



The Effects of Interactive Digital Learning Media on Preschoolers' Pre-Reading Skills and Literacy Interest

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Abstract: This study aims to examine the effects of interactive digital learning media on pre-reading skills and literacy interest among Group B children at an early childhood education center in Indonesia. The study employed a quantitative approach using a quasi-experimental pretest-posttest control group design. The sample comprised 30 children selected through purposive sampling and equally divided into an experimental group and a control group, with 15 children in each group. Data were collected using validated and reliable observation instruments measuring pre-reading skills and literacy interest. The data were analyzed using descriptive statistics, the Shapiro-Wilk normality test, Levene's test of homogeneity, paired-samples *t*-tests, independent-samples *t*-tests, and N-gain analysis. In the experimental group, the mean pre-reading skills score increased from 51.07 to 64.00, while the mean literacy interest score increased from 52.80 to 64.87. In comparison, the control group showed smaller increases in pre-reading skills, from 53.20 to 55.07, and in literacy interest, from 53.80 to 55.07. Independent-samples *t*-tests revealed statistically significant differences in posttest scores between the experimental and control groups for both outcomes ($p < .001$). The experimental group yielded N-gain scores of 0.2908 for pre-reading skills and 0.2821 for literacy interest. Although both N-gain scores were categorized as low, the experimental group demonstrated greater gains than the control group. These findings suggest that interactive digital learning media may serve as a complementary, teacher-guided strategy for supporting children's pre-reading development and engagement in early literacy activities.

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Introduction

Early childhood education plays a strategic role in establishing the foundations of children's cognitive, linguistic, social, and emotional development. Language development requires particular attention because it supports children's ability to communicate, understand symbols, acquire knowledge, and participate in literacy activities. Children aged five to six years are in a sensitive developmental period in which they begin to recognize letters, connect sounds with symbols, understand simple words, and develop readiness for formal reading instruction (Feldman, 2019; Rvachew, 2025). Appropriate and continuous stimulation during this period can strengthen children's language development and prepare them for literacy demands at the next level of education (Saju et al., 2025; Triulan et al., 2025).

Pre-reading skills represent an essential component of emergent literacy. These skills include recognizing letter forms, identifying letter sounds, distinguishing similar symbols, identifying initial sounds, and understanding simple relationships between words and images (Triulan et al., 2025). Pre-reading skills do not develop automatically but are shaped through planned, repetitive, and meaningful learning experiences that correspond to children's



developmental characteristics (Musthafa, 2021). Children who receive rich language stimulation tend to develop stronger phonological awareness, vocabulary, symbol recognition, and readiness to participate in formal reading activities (Rvachew, 2025; Triulan et al., 2025).

Literacy development is also influenced by children's interest in engaging with books, stories, letters, pictures, and other literacy materials. Literacy interest reflects children's enjoyment, attention, curiosity, and active involvement in literacy-related activities. Situational interest may emerge when children encounter learning experiences that are attractive, enjoyable, and relevant to their needs (Alfiyanti & Westhisi, 2024; Karim, 2024). A literacy-rich environment containing printed and digital materials can increase children's willingness to explore symbols, listen to stories, and participate in early reading activities (Khosa, 2025). Children with strong literacy interest are more likely to interact repeatedly with letters, words, and stories, thereby strengthening their emerging pre-reading skills (Astuti & Azizah, 2019; Pratiwi, 2020).

Preliminary observations at PAUD Buin Noni indicated that several Group B children still experienced difficulty naming letters and identifying their sounds accurately. Some children also found it difficult to distinguish similar letter forms and remember previously introduced symbols. Children's participation in reading-related activities remained limited because the learning process relied mainly on conventional materials and passive digital content. Interactive digital activities that allowed children to respond directly, receive immediate feedback, and repeat literacy exercises had not been systematically integrated into classroom instruction. Similar literacy challenges have also been reported in several early childhood education settings in East Nusa Tenggara, particularly in letter recognition, initial sound identification, and access to attractive literacy materials (Kiling et al., 2024; Laksana et al., 2024; Saju et al., 2025).

