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Influence of Digital Play on Alphabet Recognition: Evaluating Technology-Based Games in Preschool Literacy

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ABSTRACT: *This study investigated the effectiveness of traditional instruction and technology-based games in improving the alphabet knowledge of preschool learners at Panaghiusa Elementary School and San Roque Elementary School. Using a quasi-experimental design, 60 purposively selected learners were divided into two groups: a control group that received teacher-led lessons and an experimental group that used interactive educational applications, Kids Academy and Starfall. Pretest and posttest assessments measured uppercase recognition, lowercase recognition, and producing letter sounds. Results showed significant improvements in both groups, with the control group achieving higher mean gains, indicating the strong effect of structured traditional teaching. However, the experimental group also reached mastery, demonstrating that technology-based games are effective in reinforcing and sustaining alphabet knowledge while engaging learners. These findings highlight the value of combining traditional instruction with interactive digital tools to create a balanced approach for strengthening early literacy skills. The study provides practical insights for educators, curriculum planners, and policymakers in designing effective preschool literacy programs.*

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

1. Introduction

In modern educational systems, developing early literacy skills is viewed as a vital stepping stone for ensuring long-term academic achievement and overall school readiness (Cabell et al., 2019; Lonigan et al., 2018). Among these foundational skills, alphabet knowledge is considered one of the most critical components, as it serves as the building block for essential reading and writing abilities. Mastery of letter names and sounds supports key literacy processes such as decoding words, developing phonemic awareness, and achieving reading fluency (Piasta & Wagner, 2010; Neumann et al., 2017). Children who acquire strong alphabet knowledge early are more likely to become confident and independent readers as they progress through school. However, despite the implementation of structured literacy programs in many kindergarten settings, a significant number of young learners continue to struggle with recognizing and differentiating letters. One of the most common difficulties observed is distinguishing between uppercase and lowercase forms, a skill crucial for both reading and writing development. These challenges highlight the need for more

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engaging, effective, and developmentally appropriate instructional strategies that can strengthen alphabet recognition and support children in acquiring the foundational skills necessary for later literacy success.

In the Philippine educational context, reading development issues persisted significantly, notably among learners in the early grades. Numerous studies indicated that a prevalent concern within the education system was the continuous promotion of learners who lacked basic reading skills to subsequent grade levels, exacerbating academic struggles in later years (DepEd, 2019; Tan, 2022). The issue of non-readers was notably prominent among primary-grade students, underscoring an urgent need for innovative and effective instructional interventions (Cruz, 2020; Reyes & Ocampo, 2023). Globally, similar literacy challenges remained pervasive, particularly in developing regions where access to quality educational resources and engaging instructional practices was limited. UNICEF (2023) reported that over 40% of children worldwide did not acquire foundational literacy skills by age ten. Addressing these gaps directly aligned with the United Nations Sustainable Development Goal 4, advocating inclusive and equitable quality education. Complementing this, the National Association for the Education of Young Children (NAEYC, 2022) emphasized adopting evidence- based, playful, and technology-integrated literacy approaches. Emerging educational research suggested that technology-based games were effective processing strategies, significantly enhancing early literacy skills by fostering interactive, engaging, and cognitively stimulating learning environments (Hirsh-Pasek et al., 2020; Zosh et al., 2021). Studies consistently demonstrated that digital game- based learning improved student engagement, attention, cognitive processing, and knowledge retention, especially in alphabet recognition tasks among early learners (Papadakis et al., 2018; Cornito, 2023).

Despite enthusiasm around integrating technology-based games into early education, empirical research specifically examining their effectiveness in local contexts such as the Philippines remained sparse. This study aimed to address this research gap by assessing the effectiveness of carefully selected technology-based games in enhancing alphabet knowledge among kindergarten learners at Panaghiusa Elementary School and San Roque Elementary School in the Bohol Division during the academic year 2025–2026. Additionally, factors like age, gender, parental educational background, and socioeconomic status potentially influenced early literacy outcomes, necessitating a comparative analysis between traditional instructional approaches and technology-based interventions. By clearly identifying the impact of technology- enhanced games, this research aimed to offer educators and policymakers actionable insights to address early literacy issues prevalent within the Philippine educational context.

Ultimately, the outcomes of this investigation aimed to develop an enhancement plan enabling teachers at the participating schools to effectively integrate technology-based games into their literacy instruction. These findings would inform evidence-based educational practices, guide administrators in curriculum enhancement, advocate for policy adjustments emphasizing technology integration, and provide learners with engaging, interactive, and successful learning experiences.

