical symbols and tangible understanding. Concrete tools sustain learner attention and make foundational concepts (number recognition, counting, and basic operations) accessible and engaging.

Learner-Centered, Differentiated, and Targeted Instruction

Responses emphasize the program's ability to identify specific skill gaps through diagnostic assessments and provide instruction tailored to individual learner readiness levels.

A one-size-fits-all approach often fails struggling early learners. By focusing on foundational number sense before advancing to complex tasks, the intervention prevents low-performing students from falling further behind while allowing teachers to meet pupils at their actual developmental baseline.

Structured Routine, Regular Practice, and Immediate Feedback

Teachers highlighted the value of step-by-step guided practice paired with continuous progress monitoring and immediate correction. Regular, predictable routines build learner confidence and reduce math anxiety. Immediate feedback ensures students do not internalize missteps, leading to faster skill mastery and greater participation.

Biggest Challenges Faced During Implementation

Severe Time Constraints vs. Heavy Instructional Demands

The dominant challenge reported by teachers is the lack of dedicated time to execute one-on-one or small-group remediation alongside their standard curriculum teaching load. Individualized guidance is time-intensive. When intervention periods are brief or crammed into already tight daily schedules, teachers struggle to give struggling learners the repeated practice they require without neglecting other classroom responsibilities.

Extreme Diversity in Learner Ability Levels and Behavioral Factors

Managing wide variance in student readiness within a single large classroom (30+ pupils), coupled with short student attention spans, reading difficulties, and off-task behaviors. Teachers face significant pedagogical friction when balancing rapid mastery learners with students requiring multi-sensory, highly repetitive guidance. Additionally, low reading comprehension frequently acts as a secondary barrier to solving basic math tasks.

Scarcity of Learning Resources and Individual Manipulatives

Many of the study participants reported an insufficient supply or total absence of printed workbooks, activity sheets, and 1-to-1 sets of concrete manipulatives, forcing pupils to share or teachers to fund/create materials themselves. Resource shortages directly hinder implementation fidelity. When students lack individual hands-on tools, passive waiting increases, lowering overall engagement and pacing.

External Factors (Chronic Absenteeism and Limited Home Support)

Frequent student absences and lack of follow-up numeracy activities at home continuously interrupt student learning progression. Skill acquisition in early numeracy relies on cumulative retention. Absenteeism resets learning cycles, forcing teachers to repeatedly re-teach basic competencies rather than advancing student skills. (Yamauchi & Liu, 2013, pp. 208-222)

Recommended Changes and Support from the Curriculum Implementation Division

Provision of Ready-to-Use Toolkit Packages and Standardized Materials

Teachers explicitly request that the Curriculum Implementation Division (CID) supply pre-printed workbooks, differentiated activity cards, and complete 1:1 manipulative sets (counters, visual cards, shapes). Providing ready-made, high-quality material kits removes the administrative and financial burden from teachers, enabling them to focus their energy directly on instructional delivery and learner coaching.

ISSN: 3116-3475
International Journal
of Education, Research, and Innovation Perspectives
Volume 2 Issue 8 (August 2026)

Capacity Building and Coaching on Early Grade Math Pedagogy

Requests for targeted professional development workshops focusing on concrete differentiation strategies, integrating literacy with numeracy, scaffolding struggling readers, and using digital/game-based tools. Teachers seek practical, actionable pedagogical methods rather than theoretical seminars—continuous coaching and demonstration teaching foster long-term instructional confidence in managing diverse learners.

Structural Time Allocation and Small-Group Optimization

Recommendations include shortening intervention sessions (e.g., 10–15-minute focused bursts to match attention spans), reducing pull-out group sizes (e.g., 3 to 5 learners per session), and establishing formal, non-conflicting time slots within the official class schedule. Adjusting timetable structures to accommodate young children's attention spans ensures maximum cognitive focus and makes individualized remediation logistically realistic for teachers.

Strengthening Parental Engagement with Take-Home Tools

Proposals to distribute simple, contextualized home-based numeracy activities that parents can easily facilitate with their children. Extending learning opportunities into the home environment reinforces classroom interventions and helps bridge learning gaps created by limited school contact time.

Findings

From the gathered and analyzed data, the following were the findings of this study:

1. The data demonstrates substantial learner progress from the Beginning of School Year (BOSY) to the End of School Year (EOSY) across a total enrolment of 2,264 learners across three cohort groups. The percentage of learners performing at or above grade level increased dramatically, while non-proficient levels dropped significantly.

2. The data shows that there is a significant difference between the level of numeracy skills of the learners before and after the implementation of Project NSO, with a notable percentage of learners increasing from not proficient to nearly proficient, proficient, and highly proficient across the three groups.