Interactive digital learning media offer an alternative approach for addressing these problems because they combine visual, auditory, textual, and interactive elements in a single learning experience. Multimedia learning becomes more meaningful when verbal and visual information is presented in an integrated and developmentally appropriate manner (Plass et al., 2020). Interactive quizzes, educational games, digital stories, and letter-recognition applications can provide repetition, immediate feedback, and opportunities for children to make choices during learning activities (Karim, 2024; Rahman et al., 2023). These characteristics allow children to participate actively rather than receive information passively. Game-based digital activities can also increase attention, motivation, and engagement when their content and level of difficulty are aligned with learners' characteristics (Alfiyanti & Westhisi, 2024; Janković et al., 2023).

While interactive digital media offer educational benefits, their use in early childhood education should remain developmentally appropriate and carefully guided. Current guidance emphasizes that digital media use for young children should prioritize high-quality educational content, adult co-engagement, and a balance between digital and non-digital experiences so that media use does not displace physical activity, play, sleep, reading, and direct social interaction (Munzer et al., 2026). In classroom practice, screen-based activities should therefore be limited to short and purposeful learning periods, accompanied by teacher guidance, and alternated with play-based activities, printed materials, and direct interaction. These principles are particularly important for children aged five to six years because digital media are intended to support learning rather than replace developmentally appropriate hands-on and social experiences.



Previous studies have demonstrated that digital animation, educational applications, interactive multimedia, and game-based learning can support early literacy development (Hasan et al., 2024; Rahman et al., 2023; Wahyuni & Nurjanah, 2022). Other studies have reported that interactive platforms and digital storytelling increase children's motivation and interest in literacy activities (Alfiyanti & Westhisi, 2024; Karim, 2024). Most previous research, nevertheless, has examined cognitive and affective literacy outcomes separately. Studies focusing on pre-reading skills commonly emphasize letter recognition, letter sounds, vocabulary, or phonological awareness without assessing children's literacy interest. Research examining literacy interest often measures motivation and engagement without connecting those outcomes to specific pre-reading indicators. Several studies also employed limited samples, lacked comparison groups, or measured literacy as a general construct rather than distinguishing between pre-reading competence and affective engagement.

The scientific novelty of this study lies in two main contributions. First, it simultaneously examines pre-reading skills as a cognitive-language outcome and literacy interest as an affective outcome within a single quasi-experimental design. Previous studies have commonly examined early literacy competence or learning interest as separate outcomes, making it difficult to explain whether an interactive digital intervention can influence both dimensions simultaneously. Second, the study provides empirical evidence from Kota Soe, East Nusa Tenggara, an underserved and geographically underrepresented setting in early childhood digital literacy research. Evidence from such settings remains limited compared with studies conducted in areas with greater access to educational technology and research resources. By examining both cognitive-language and affective outcomes in this setting, the study broadens the empirical basis for understanding the potential of interactive digital media in diverse early childhood educational environments.

The study proposed that interactive digital learning media would produce a significant improvement in the pre-reading skills of Group B children compared with conventional learning. The study also proposed that interactive digital learning media would produce a significant improvement in children's literacy interest compared with conventional learning. Accordingly, this study aimed to analyze the effect of interactive digital learning media on the pre-reading skills and literacy interest of Group B children at PAUD Buin Noni.

Research Method

This study used a quantitative approach with a quasi-experimental method and a pretest–posttest control group design (Hasibuan, 2024). The research involved an experimental group that received learning through interactive digital media and a control group that received conventional learning. Both groups were given pretest and posttest to measure changes in pre-reading skills and literacy interest. The research was conducted at PAUD Buin Noni, Oebesa Village, Kota Soe Subdistrict, Timor Tengah Selatan Regency, from January to April 2026. The participants were Group B children enrolled at the institution during the research period. A total of 30 children were selected using purposive sampling. The participants were divided into two groups, consisting of 15 children in the experimental group and 15 children in the control group. The sampling procedure was applied to ensure that the participants met the characteristics required for the implementation of the study.

The instruments were tested for validity and reliability before use. Content validity was assessed by two experts, construct validity was analyzed using Pearson item-total correlation, and reliability was tested using Cronbach's Alpha. The pre-reading instrument



