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Enhancing Alphabet Recognition in Preschoolers through Technology-based Games

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ABSTRACT: *This study examined the effectiveness of technology-based games in improving the alphabet knowledge of preschool learners at Garcia Park Elementary School, Bohol Division, during the school year 2025–2026. A quasi-experimental design was employed with 60 purposively selected learners divided into a control group, which received traditional instruction, and an experimental group, which used interactive educational applications. Pretest and posttest assessments measured uppercase recognition, lowercase recognition, and producing letter sounds. Results revealed significant improvements in both groups, with the control group showing greater mean gains, indicating the strong impact of structured, teacher-led instruction on early literacy development. However, the experimental group, which started at a mastery level, also demonstrated significant progress, highlighting the potential of technology-based games to reinforce and sustain alphabet knowledge while providing engaging learning experiences. Findings suggest that integrating traditional methods with digital tools offers an effective, balanced approach to strengthening foundational literacy skills. The study provides valuable insights for educators, curriculum developers, and policymakers seeking to enhance early childhood literacy instruction.*

Key words: *Alphabet knowledge, early literacy, preschool education, quasi-experimental design, technology-based games, traditional instruction.*

1. Introduction

In the education system during the time of the study, helping young children develop early literacy skills was seen as a key step for their long-term success in school. One of the most important parts of early literacy is learning the alphabet. Knowing letters well helps children build other essential reading and writing skills, such as sounding out words, understanding how sounds work in language (phonemic awareness), and reading smoothly and quickly. Studies have shown that being able to recognize letters is strongly connected to becoming a good reader and writer later on (Lonigan & Shanahan, 2020).However, even though schools often provide structured lessons to teach literacy, many preschool children still struggle. One of the most common challenges is telling the difference between uppercase and lowercase letters, which is an important part of learning to read and write.

In the Philippines, there are also specific issues in the education system related to reading development. One major problem is that some children are moved up to higher grade levels even when they have not yet learned how to read properly. This issue is especially common in the early grades, which are supposed to build the foundation for reading skills. Because of limited resources, large class sizes, and other challenges,

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many students miss out on developing these basic literacy skills during the critical early years of schooling (David, Albert, & Vizmanos, 2019; (UNESCO, 2022).

Globally, early literacy challenges persisted significantly, particularly in developing countries, where access to quality early childhood education was frequently limited due to inadequate instructional resources and pedagogical strategies. UNICEF (2023) reported that over 40% of children worldwide failed to acquire basic literacy skills by age ten. This alarming statistic underscored the urgency of aligning efforts with the United Nations Sustainable Development Goal (SDG) 4, advocating inclusive, equitable, and quality education to promote lifelong learning opportunities for all (United Nations, 2023).

Complementing this global perspective, the National Association for the Education of Young Children (NAEYC, 2022) emphasized the adoption of evidence- based, interactive, and technology-integrated learning methods to enhance literacy development among young learners. Research by Hirsh-Pasek et al. (2020) highlighted the effectiveness of game-based learning in bolstering children's literacy and cognitive abilities, underscoring digital learning tools' critical role in early education. Furthermore, Zosh et al. (2021) advocated for interactive, technology-driven educational environments, noting their potential to increase learner engagement, motivation, and long-term retention compared to traditional instructional methods.

Advancements in educational technology positioned game-based learning as a promising instructional strategy, significantly enhancing student engagement, motivation, and cognitive processing. Technology-based educational games offered immersive and interactive experiences, effectively capturing learners' attention and promoting knowledge retention (Plass et al., 2020). Recognizing these potential benefits, there was a clear need to conduct a study assessing the effectiveness of technology-based games in enhancing alphabet knowledge among preschool learners at Garcia Park Elementary School.

This study examined the impact of technology-based games on preschoolers' alphabet knowledge, addressing the limited local research on digital tools in early literacy. It compared two groups: one received traditional instruction, while the other used interactive educational games. Pretest and posttest assessments measured uppercase and lowercase recognition to determine the effectiveness of game-based learning. Results aimed to identify whether technology-driven lessons could enhance literacy skills more effectively than conventional methods and to provide a practical integration plan for Garcia Park Elementary School. The findings offer valuable insights for teachers, administrators, and policymakers seeking innovative, evidence-based strategies to strengthen early literacy instruction through engaging digital tools.