3.
    a. Teachers hold a consistently positive perception of the content and materials used in the Program Numeracy Skills intervention design, yielding an overall General Average of 3.34 with a verbal interpretation of "Agree".
    b. Teachers hold a positive perception regarding the implementation and delivery of the Program Numeracy Skills, resulting in an overall General Average of 3.18 with a verbal interpretation of "Agree".
    c. Teachers report a positive student response during the implementation of Program Numeracy Skills, with all indicators receiving an overall verbal interpretation of "Agree".
    d. Teachers report positive outcomes regarding the impact of Program Numeracy Skills on addressing learner numeracy gaps, yielding an overall General Mean Score of 3.24 with a verbal interpretation of "Agree".

4. On the most effective features of the numeracy interventions, the teachers report that there are hands-on manipulative and concrete visual aids, there are learner-centered, differentiated, and targeted instructions, as well as structured routine, regular practice, and immediate feedback for learners' progress.

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Volume 2 Issue 8 (August 2026)

Table 10. *Perceived Most Effective Features of Project NSO*

Sub-theme / Category	Core description	Participants verbatim excerpts
1. Hands-On Manipulatives and Concrete Visual Aids	Utilization of physical tools (counters, blocks, beads, card drills, and visual charts) to bridge abstract mathematical concepts with concrete understanding.	• *"Hands-on activities using concrete manipulatives helps children visualize numbers and operations..."* • *"Use of manipulative and visual models."*
2. Learner-Centered, Differentiated, and Targeted Instruction	Provision of tailored activities based on diagnostic assessment results to address individual learning gaps and baseline readiness levels.	• *"Its ability to provide targeted, individualized instruction based on each learner's specific numeracy needs."* • *"The numeracy intervention addresses learning gaps through differentiated activities."*
3. Structured Routine, Regular Practice, and Immediate Feedback	Implementation of step-by-step guided practice with real-time feedback and continuous monitoring to build confidence and skill mastery.	• *"It provides regular practice, immediate feedback, and continuous assessment, helping learners build confidence."* • *"Structured practice with immediate feedback, which helps identify learners' needs."*

Note. NSO = Numeracy Skills Observed. Qualitative themes were derived from thematic analysis of teacher verbatim responses.

Hands-On Manipulatives and Concrete Visual Aids

Teachers consistently identified physical instructional tools—such as counters, blocks, beads, card drills, and visual charts—as pivotal to student comprehension. Key Stage 1 learners operate primarily at concrete stages of cognitive development. Physical tools bridge the gap between abstract mathematical symbols and tangible understanding, sustaining learner attention and making foundational operations (counting, addition, subtraction) accessible and engaging.

Learner-Centered, Differentiated, and Targeted Instruction

Teachers emphasized the value of using initial diagnostic assessments to identify specific domain deficits. Rather than applying a uniform, one-size-fits-all approach, the intervention allowed educators to meet learners at their actual developmental baselines, strengthening foundational number sense before advancing to complex competencies.

Structured Routine, Regular Practice, and Immediate Feedback

The predictable structure of step-by-step guided practice, combined with real-time feedback, emerged as a major factor in building learner confidence. Immediate correction prevented students from internalizing missteps, reduced math anxiety, and accelerated skill acquisition.

5. In terms of the biggest challenges faced by the teachers during the implementation, these are their answers: severe time constraints vs. heavy instructional demands; extreme diversity in learner ability levels and behavioral factors; scarcity of learning resources and individual manipulatives; and external factors (Chronic Absenteeism and Limited Home Support).

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of Education, Research, and Innovation Perspectives
Volume 2 Issue 8 (August 2026)

Table 11. *Perceived Challenges Encountered in the Implementation of Project NSO*

Sub-theme / Category	Core description	Participants verbatim excerpts
1. Severe Time Constraints vs. Heavy Instructional Demands	Insufficient dedicated timetable slots to conduct small-group or one-on-one remediation while managing regular class schedules.	• *"The biggest challenge is addressing the varying learning needs... within the limited instructional time."* • *"Constraint time and availability of the room to conduct the activities."*
2. Extreme Diversity in Learner Ability Levels and Behaviors	Friction caused by wide variance in student readiness, short attention spans, low reading comprehension, and off-task behavior in large classes.	• *"Different learning needs and pace of each learner while managing limited time..."* • *"Large differences in student skill levels make one plan hard to fit all."*
3. Scarcity of Learning Resources and Individual Tools	Insufficient supply of printed workbooks, activity sheets, and individual 1-to-1 manipulative sets.	• *"Lack of printed materials for worksheet... provide modules and more manipulatives."* • *"Limited materials during intervention... learners have to share."*
4. External Barriers (Absenteeism and Limited Home Support)	Interruptions in learning retention due to chronic student absences and minimal reinforcement of numeracy tasks at home.	• *"Absenteeism of the pupils and lack of support..."* • *"Inconsistent support from parents in reinforcing numeracy skills at home."*

Note. NSO = Numeracy Skills Observed. Qualitative themes were derived from thematic analysis of teacher verbatim responses.