obtained a reliability coefficient of 0.913, while the literacy interest instrument obtained a coefficient of 0.940, indicating that both instruments were highly reliable. The research procedure included preparation, instrument development, group assignment, pretest, treatment, posttest, and data analysis. The experimental group received learning through interactive digital media for five meetings. The intervention was delivered using laptop and Canva. The digital learning activities integrated letters, pictures, sounds, animations, and interactive response features. The activities included letter recognition, letter-sound identification, symbol discrimination, matching activities, and initial-sound exercises. Children were able to select responses, receive immediate feedback, and repeat activities under teacher guidance. The control group followed regular classroom instruction using teacher explanations, letter cards, picture books, and other conventional learning materials. Data were analyzed using descriptive and inferential statistics with SPSS. Descriptive statistics were used to determine the mean and standard deviation. Inferential analysis included the Shapiro–Wilk normality test, Levene’s homogeneity test, paired-samples t-test, and independent-samples t-test at a significance level of .05. The magnitude of improvement was further evaluated using normalized gain (N-Gain), calculated using the following formula (Syafei, 2025):

$$g = (\text{posttest score} - \text{pretest score}) / (\text{maximum possible score} - \text{pretest score})$$

The N-Gain values were interpreted as low when $g < 0.30$, moderate when $0.30 \leq g < 0.70$, and high when $g \geq 0.70$ (Elfrianto et al., 2022). This analysis was used to describe the relative magnitude of improvement from pretest to posttest in each group.

Results and Discussion

Result

The Shapiro–Wilk test showed that the pretest and posttest scores of pre-reading skills and literacy interest in both groups had significance values greater than .05. The data were therefore normally distributed. Levene’s test produced significance values of .080 for pre-reading skills and .152 for literacy interest, indicating homogeneous variances between the experimental and control groups. These results confirmed that the data met the assumptions required for parametric analysis.

Table 1. Descriptive Statistics and Within-Group Test Results

Variable	Group	Pretest M (SD)	Posttest M (SD)	Mean Increase	<i>t</i>	<i>df</i>	<i>p</i>
Pre-reading skills	Experimental	51.07 (3.92)	64.00 (6.84)	12.93	−9.246	14	< .001
	Control	53.20 (3.45)	55.07 (3.01)	1.87	−4.525	14	< .001
Literacy interest	Experimental	52.80 (3.53)	64.87 (6.19)	12.07	−9.791	14	< .001
	Control	53.80 (2.93)	55.07 (3.01)	1.27	−2.523	14	.024

The mean pre-reading score of the experimental group increased by 12.93 points, from 51.07 at the pretest to 64.00 at the posttest. The paired-samples t-test indicated a significant increase, $t(14) = -9.246$, $p < .001$. The control group showed a smaller increase of 1.87 points, from 53.20 to 55.07, which was also statistically significant, $t(14) = -4.525$, $p < .001$. A similar pattern was observed for literacy interest. The experimental group increased by 12.07 points, from 52.80 to 64.87, $t(14) = -9.791$, $p < .001$, whereas the control group increased by 1.27 points, from 53.80 to 55.07, $t(14) = -2.523$, $p = .024$. Although both groups



showed statistically significant within-group changes, the magnitude of improvement was considerably greater in the experimental group.

Table 2. Between-Group Comparison and N-Gain Results

Variable	Posttest Mean Difference	t	df	p	95% CI	Experimental N-Gain	Control N-Gain
Pre-reading skills	8.933	4.633	28	< .001	[4.983, 12.883]	0.2908	0.0425
Literacy interest	9.800	5.517	28	< .001	[6.161, 13.439]	0.2821	0.0293

The independent-samples t-test showed a significant posttest difference in pre-reading skills between the experimental and control groups, $t(28) = 4.633$, $p < .001$. The experimental group obtained a posttest mean that was 8.933 points higher than the control group, with a 95% confidence interval of [4.983, 12.883]. A significant between-group difference was also found for literacy interest, $t(28) = 5.517$, $p < .001$, with a mean difference of 9.800 points and a 95% confidence interval of [6.161, 13.439]. These results supported both research hypotheses.

Discussion

The significant increase in pre-reading skills indicates that interactive digital media provided literacy stimulation that was more intensive and varied than conventional media. The combination of letters, images, sounds, animation, and immediate feedback enabled children to receive information through visual and auditory channels simultaneously. Children were not limited to observing the teacher's explanation because they could identify letters, listen to letter sounds, select responses, and repeat activities. Multimodal presentation supports children's understanding when verbal and visual information are integrated in a developmentally appropriate learning activity (Plass et al., 2020).

The improvement also reflects the importance of repetition in developing early literacy. Interactive digital media allowed children to repeat letter recognition, sound discrimination, symbol matching, and initial sound activities without experiencing the repetition as a monotonous exercise. The activities were presented as games and simple challenges, allowing children to make mistakes, receive feedback, and try again. Language acquisition in early childhood develops gradually through repeated and meaningful stimulation provided by the learning environment (Iverson, 2022).