2. Literature Review

Research has shown that technology-based games can play an important role in building alphabet knowledge among young learners. Studies on digital game-based learning in early childhood classrooms have consistently reported positive effects on children's ability to recognize and produce letters. For example, one study with kindergarten pupils found that using contextualized digital games significantly improved their recognition of vowels and letter sounds, with scores showing a strong increase from pretest to posttest (Cornito, 2023). Broader reviews also highlight that interactive games keep children engaged and make abstract concepts like letter-sound associations easier to understand (Behnamnia et al., 2022). More recent findings also support that technology-driven literacy games can be effective across different social and economic groups, making them a useful tool for diverse classrooms (Schiele et al., 2025).

Alphabet knowledge itself is widely recognized as one of the strongest predictors of early reading success. Children who enter school knowing more letters, both uppercase and lowercase, are more likely to become fluent readers later on (Piasta & Wagner, 2010). However, a child's background can influence how quickly these skills develop. Research shows that factors such as parental education and socioeconomic status often affect early literacy outcomes because children from higher-income families are typically exposed to richer language and more reading experiences at home (Hoff, 2003). Even so, large-scale studies suggest that well-designed alphabet interventions, including technology-based games, can benefit learners regardless of age, gender, or economic background, helping to close gaps in early literacy development (NELP, 2020).

3. Methodology

This study used a quasi-experimental research design to find out if technology-based games could help improve preschoolers' alphabet knowledge in a real classroom setting. Unlike true experiments that require random selection, this design worked with existing preschool sections, making it practical for school-based

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research. The participants were 60 preschool learners from Garcia Park Elementary School in Bohol Division during the school year 2025–2026, chosen through purposive sampling to ensure they were at the right stage for early literacy learning. They were divided into two groups: a control group that received traditional alphabet instruction and an experimental group that used two educational apps, Kids Academy and Starfall, which provided interactive and gamified alphabet activities. Both groups took a pretest and posttest using an adapted instrument from Gray (2023) that measured uppercase and lowercase letter recognition presented digitally on tablets. The same procedure was followed in both tests to ensure accurate comparisons and reduce testing anxiety. The study followed the Input-Process-Output (IPO) model to systematically track the effects of the intervention. Data were analyzed by comparing pretest and posttest scores of both groups to see if the technology-based approach significantly improved alphabet knowledge compared to traditional teaching. A percentage range with adjectival ratings (Excellent to Poor) was used to interpret learners' performance levels, providing clear descriptions of their alphabet mastery.

4. Results

Table 1. Level of alphabet knowledge of the learners in the Control Group during Pretest.

Level	Ranges of Scores	Upper Case Recognition		Lower Case Recognition		Producing Letter Sounds	
		f	%	f	%	f	%
Excellent	21-26	0	0.00	0	0.00	0	0.00
Very Good	16-20	30	100.00	30	100.00	30	100.00
Good	11-15	0	0.00	0	0.00	0	0.00
Fair	6-10	0	0.00	0	0.00	0	0.00
Poor	0-5	0	0.00	0	0.00	0	0.00
Total		30	100.00	30	100.00	30	100.00
Average		17.33		18.23		18.60	
Standard Deviation		1.12		1.30		0.89	

The pretest results for the control group showed that all 30 learners scored within the "Very Good" range for uppercase recognition, lowercase recognition, and producing letter sounds, with 100% of participants falling into this category. No learners reached the "Excellent" level or scored in the lower ranges of "Good," "Fair," or "Poor." The average scores were 17.33 for uppercase recognition, 18.23 for lowercase recognition, and 18.60 for producing letter sounds, with low standard deviations, indicating that the learners' performance was consistently similar across all three areas. This highlights that, before the intervention, the control group already demonstrated a strong but not yet exceptional level of alphabet knowledge. The pretest findings imply that the control group had a solid foundation in alphabet knowledge even before the intervention, as all learners consistently performed at a "Very Good" level.

