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Article

Assessing the Role of Digital Tools in Enhancing Numeracy Skills Among Primary School Learners

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Abstract: This research assessed the effectiveness of digital tools in enhancing numeracy skills among primary school learners, during S.Y. 2025-2026 as a basis for a development plan. A quasi-experimental research design using the pre-test and post-test scores of the two groups was employed. A total of 15 learners from the control group and 15 from the experimental group participated in the study. A pre-test and post-test assessment survey of numeracy skills was used as the main instrument. The data were analyzed using simple percentages, weighted means, standard deviations, and t-tests. Pre-test results showed very good numeracy in the control group and fair numeracy in the experimental group, while post-test results indicated very good numeracy in the control group and excellent numeracy in the experimental group, with both groups demonstrating significant pre–post improvements and a significant mean gain difference. Both groups improved, but the experimental group achieved significantly greater gains, rising from fair to excellent numeracy and confirming the strong impact of technology-integrated mathematics instruction. It is recommended that the development plan, as the study's output, be implemented to strengthen learners' numeracy skills.

Keywords: Digital Tools, Numeracy Skills, Primary School Learners, Mathematics Instruction, Quasi-Experimental Design, Pre-test and Post-test

Introduction

Numeracy is a foundational skill that enables primary school learners to understand numbers, solve everyday problems, interpret patterns, and participate successfully in later mathematics learning (Hoogland, 2023). In the primary grades, weak numeracy may affect learners' confidence, classroom participation, and readiness for more complex concepts such as fractions, measurement, and problem solving. Recent international evidence shows that many learners experienced serious learning

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setbacks after school disruptions, making early assessment and support in mathematics especially important (World Bank et al., 2022). Large-scale assessments also continue to show uneven mathematics performance across learners and school systems (OECD, 2023). Similarly, TIMSS 2023 results emphasized the need to strengthen early mathematics foundations through instruction that is responsive to learners' needs (Mullis et al., 2024).

Digital tools have become increasingly relevant in mathematics instruction because they can provide visual representations, interactive practice, immediate feedback, and learner-paced activities. For primary learners, these features may help make abstract numerical ideas more concrete and engaging. However, technology alone does not guarantee improvement; its effectiveness depends on instructional design, teacher guidance, access, and alignment with learning objectives. UNESCO (2023a) emphasized that technology should be used as a tool for equity and learning, not as a substitute for effective teaching. The U.S. Department of Education (2024) likewise highlighted the importance of closing digital access, design, and use gaps. In mathematics and science learning, digital tools have shown potential benefits when they are meaningfully integrated into instruction (Hillmayr et al., 2020).

At Jack Dailey Elementary School, assessing learners before and after instruction can help determine whether digital tools contribute to measurable improvement in numeracy skills. A pretest provides baseline information about the control and experimental groups before the intervention begins, while a posttest shows the level of numeracy skills after instruction has been delivered. This design is useful because it allows comparison between learners who received traditional instruction and learners who used digital tools as part of their learning experience. Evidence-based guidance for elementary mathematics recommends identifying learners' difficulties early and providing structured intervention (Fuchs et al., 2021). Mathematics organizations have also stressed the importance of diagnosing learning needs after disrupted instruction (NCTM & NCSM, 2020). Digital fraction learning research further suggests that technology can support mathematical understanding when tasks are carefully designed (Reinhold et al., 2020).

The present study focuses on two groups of primary school learners: the control group and the experimental group. The control group represents learners who receive the usual numeracy instruction, while the experimental group represents learners who receive instruction enhanced by digital tools. Comparing the pretest and posttest results of these groups can show whether both groups began at a similar level and whether one group demonstrated greater improvement after the intervention. Prior research has found that computer-based mathematics interventions can improve achievement, especially for learners who need additional support. At the same time, education systems have recognized that post-pandemic learning requires careful use of both traditional and digital strategies. Emerging discussions on educational

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technology also emphasize responsible use of digital systems to support teaching and learning decisions.