The finding supports previous research showing that contextual learning positively influences beginning reading skills because children understand symbols more easily when learning materials are connected to familiar experiences (Antara et al., 2019). The digital activities used in the present study combined language symbols with pictures, sounds, and simple content related to children's daily experiences. This characteristic helped children move from merely memorizing letter forms to understanding the relationship between symbols, sounds, pictures, and meanings.

The finding is also consistent with research on audiovisual animation, which demonstrated that integrated visual and auditory stimuli improve children's attention, comprehension, and involvement in language learning (Pishghadam et al., 2024). The present study extends that finding because the media did not only display audiovisual material but also required children to provide direct responses. Interactivity placed children as active participants rather than passive recipients of information.

Comparable results were reported in research on game-based interactive digital media, which found that educational games can strengthen early childhood literacy through active



participation and immediate feedback (Rahman et al., 2023). Digital media have also been found to stimulate the literacy skills of children aged five to six years by presenting learning materials in attractive and accessible forms (Satriana et al., 2022). The present findings confirm those studies while providing more specific evidence that digital interactivity affects letter recognition, letter sounds, symbol discrimination, and other components of pre-reading readiness.

The increase in literacy interest demonstrates that the media affected the affective dimension of literacy as well as children's cognitive-language abilities. Children's interest grew because the learning experience contained visual attraction, sound, play, choice, and direct involvement. Interest in early childhood tends to develop when activities produce enjoyment, curiosity, successful experiences, and opportunities to participate actively (van Aswegen & Pendergast, 2023).

Immediate feedback contributed to children's positive emotional experiences during learning. Correct responses produced reinforcement, while incorrect responses could be revised without direct negative judgment from the teacher or peers. This condition reduced children's fear of making mistakes and encouraged them to participate repeatedly. Positive learning experiences gradually changed literacy activities from tasks that children had to complete into activities they were willing to explore.

The result supports previous research showing that digital media increase children's involvement because dynamic visual presentations are easier to understand and more attractive than passive instructional materials (Antara et al., 2022; Song, 2026). Children in the experimental group observed, listened, selected answers, and repeated activities according to their learning pace. Such involvement was reflected in greater enthusiasm, attention, participation, and willingness to interact with literacy materials.

The finding is consistent with research showing that visual media used in storytelling can improve interest and beginning reading-writing achievement by focusing children's attention and stimulating curiosity (Bayu, 2019; Masnipal & Hakim, 2026). Interactive digital media expanded the role of visual media by adding audio, movement, educational games, and direct responses. The richer interaction explains why the improvement in literacy interest was much greater in the experimental group.

The finding also supports studies on enjoyable learning assisted by audiovisual media, which reported that pleasant learning environments increase motivation, participation, and language learning outcomes (Bayu & Wahyuni, 2019; Yeh, 2022; Yuan & Jianfei, 2024). Enjoyment has particular importance in early childhood education because young children's willingness to learn is strongly influenced by their emotional experiences. Children who feel interested and successful tend to maintain attention longer and voluntarily repeat the activity.

The simultaneous improvement in pre-reading skills and literacy interest represents the central scientific finding of the study. Interactive digital learning media did not only help children recognize letters and language sounds but also encouraged them to enjoy and participate in literacy activities. Cognitive competence and affective interest developed together because children acquired new skills through experiences perceived as enjoyable and meaningful. Literacy interest encouraged children to interact more frequently with symbols and words, while increased competence created successful experiences that further strengthened their interest (Indriani & Suteja, 2023).

The combined finding extends previous studies that mainly examined early literacy ability or learning interest as separate outcomes. Research on digital literacy media commonly emphasizes letter recognition, phonological awareness, or beginning reading



performance, while research on interactive platforms frequently focuses on motivation and engagement (Naeem & Khan, 2024; Tawil & Tarawneh, 2025). The present study shows that one learning intervention can influence both dimensions within the same experimental design.

The low N-Gain classification requires careful interpretation because statistical significance and normalized gain describe different aspects of the findings. The significant between-group differences indicate that the improvement observed in the experimental group was unlikely to be explained by random variation alone, whereas N-Gain reflects the relative magnitude of improvement achieved during the intervention. Although the experimental group performed significantly better than the control group, N-Gain values of 0.2908 for pre-reading skills and 0.2821 for literacy interest remained within the low category.