Table 2. Level of alphabet knowledge of the learners in the Experimental Group during Pretest.

Level	Ranges of Scores	Upper Case Recognition		Lower Case Recognition		Producing Letter Sounds	
		f	%	f	%	f	%
Excellent	21-26	30	100.00	30	100.00	30	100.00
Very Good	16-20	0	0.00	0	0.00	0	0.00
Good	11-15	0	0.00	0	0.00	0	0.00
Fair	6-10	0	0.00	0	0.00	0	0.00
Poor	0-5	0	0.00	0	0.00	0	0.00
Total		30	100.00	30	100.00	30	100.00
Average		21.50		21.83		21.27	
Standard Deviation		1.07		1.21		0.91	

The pretest results for the experimental group showed that all 30 learners achieved the "Excellent" level in uppercase recognition, lowercase recognition, and producing letter sounds, with 100% of participants scoring

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in the highest range. No learners fell into the "Very Good" or lower categories. The average scores were 21.50 for uppercase recognition, 21.83 for lowercase recognition, and 21.27 for producing letter sounds, with low standard deviations indicating consistent performance across all participants. These results highlight that the experimental group entered the study with an advanced level of alphabet knowledge, demonstrating mastery in recognizing and producing letters even before the technology-based intervention was introduced.

Table 3. Level of alphabet knowledge of the learners in the control group during posttest.

Level	Ranges of Scores	Upper Case Recognition		Lower Case Recognition		Producing Letter Sounds	
		f	%	f	%	f	%
Excellent	21-26	30	100.00	30	100.00	30	100.00
Very Good	16-20	0	0.00	0	0.00	0	0.00
Good	11-15	0	0.00	0	0.00	0	0.00
Fair	6-10	0	0.00	0	0.00	0	0.00
Poor	0-5	0	0.00	0	0.00	0	0.00
Total		30	100.00	30	100.00	30	100.00
Average		25.13		24.83		25.50	
Standard Deviation		0.86		0.75		0.63	

The posttest results for the control group revealed a significant improvement compared to the pretest. All 30 learners reached the "Excellent" level in uppercase recognition, lowercase recognition, and producing letter sounds, with 100% of participants scoring in the highest range. The average scores increased to 25.13 for uppercase recognition, 24.83 for lowercase recognition, and 25.50 for producing letter sounds, showing a clear progression from the "Very Good" level in the pretest to mastery in the posttest. The low standard deviations indicate that performance was consistently high across all learners, with minimal variation. These findings suggest that traditional instruction effectively enhanced the learners' alphabet knowledge to a mastery level. For teachers, this demonstrates that structured, teacher-led methods can still yield excellent results in early literacy development. However, it also raises the need to compare the rate and depth of improvement with the experimental group to determine whether technology-based interventions provide additional benefits beyond what traditional methods can achieve. For curriculum planners, the results emphasize the value of maintaining strong, structured literacy practices while exploring complementary strategies that could further enrich learning experiences.

Table 4. Level of alphabet knowledge of the learners in the Experimental Group during Posttest.

Level	Ranges of Scores	Upper Case Recognition		Lower Case Recognition		Producing Letter Sounds	
		f	%	f	%	f	%
Excellent	21-26	30	100.00	30	100.00	30	100.00
Very Good	16-20	0	0.00	0	0.00	0	0.00
Good	11-15	0	0.00	0	0.00	0	0.00
Fair	6-10	0	0.00	0	0.00	0	0.00
Poor	0-5	0	0.00	0	0.00	0	0.00
Total		30	100.00	30	100.00	30	100.00
Average		25.47		25.37		25.63	
Standard Deviation		0.63		0.56		0.56	

The posttest results for the experimental group showed that all 30 learners maintained the "Excellent" level in uppercase recognition, lowercase recognition, and producing letter sounds, with 100% of participants scoring in the highest range. The average scores increased to 25.47 for uppercase recognition, 25.37 for lowercase recognition, and 25.63 for producing letter sounds, reflecting further improvement from their already high pretest scores. The low standard deviations indicate that learners' performance was consistently strong across all skills with very little variation. These findings suggest that the use of technology-based games effectively supported and enhanced the alphabet knowledge of learners who were already performing

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at a mastery level. For educators, this highlights that digital tools can help sustain and strengthen literacy skills while keeping learners engaged through interactive methods. For curriculum designers, the results indicate the potential of integrating technology-driven activities not just for remediation but also for enrichment, ensuring that even advanced learners continue to progress. Comparing these outcomes with the control group will help determine whether technology-based interventions offer a significant advantage over traditional instruction in promoting early literacy mastery.