Severe Time Constraints vs. Heavy Instructional Demands

The most dominant challenge reported was the lack of dedicated time blocks for individualized or small-group remediation alongside regular curriculum loads. Providing one-on-one assistance to struggling pupils is time-intensive, creating friction when teachers must complete mandatory regular lessons within tight daily schedules.

Extreme Diversity in Learner Ability Levels and Behaviors

Managing broad variance in student readiness within large class sizes (30+ pupils) posed significant pedagogical hurdles. Teachers struggled to balance rapid mastery with pupils requiring multi-sensory repetition, a difficulty compounded by short attention spans and underlying reading comprehension barriers.

Scarcity of Learning Resources and Individual Tools

Implementation commitment was frequently compromised by an insufficient supply or total absence of pre-printed workbooks and individual (1-to-1) manipulative sets. This forced pupils to share materials, resulting in passive waiting time, or required teachers to fund and prepare visual aids personally.

External Barriers (Chronic Absenteeism and Limited Home Support)

Skill acquisition in early numeracy relies on cumulative, sequential retention. Frequent student absences continuously disrupted learning progression, forcing teachers to repeatedly re-teach basic concepts rather than advancing. Furthermore, minimal home-based math reinforcement limits the sustained impact of classroom instruction.

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of Education, Research, and Innovation Perspectives
Volume 2 Issue 8 (August 2026)

6. For the teachers' recommendations on changes and support from the Curriculum Implementation Division: the teachers suggested that the provision of ready-to-use toolkit packages and standardized materials should be on time; they also mentioned that they need capacity building and coaching on early grade Math pedagogy; and strengthening parental engagement with take-home tools.

CONCLUSIONS

Based on the findings and implications of the study, the following are the conclusions derived by the researchers:

1. ***Efficacy of the Intervention Program***. The Program Numeracy Skills Observed intervention is highly effective in accelerating mathematical performance, as evidenced by significant gains in grade-level proficiency and substantial reductions in non-proficient learners across the cohort.
2. ***Positive Perception and Acceptance***. Teachers strongly endorse the program's curriculum, delivery model, and impact, noting high levels of learners' engagement and positive outcomes in bridging critical numeracy gaps.
3. ***Essential Instructional Strategies.*** The integration of concrete visuals, hands-on manipulatives, learner-centered differentiated instruction, and structured feedback routines is the core pedagogical driver of successful numeracy acquisition.
4. ***Operational and External Bottlenecks***. While effective, the overall impact of the intervention was hindered by instructional time constraints, material shortages, extreme learner diversity, and external barriers such as absenteeism and lack of home support.
5. ***Need for Targeted Institutional Support.*** Enhancing and sustaining the program requires timely provision of standardized learning toolkits by the Curriculum Implementation Division (CID), targeted professional coaching in early grade Math pedagogy, and structured programs to foster parental involvement.

Recommendations:

Based on the research findings, implications, and conclusions, the following are the recommendations made by the researchers:

1. ***Program Sustenance and Scaling.*** Institutionalize, sustain, and consider expanding the Program Numeracy Skills intervention to other grade levels, given its proven efficacy in accelerating mathematical performance and its strong teacher endorsement.
2. ***Systemic Integration of High-Impact Pedagogies***. Embed the mandatory use of concrete visual aids, hands-on manipulatives, differentiated instruction, and structured feedback routines into standard daily lesson plans and school-wide instructional guidelines.
3. ***Timely Resource Allocation by CID***. Partner with the Curriculum Implementation Division (CID) to establish a streamlined timetable for the timely distribution of standardized learning toolkits and complete sets of physical manipulatives to resolve material shortages.
4. ***Targeted Professional Development and Coaching***. Organize continuous capacity-building workshops and coaching sessions focused on early grade Math pedagogy, time-management strategies, and classroom management techniques for handling diverse learner abilities.
5. ***Strengthening Home-School Collaboration***. Launch structured parental engagement initiatives and distribute user-friendly take-home learning toolkits to encourage home support and help mitigate the effects of chronic learner absenteeism.
6. ***Instructional Schedule Optimization*** Review current class schedules to protect and optimize dedicated time blocks for numeracy intervention, easing teachers' instructional time constraints and workload pressures.

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