2. Literature Review

Alphabet knowledge is recognized as a key predictor of future reading success, with studies showing that children who master a greater number of letters early tend to achieve better reading outcomes later on (Chen et al., 2023; Piasta & Wagner, 2010). Research highlights that teaching multiple letters per week is more effective than the traditional slow-paced one-letter approach, resulting in faster acquisition of letter names and sounds (Piasta & Wagner, 2010). Other studies found that knowledge of uppercase letters significantly increases the likelihood of recognizing lowercase forms, showing the strong link between the two (Pence-Turnbull et al., 2010). Letter-sound knowledge has also been identified as critical in reinforcing the alphabetic principle and supporting decoding skills (Huang, 2014). Longitudinal findings emphasize that consistent and early exposure to alphabet instruction is vital to preventing reading difficulties later in schooling (Piasta et al., 2022).

Instructional strategies have also been shown to play a major role in developing alphabet knowledge. Evidence-based interventions produce stronger gains in letter recognition and sound production than unstructured teaching approaches (Gerde et al., 2019). The National Reading Panel stresses the value of systematic phonics combined with alphabet teaching in improving decoding and reading fluency (National Reading Panel, 2000). Multicomponent instruction that integrates letter names, sounds, and writing in meaningful contexts has been proven to strengthen learning outcomes (Piasta, 2022). Recent studies also

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highlight the growing role of digital and game-based tools, which, when integrated with traditional methods, can boost engagement and help reinforce alphabet skills (Liu, 2024; Bautista et al., 2024).

3. Methodology

This study employed a quasi-experimental research design to examine the effectiveness of technology-based games in enhancing preschoolers' alphabet knowledge within an actual classroom environment. Unlike true experimental designs that require random assignment, this approach utilized existing preschool sections, making it more feasible for a school-based setting. A total of 60 preschool learners from Panaghiusa Elementary School and San Roque Elementary School were selected through purposive sampling to ensure that participants were within the critical stage for developing early literacy skills. The learners were divided into two groups: a control group that received traditional alphabet instruction and an experimental group that engaged with two interactive educational applications, Kids Academy and Starfall, both designed to deliver gamified alphabet-learning activities. To measure the learners' skills, both groups completed pretests and posttests using an adapted assessment tool from Gray (2023), which evaluated uppercase and lowercase letter recognition through a digital format on tablets. The testing procedure was standardized for both groups to maintain consistency and reduce potential anxiety among learners. The study was structured using the Input-Process-Output (IPO) model to ensure a systematic evaluation of the intervention. Data were analyzed by comparing pretest and posttest results to determine whether the technology-based games produced significant improvements over traditional instruction. Learners' performance levels were interpreted using a percentage range with adjectival ratings from "Excellent" to "Poor," providing clear descriptions of their mastery of alphabet knowledge. This design allowed for practical insights into the potential benefits of integrating digital tools into early literacy instruction.

4. Results

The pretest results in table 1 for the control group show that all 30 learners scored within the "Very Good" category across uppercase recognition, lowercase recognition, and producing letter sounds, representing 100% of participants. None of the learners reached the "Excellent" level or fell into the lower categories of "Good," "Fair," or "Poor." The computed average scores were 18.00 for uppercase recognition, 17.20 for lowercase recognition, and 17.93 for producing letter sounds, with low standard deviations indicating consistent performance among the learners. These findings suggest that before the intervention, the control group already demonstrated a strong foundation in alphabet knowledge, though not yet at a mastery level. This baseline indicates potential for growth with further instruction and provides a clear starting point for measuring the effectiveness of the teaching methods applied in the study.

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		18.00		17.20		17.93	
Standard Deviation		1.29		1.10		1.11	

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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	20	66.67	20	66.67	17	56.67
Very Good	16-20	10	33.33	10	33.33	13	43.33
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		21.03		21.27		20.63	
Standard Deviation		1.10		1.23		0.81	

The pretest results for the experimental group indicate that a majority of learners were already performing at a high level before the intervention. For uppercase recognition and lowercase recognition, 66.67% of the learners achieved the "Excellent" level, while the remaining 33.33% scored within the "Very Good" category. In producing letter sounds, 56.67% reached the "Excellent" level and 43.33% scored "Very Good." No learners fell into the "Good," "Fair," or "Poor" ranges in any of the areas assessed. The computed average scores were 21.03 for uppercase recognition, 21.27 for lowercase recognition, and 20.63 for producing letter sounds, with low standard deviations showing consistent performance across the group. These results suggest that the experimental group started with a stronger baseline of alphabet knowledge compared to typical expectations, indicating they were already well-prepared for further literacy instruction and providing a solid foundation to measure the added impact of technology-based games.