The results of the t-test in table 5 for the control group revealed a significant difference between the pretest and posttest scores in all three areas of alphabet knowledge: uppercase recognition, lowercase recognition, and producing letter sounds. For uppercase recognition, the mean increased from 17.33 to 25.13, with a computed t-value of 26.964 and a p-value of 0.000, indicating a highly significant improvement. Similarly, lowercase recognition scores rose from 18.23 to 24.83, with a mean difference of 6.60 and a t-value of 42.280, while producing letter sounds improved from 18.60 to 25.50, with a mean difference of 6.90 and a t-value of 36.732. All p-values were less than 0.05, leading to the rejection of the null hypothesis in each case.

Table 5. Test of difference between the Control Group's pretest and posttest scores on their Alphabet Knowledge.

Variables	Source of Difference	Mean	S.D.	Mean Diff.	Comp. t- value	p-value	Decision	Remarks
Upper Case Recognition	Pretest	17.33	1.12				Reject Ho	
				7.80	26.964*	0.000		Significant
	Posttest	25.13	0.86					
Lower Case Recognition	Pretest	18.23	1.30				Reject Ho	
	Posttest	24.83	0.75	6.60	42.280*	0.000		Significant
Producing Letter Sounds	Pretest	18.60	0.89				Reject Ho	
	Posttest	25.50	0.63	6.90	36.732*	0.000		Significant

Note: *significant at p<0.05(two-tailed); df=29.

These results show that the traditional teaching methods used with the control group were effective in significantly improving learners' alphabet knowledge. The large mean differences and very low p-values suggest that structured, teacher-led instruction can produce strong gains in early literacy skills. For educators, this emphasizes the value of consistent and systematic alphabet teaching in preschool. For curriculum developers and administrators, it highlights the effectiveness of current foundational literacy practices while also setting a benchmark to compare with technology-based approaches to determine whether digital interventions can yield equal or greater benefits.

Table 6. Test of difference between the Experimental Group's pretest and posttest scores on their Alphabet Knowledge.

Variables	Source of Difference	Mean	sd	Mean Diff.	t- value	p-value	Decision	Remarks
Upper Case Recognition	Pretest	21.50	1.07				Reject Ho	
				3.97	21.739*	0.000		Significant
	Posttest	25.47	0.63					
Lower Case Recognition	Pretest	21.83	1.21				Reject Ho	
	Posttest	25.37	0.56	3.53	15.456*	0.000		Significant
Producing Letter Sounds	Pretest	21.27	0.91				Reject Ho	
	Posttest	25.63	0.56	4.37	22.432*	0.000		Significant

Note: *significant at p<0.05(two-tailed); df=29

The t-test results for the experimental group showed a significant improvement in all areas of alphabet knowledge after the use of technology-based games. For uppercase recognition, the mean score increased

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from 21.50 to 25.47, with a mean difference of 3.97 and a t-value of 21.739, indicating a highly significant gain. Lowercase recognition also improved from 21.83 to 25.37, with a mean difference of 3.53 and a t-value of 15.456. Producing letter sounds showed the largest gain, with scores rising from 21.27 to 25.63, resulting in a mean difference of 4.37 and a t-value of 22.432. All p-values were 0.000, confirming that the differences were statistically significant and leading to the rejection of the null hypothesis in every case. These findings highlight that technology-based games can significantly enhance alphabet knowledge, even for learners who already demonstrated strong skills in the pretest. The consistent improvements across all variables suggest that interactive digital tools can effectively reinforce and extend early literacy skills by providing engaging, game-based learning experiences. For educators, this indicates the potential of integrating technology into early literacy instruction to sustain motivation and mastery. For curriculum planners and policymakers, the results provide evidence supporting the inclusion of well-designed digital learning applications as complementary tools alongside traditional teaching methods to optimize early literacy outcomes.