The factor most directly supported by the present research design is the relatively short intervention period of only five meetings. Pre-reading abilities such as stable letter recognition, sound-symbol association, discrimination of similar symbols, and retention of previously learned symbols develop gradually through repeated and sustained exposure. Five sessions may have been sufficient to produce statistically detectable changes but not long enough to generate moderate or high normalized gains. Literacy interest may likewise require repeated positive experiences before short-term enthusiasm develops into a more stable pattern of engagement.

Other contextual factors may also have influenced the magnitude of improvement. Children aged five to six years may require an adaptation period before they can use interactive digital interfaces efficiently, particularly when their previous exposure to educational technology differs. Possible limitations in device availability, technical performance, or opportunities for individual interaction may also influence the intensity of digital learning. However, these factors were not systematically measured in the present study and therefore cannot be considered confirmed explanations for the low N-Gain. Future research should document children's prior digital experience, adaptation time, device availability, intervention fidelity, and the duration of active interaction with the media so that the contribution of these factors can be examined empirically.

The small improvement observed in the control group also indicates that conventional classroom instruction remained beneficial. Children continued to receive literacy stimulation through teacher interaction, letter cards, picture books, verbal explanations, and other learning materials. The contrast between the groups therefore suggests that the observed advantage was not simply the result of technology exposure itself but was associated with the additional interactive, repetitive, multisensory, and feedback-based learning opportunities provided through the digital intervention.

The findings imply that interactive digital media should be positioned as a pedagogical support rather than a replacement for teachers. Teachers remain responsible for selecting developmentally appropriate content, guiding children's interaction, connecting digital activities with real objects and printed materials, and preventing excessive screen exposure. A balanced combination of interactive digital activities, picture books, storytelling, letter games, and direct teacher-child interaction can create a richer early literacy environment. Technology-based literacy learning should remain aligned with play-based learning and the developmental needs of young children (Astawan & Bayu, 2025; Bayu et al., 2023).



Conclusion

Interactive digital learning media significantly improved preschool children's pre-reading skills and literacy interest compared with conventional learning. The findings indicate that interactive digital media can simultaneously support the cognitive-language dimension of early literacy through letter, sound, and symbol recognition and the affective dimension through increased interest, attention, and engagement in literacy activities. These improvements appear to be associated with the integration of visual, auditory, interactive, repetitive, and play-based learning elements that provide children with opportunities to respond directly and receive immediate feedback. Although the N-Gain values remained in the low category, the experimental group achieved substantially greater gains than the control group. The findings provide preliminary empirical support for the use of teacher-guided interactive digital media as a complementary literacy strategy in early childhood educational settings, including those in geographically underserved and resource-constrained regions. Nevertheless, generalization should be made cautiously because the study involved a small sample from a single institution and an intervention of only five meetings. Interactive digital media should therefore complement, rather than replace, teacher-child interaction, play-based learning, printed materials, and other developmentally appropriate literacy experiences.

Recommendation

Teachers are advised to integrate interactive digital media with picture books, storytelling, letter games, play-based activities, and direct teacher-child interaction rather than using digital media as a substitute for conventional learning. Digital activities should be developmentally appropriate, implemented in short and purposeful periods, and accompanied by teacher guidance to maintain their educational value and prevent excessive screen exposure.

Educational media and application developers are encouraged to design early literacy media with simple and age-appropriate interfaces, clear visual and auditory cues, immediate feedback, limited distracting elements, and activities that encourage children to connect digital experiences with real objects, language, and social interaction. Accessibility and ease of use should also be considered so that interactive media can be implemented in educational settings with varying technological resources.

Local education authorities and policymakers should support the responsible integration of digital media in early childhood education through teacher professional development, appropriate technological infrastructure, guidance on developmentally appropriate media use, and equitable access to high-quality educational resources. Digital learning policies should emphasize the pedagogical purpose of technology rather than technology use itself and maintain a balance between digital learning, play, printed materials, physical activity, and face-to-face interaction.

Future studies should involve larger samples from several early childhood education institutions, extend the intervention period, and examine the sustainability of improvements over time. Future research should also investigate children's prior digital experience, adaptation to interactive technology, device accessibility, and intervention fidelity to determine whether these factors influence the magnitude of learning gains.



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