Despite growing interest in educational technology, a research gap remains in understanding how digital tools specifically affect numeracy skills among primary school learners in local school contexts such as Jack Dailey Elementary School. Many studies discuss digital learning broadly, but fewer focus on practical classroom comparisons between control and experimental groups using pretest and posttest numeracy data. UNESCO (2023b) warned that many digital education initiatives expanded rapidly during school closures without enough evidence of learning effectiveness. International recovery reports also show that schools need stronger evidence on which interventions truly address learning loss. In addition, global education monitoring continues to stress that access to technology must be connected to measurable learning outcomes rather than availability alone.

Therefore, this study is directed toward determining the level of numeracy skills of the control and experimental groups during the pretest and posttest. Specifically, it seeks to establish the baseline numeracy level of both groups, identify their post-intervention performance, and examine whether digital tools appear to enhance numeracy skills more effectively than traditional instruction alone. This direction is important because learning recovery efforts recommend targeted instruction, regular assessment, and interventions that are both practical and evidence-based. Monitoring learning through reliable data also supports better educational decisions at the school level. Furthermore, evidence on cost-effective learning interventions emphasizes that schools should adopt strategies that show clear benefits for learners' actual achievement.

Literature Review

Digital tools have been increasingly recognized as useful supports for improving learners' numeracy skills because they provide interactive, visual, and immediate learning experiences. In mathematics instruction, learners often benefit when abstract number concepts are presented through concrete representations such as digital games, simulations, number lines, visual models, and guided practice activities. These tools can help learners develop counting, computation, problem-solving, and number sense skills at their own pace. Studies have shown that technology-enhanced mathematics learning can improve engagement and achievement when digital activities are aligned with clear learning objectives and supported by teacher guidance (Hillmayr et al.). Similarly, digital learning environments may help both high-performing and low-performing learners understand mathematical concepts more deeply when tasks are designed to encourage active thinking rather than simple memorization (Reinhold et al.). Evidence also suggests that computer-based mathematics interventions can support learners who struggle with basic numeracy

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by giving them repeated practice, feedback, and opportunities for mastery (Ran et al.). However, the effectiveness of digital tools in numeracy instruction depends on how they are used in the classroom. Technology does not automatically improve learning outcomes; it must be connected to appropriate teaching strategies, meaningful assessment, and learners' actual needs. For primary school learners, teachers remain essential in selecting suitable digital materials, explaining mathematical ideas, monitoring progress, and helping learners transfer digital practice into real problem-solving situations. Research on elementary mathematics intervention emphasizes the need for structured instruction, early identification of learning difficulties, and continuous assessment to improve numeracy performance (Fuchs et al.). International education reports also highlight that digital learning should address equity, access, and measurable learning outcomes rather than focusing only on the presence of devices or applications (UNESCO). In addition, learning recovery studies stress that schools must use evidence-based interventions to close achievement gaps and strengthen foundational skills after instructional disruptions (World Bank et al.).

Methodology

This study employed a quasi-experimental research design to determine the effectiveness of digital tools in enhancing the numeracy skills of primary school learners at Jack Dailey Elementary School, Clark County School District, Las Vegas, Nevada. The design involved two groups: the control group, which received traditional numeracy instruction without the use of digital tools, and the experimental group, which received numeracy instruction integrated with digital tools. This design was appropriate because it allowed the researcher to compare learner performance before and after the intervention while using intact groups in a natural classroom setting. The participants consisted of 30 Grade 1 learners, with 15 learners assigned to the control group and 15 learners assigned to the experimental group. They were selected through purposive and universal sampling. The study also gathered profile information from learners and teachers to provide context for the results. Learner profiles included age, gender, access to digital devices, frequency of digital tool use, internet connectivity, parents' educational attainment, family income, and learning modality. Teacher profiles included age, gender, civil status, educational attainment, specialization, teaching experience, numeracy teaching experience, ICT-related training, familiarity with digital tools, and access to school technology. Data were gathered using a researcher-made numeracy assessment composed of three areas: Number Sense and Counting, Addition and Subtraction, and Word Problems. A pretest was administered to establish baseline numeracy skills, while a posttest was given after the intervention to measure improvement. Scores were interpreted using five levels: Outstanding, Very Satisfactory, Satisfactory, Fairly Poor, and Poor. The t-test was used to determine whether there was a significant difference between pretest and posttest scores.