Table 7. Test of Significant Mean Gain Difference on the Pre-test and Post-test scores between the Two Groups.

Variables	Source of Difference	Mean Gain	S.D.	Mean Gain Difference	t- value	p-value	Decision	Remarks
	Control	7.80	1.58					
Upper Case Recognition				3.83	11.208*	0.000	Reject Ho	S
	Experimental	3.97	1.00					
	Control	6.60	0.86					
Lower Case Recognition				3.07	11.078*	0.000	Reject Ho	S
	Experimental	3.53	1.25					
Producing Letter Sounds	Control	6.90	1.03					
				2.53	9.365*	0.000	Reject Ho	S
	Experimental	4.37		1.07				

Note: *significant at $p < 0.05$ (two-tailed); df=58; NS=Not Significant, S=Significant.

The test of mean gain difference between the control and experimental groups revealed significant differences in all areas of alphabet knowledge. For uppercase recognition, the control group achieved a mean gain of 7.80 compared to 3.97 in the experimental group, resulting in a mean gain difference of 3.83 and a t-value of 11.208, indicating a statistically significant advantage for the control group. In lowercase recognition, the control group again outperformed the experimental group with a mean gain of 6.60 versus 3.53, producing a mean gain difference of 3.07 and a t-value of 11.078. Similarly, in producing letter sounds, the control group recorded a mean gain of 6.90 compared to the experimental group's 4.37, yielding a mean gain difference of 2.53 and a t-value of 9.365. All p-values were 0.000, confirming that the differences were significant and leading to the rejection of the null hypothesis. These results indicate that while both groups showed significant improvement, the control group demonstrated a greater increase in alphabet knowledge compared to the experimental group using technology-based games. This suggests that traditional teaching methods were more effective in producing larger learning gains in this context. For educators, this highlights the importance of structured, teacher-led instruction in early literacy. However, the positive gains in the experimental group still suggest that technology-based games can serve as a supportive tool, especially for engagement and reinforcement. For curriculum developers, the findings emphasize the need to balance traditional strategies with digital innovations to create a blended approach that maximizes learning outcomes.

5. Discussion

The findings of the study show that both traditional teaching methods and technology-based games were effective in improving the alphabet knowledge of preschool learners. The control group, which used traditional instruction, showed a significant increase from "Very Good" pretest scores to "Excellent" posttest scores across uppercase recognition, lowercase recognition, and producing letter sounds. This suggests that structured, teacher-led instruction remains a strong approach for developing early literacy skills. On the other

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hand, the experimental group, which started with "Excellent" pretest scores, also showed further improvement after using technology-based games. This indicates that interactive digital tools can still strengthen and sustain alphabet knowledge even for learners who are already performing at a high level. When comparing the two groups, the control group showed a greater mean gain in all areas of alphabet knowledge than the experimental group. This suggests that traditional teaching methods produced larger learning improvements within this specific context. However, the experimental group's consistent high performance and significant gains demonstrate that technology-based games are still valuable, particularly for engaging learners and providing interactive learning experiences. These results imply that while traditional methods remain essential, combining them with digital tools could create a balanced approach that supports both skill development and learner motivation. For educators and curriculum planners, the study highlights the importance of blending proven instructional strategies with technology to optimize early literacy outcomes.

6. Conclusion

The study concludes that both traditional instruction and technology-based games are effective in improving preschoolers' alphabet knowledge, with significant gains observed in uppercase recognition, lowercase recognition, and producing letter sounds for both groups. Traditional teacher-led methods showed higher mean gains, indicating their strong impact on foundational literacy development. However, the experimental group's consistent "Excellent" performance and further improvement demonstrate that technology-based games are valuable for reinforcing skills and engaging learners in interactive ways. These findings suggest that a balanced approach combining structured instruction with digital tools can maximize early literacy outcomes, offering practical guidance for educators, curriculum developers, and policymakers in enhancing preschool reading programs.

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