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		25.50		25.80		25.57	
Standard Deviation		0.68		0.41		0.57	

The posttest results for the control group revealed that all 30 learners achieved the "Excellent" level in uppercase recognition, lowercase recognition, and producing letter sounds, with 100% scoring in the highest category. None of the participants fell into the "Very Good," "Good," "Fair," or "Poor" ranges. The average scores were 25.50 for uppercase recognition, 25.80 for lowercase recognition, and 25.57 for producing letter sounds. Low standard deviations between 0.41 and 0.68 indicate highly consistent performance across all learners, showing that their skills were uniformly strong after the intervention. These findings demonstrate that traditional teacher-led instruction was highly effective in raising learners' alphabet knowledge to a mastery level. For educators, this emphasizes the value of systematic and structured approaches in early literacy development. The consistent high scores also suggest that such methods can ensure equitable learning outcomes among a whole class, minimizing performance gaps. For curriculum planners and school administrators, the results provide evidence that strengthening existing traditional practices can yield excellent results, while also offering a benchmark to compare with innovative approaches such as technology-based games to determine whether blended methods could further enhance learning outcomes.

The posttest results in table 4for the experimental group show that all 30 learners achieved the "Excellent" level in uppercase recognition, lowercase recognition, and producing letter sounds, with 100% of participants

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scoring in the highest range. No learners scored in the "Very Good," "Good," "Fair," or "Poor" categories. The average scores were 25.33 for uppercase recognition, 25.83 for lowercase recognition, and 25.83 for producing letter sounds. The low standard deviations, ranging from 0.38 to 0.76, indicate that the learners' performance was consistently strong across all three areas, reflecting uniform mastery of alphabet knowledge after the technology-based intervention.

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		25.33		25.83		25.83	
Standard Deviation		0.76		0.38		0.38	

These findings suggest that the use of interactive educational applications was effective in enhancing and sustaining high levels of alphabet knowledge among preschoolers. For educators, this underscores the value of integrating digital tools into early literacy instruction to engage learners while reinforcing critical skills. The uniform results also imply that technology-based games can help ensure consistent learning outcomes across diverse learners. For curriculum planners and policymakers, the results provide evidence supporting the inclusion of well-designed educational apps as a complement to traditional teaching methods, highlighting their potential to create engaging and equitable early literacy experiences.

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

Variables	Source of Difference	Mean	sd	Mean Diff.	Comp. t-value	p-value	Decision	Remarks
Upper Case Recognition	Pretest	18.00	1.29				Reject Ho	
				7.50	34.340*	0.000		Significant
	Posttest	25.50	0.68					
Lower Case Recognition	Pretest	17.20	1.10				Reject Ho	
				8.60	38.594*	0.000		Significant
	Posttest	25.80	0.41					
Producing Letter Sounds	Pretest	17.93	1.11				Reject Ho	
	Posttest	25.57	0.57	7.63	36.068*	0.000		Significant

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

The t-test results for the control group showed a significant difference between the pretest and posttest scores in all areas of alphabet knowledge. For uppercase recognition, the mean score increased from 18.00 to 25.50, with a mean difference of 7.50 and a computed t-value of 34.340. In lowercase recognition, scores rose from 17.20 to 25.80, resulting in a mean difference of 8.60 and a t-value of 38.594. Producing letter sounds also improved significantly, with the mean increasing from 17.93 to 25.57, yielding a mean difference of 7.63 and a t-value of 36.068. All p-values were 0.000, indicating that the differences were statistically significant and leading to the rejection of the null hypothesis in every case. These findings confirm that the traditional instruction used in the control group was highly effective in improving preschoolers' alphabet knowledge. The large mean differences and low p-values highlight the strong impact of structured, teacher-led methods on early literacy development. For educators, this reinforces the importance of systematic teaching approaches in

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building foundational reading and writing skills. For curriculum developers and policymakers, the results provide evidence that traditional classroom methods can yield significant learning gains and serve as a benchmark for evaluating newer strategies, including the integration of technology-based tools.