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Results

Table 1. Level of Numeracy Skills of the Two Groups During Pre-test

Level	Ranges of Scores	Control f	Control %	Experimental f	Experimental %
Excellent	16–20	1	6.67	2	13.33
Very Good	12–15	5	33.33	3	20.00
Good	8–11	3	20.00	3	20.00
Fair	4–7	3	20.00	4	26.67
Poor	0–3	3	20.00	3	20.00
Total		15	100.00	15	100.00
Average		9.00		8.73	
Standard Deviation		5.24		5.95	

As shown in Table 1, the numeracy skill levels of the control and experimental groups on the pre-test are generally comparable, indicating that both groups started with similar levels of ability before the intervention. In the control group, most learners fell into the Very Good level, with five learners scoring 12-15 (3.33%) and the good level with three (3) learners scoring 8-11 (20.00%). In contrast, the experimental group showed a more even distribution across performance levels, with a slightly higher percentage in the Fair level of four (4) learners with 4-7 scores (26.67%). Both groups had the same proportion of learners in the Poor level (20.00%), suggesting parallel weaknesses in foundational numeracy skills. The average scores also support this similarity, with the control group having a mean of 9.00. In contrast, the experimental group had a slightly lower mean of 8.73, indicating only a minimal difference between the groups. The standard deviations of 5.24 for the controlled group and 5.95 for the experimental group indicate moderate variability in both groups, with the experimental group showing slightly more variability in performance.

Table 2. Level of Numeracy Skills of the Two Groups During the Post-Test

Level	Ranges of Scores	Control f	Control %	Experimental f	Experimental %
Excellent	16–20	3	20.00	6	40.00
Very Good	12–15	5	33.33	4	26.67
Good	8–11	3	20.00	4	26.67
Fair	4–7	3	20.00	1	6.67
Poor	0–3	1	6.67	0	0.00
Total		15	100.00	15	100.00
Average		10.80		13.93	
Standard Deviation		4.90		4.40	

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As shown in Table 2, the post-test results showed a clear improvement in numeracy skills for both groups, but the experimental group demonstrated a more substantial gain in performance. A greater proportion of learners in the experimental group reached the Excellent level (40.00%) than in the control group (20.00%), and none fell into the Poor level, unlike in the control group, where 6.67% remained at that level. The experimental group also achieved a notably higher average of 13.93 than the control group of 10.80, indicating stronger overall performance after the intervention. Additionally, the slightly lower standard deviation in the experimental group, 4.40, suggests more consistent learning outcomes among its members. These findings imply that the instructional strategy or innovation used, such as the use of digital tools in the experimental group, was effective in improving numeracy performance, producing not only higher achievement but also reduced performance gaps among learners.

Table 3. Test of Difference Between the Pre-test and Post-test Scores of the Control Group

Source of Difference	Mean	Standard Deviation	Mean Difference	Computed t-value	p-value	Decision	Result
Pre-test	9.00	5.24					
Post-test	10.80	4.90	1.80	4.006*	0.001	Reject Ho	Significant

Significant at $p < 0.05$, two-tailed; df = 14

As presented in Table 3, the computed p-value of 0.001, which is less than the 0.05 level of significance, indicate that the control group demonstrated a statistically significant improvement in numeracy skills from pre-test to post-test, as shown by the mean increase from 9.00 to 10.80 and a computed t-value of 4.006, leading to the rejection of the null hypothesis. The results indicate that even without exposure to the intervention, the control group still experienced meaningful learning gains, likely due to regular classroom instruction, continued practice, or natural progression in numeracy understanding. The moderate mean difference of 1.80, however, suggests that these gains were limited compared to what may be observed in an enhanced instructional setting. The increase in the score suggests that traditional teaching methods still contribute positively to numeracy development. However, their impact may not be as strong or transformative as that of innovative approaches.

Table 4. Test of the Difference Between the Pre-test and Post-test Scores of the Experimental Group

Source of Difference	Mean	Standard Deviation	Mean Difference	Computed t-value	p-value	Decision	Result
Pre-test	8.73	5.95					
Post-test	13.93	4.40	5.20	9.390*	0.000	Reject Ho	Significant

Significant at $p < 0.05$, two-tailed; df = 14.