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	21.03	1.10				Reject Ho	
				4.30	17.883*	0.000		Significant
	Posttest	25.33	0.76					
Lower Case Recognition	Pretest	21.27	1.23				Reject Ho	
	Posttest	25.83	0.38	4.57	19.998*	0.000		Significant
Producing Letter Sounds	Pretest	20.63	0.81				Reject Ho	
	Posttest	25.83	0.38	5.20	32.121*	0.000		Significant

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

The t-test results for the experimental group revealed a significant improvement in all areas of alphabet knowledge following the use of technology-based games. For uppercase recognition, the mean score increased from 21.03 to 25.33, with a mean difference of 4.30 and a computed t-value of 17.883. Lowercase recognition rose from 21.27 to 25.83, resulting in a mean difference of 4.57 and a t-value of 19.998. Producing letter sounds showed the largest improvement, with scores increasing from 20.63 to 25.83, yielding a mean difference of 5.20 and a t-value of 32.121. All p-values were 0.000, confirming that the differences were statistically significant and leading to the rejection of the null hypothesis in each case. These findings indicate that technology-based games were effective in significantly enhancing preschoolers' alphabet knowledge. The consistent improvements across all skill areas suggest that interactive digital tools can provide engaging and impactful learning experiences that reinforce letter recognition and sound production. For educators, this highlights the value of integrating technology into early literacy instruction to supplement traditional teaching methods and increase learner engagement. For curriculum planners and policymakers, the results provide evidence supporting the use of well-designed educational apps as complementary resources for developing foundational literacy skills in preschool settings.

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	t- value	p-value	Decision	Remarks
	Control	7.50	1.20					
Upper Case Recognition				-3.20	9.851*	0.000	Reject Ho	Significant
	Experimental	4.30	1.32					
	Control	8.60	1.22					
Lower Case Recognition				-4.03	12.641*	0.000	Reject Ho	Significant
	Experimental	4.57	1.25					
	Control	7.63	1.16					
Producing Letter Sounds				-2.43	9.132*	0.000	Reject Ho	Significant
	Experimental	5.20	0.89					

Note: *significant at p < 0.05 (two-tailed); df=58

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The test of significant mean gain difference between the control and experimental groups showed that the control group achieved higher gains in all areas of alphabet knowledge compared to the experimental group. For uppercase recognition, the control group recorded a mean gain of 7.50 versus 4.30 in the experimental group, resulting in a mean gain difference of -3.20 with a t-value of 9.851. In lowercase recognition, the control group's mean gain was 8.60 compared to 4.57 for the experimental group, yielding a mean gain difference of -4.03 and a t-value of 12.641. For producing letter sounds, the control group also outperformed the experimental group with a mean gain of 7.63 versus 5.20, resulting in a mean gain difference of -2.43 and a t-value of 9.132. All p-values were 0.000, confirming that the differences were statistically significant and leading to the rejection of the null hypothesis. These results suggest that while both traditional instruction and technology-based games were effective in improving alphabet knowledge, traditional teacher-led methods produced larger learning gains in this study. This emphasizes the continued importance of structured, direct instruction in early literacy development. However, the significant improvements in the experimental group also indicate that technology-based games can still be a valuable tool, particularly for maintaining engagement and reinforcing learning. For educators and curriculum planners, the findings support the use of a blended approach that combines the strengths of traditional methods with the interactive benefits of digital tools to maximize early literacy outcomes.

5. Discussion

The results of the study show that both teaching methods traditional instruction and technology-based games were effective in improving the alphabet knowledge of preschool learners. The control group, which received traditional teacher-led lessons, showed a large improvement from "Very Good" scores in the pretest to "Excellent" in the posttest across all areas: uppercase recognition, lowercase recognition, and producing letter sounds. The experimental group, which used technology-based games, also demonstrated significant gains, with all learners achieving "Excellent" posttest scores. This indicates that both approaches helped develop strong alphabet skills, which are essential for early reading and writing. The high consistency of scores in both groups shows that the interventions worked well for all learners, not just a few. When comparing the two groups, the control group showed larger mean gains than the experimental group in all areas of alphabet knowledge. This suggests that traditional, teacher-led instruction had a stronger effect in this particular context. However, the experimental group also achieved mastery and demonstrated that technology-based games can be an engaging and effective way to support early literacy development. These findings imply that while traditional teaching remains very effective for building foundational skills, technology-based games can serve as a strong supplement to reinforce learning and maintain student motivation. Combining both methods could provide a balanced approach, ensuring children benefit from the structure of direct teaching while also enjoying the interactive and engaging aspects of digital learning tools.

6. Conclusion

The study concludes that both traditional teacher-led 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. The control group showed greater mean gains, highlighting the strong impact of structured, direct teaching methods on early literacy development. However, the experimental group also achieved mastery, demonstrating that technology-based games are valuable tools for reinforcing learning and keeping young learners engaged. These findings suggest that a blended approach, combining traditional instruction with interactive digital tools, can maximize early literacy outcomes and provide a balanced strategy for educators, curriculum developers, and policymakers in enhancing preschool reading programs.

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