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As shown in Table 4, with the computed p-value of 0.000 which is less than the 0.05 level of significance indicates that there was a clear improvement in the experimental group's performance, with scores rising from a mean of 8.73 in the pre-test to 13.93 in the post-test. The computed t-value of 9.390 indicates that this difference is statistically significant, leading to the rejection of the null hypothesis. This demonstrates that the intervention had a meaningful positive impact on the learners' learning. The mean difference of 5.20 further highlights the notable gains achieved through the intervention.

Table 5. Test of Mean Gain Difference on the Pre-test and Post-test Scores Between the Two Groups

Source of Difference	Mean Gain	Standard Deviation	Mean Gain Difference	Computed t-value	p-value	Decision	Result
Control	1.80	1.74					
Experimental	5.20	2.14	3.40	4.768*	0.000	Reject Ho	Significant

Significant at $p < 0.05$, two-tailed; df = 28.

As shown in Table 5, with the computed p-value of 0.000, which is less than the 0.05 level of significance, the difference in learning gains between the control and experimental groups showed that the experimental group noticeably showed a higher mean gain of 5.20 compared to 1.80 for the control group. The computed t-value of 4.768 confirms that this difference is statistically significant, thereby rejecting the null hypothesis. This indicates that the intervention had a much stronger effect on the experimental group's learning outcomes than traditional instruction alone. The mean gain difference of 3.40 further suggests the clear advantage of the intervention, which is the integration of digital tools in improving student performance.

Discussions

The results show that the control and experimental groups had almost similar numeracy skill levels during the pre-test, which means that both groups began the study with comparable ability. The control group obtained a mean score of 9.00, while the experimental group obtained a slightly lower mean score of 8.73. This small difference suggests that neither group had a major advantage before the intervention was implemented. The distribution of scores also showed that both groups had learners who performed at different levels, including those in the Poor, Fair, Good, Very Good, and Excellent categories. This indicates that the learners had varied numeracy abilities at the beginning of the study, and some learners still needed more support in basic number sense, counting, addition, subtraction, and word problem solving. Since the two groups started at nearly the same level, the post-test results became a valid basis for determining whether the use of digital tools helped improve

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numeracy performance. During the post-test, both groups showed improvement, but the experimental group performed better than the control group. The control group's mean increased from 9.00 to 10.80, while the experimental group's mean increased from 8.73 to 13.93. This means that traditional instruction helped learners improve, but the use of digital tools produced a greater increase in numeracy skills. The experimental group also had more learners in the Excellent level, with 40.00%, compared to only 20.00% in the control group. In addition, no learner in the experimental group remained in the Poor level during the post-test, while 6.67% of the control group still fell under that category. These findings suggest that digital tools helped learners engage better with numeracy lessons, practice skills more effectively, and understand mathematical concepts more clearly.

The statistical results further support the effectiveness of the intervention. The control group showed a significant difference between the pre-test and post-test scores, with a mean difference of 1.80 and a p-value of 0.001. This proves that regular classroom instruction still contributed to learning improvement. However, the experimental group showed a much higher mean difference of 5.20 and a p-value of 0.000, indicating a stronger improvement after the integration of digital tools. The comparison of mean gains between the two groups also showed a significant difference, with the experimental group gaining 5.20 compared to the control group's 1.80. Since the p-value was 0.000, the null hypothesis was rejected. This confirms that the use of digital tools had a significantly greater effect on improving the numeracy skills of primary school learners than traditional instruction alone.

Conclusion

The study found that both the control and experimental groups improved from pre-test to post-test, suggesting that regular classroom instruction supports the development of numeracy skills. However, the group that used digital tools demonstrated a much greater improvement. While the experimental group started with only a fair level of numeracy, their performance rose to an excellent level after the intervention, whereas the control group remained at a very good level and did not achieve the same level of growth. The significant differences between pre- and post-test results confirm that integrating digital tools had a meaningful, positive impact on learners' numeracy development. In general, the findings highlight the value of digital learning tools as effective support in mathematics instruction, as they promote engagement, provide interactive learning experiences, and strengthen learners' mastery of numeracy skills, making their integration a promising strategy for future instructional planning.

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