

Efforts to Improve Early Reading Skills in 4- to 5-Year-Old Children Using the Wordwall Interactive Digital Game at Sabilina Islamic Preschool

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Abstract

Science literacy is one of the abilities that students must have to compete in the international world. Various efforts are made to improve science literacy. The purpose of this research is to review, summarize, and analyze the results of primary research on various learning models to improve science literacy through a comprehensive Systematic Literature Review. This research was conducted at the elementary, junior high, and high school levels using the PRISMA (Preferred Reporting Items for Systematic Review and Meta Analysis) method. Data was collected from the Google Scholar database published from 2015 to May 2026 with the keywords "Effectiveness", "Learning model", "Science", "improving science literacy". The first search results using Publish on Perish obtained as many as 200 articles. Several inclusion and exclusion criteria were applied so that 18 articles were analyzed and synthesized according to the research focus. This study found that the guided inquiry model was proven to be effective in improving science literacy with an average N-Gain value of 0.89 with a high category, the most frequently used learning model in this study was Problem Based Learning (44%), the combination of STEM approaches and PhET platforms with a learning model was widely carried out with a frequency of 2 studies (29%), and research was widely applied at the junior high school level (61%).

Keywords

Effectiveness, Learning Model, Science Learning, Science Literacy, SLR



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INTRODUCTION

Early childhood education is a crucial stage in fostering all aspects of a child's development. Early childhood is the "golden age" a critical period for the development of various skills, including language skills. Language is one of the foundational skills that must

be developed in early childhood. In this language development process, early reading skills are a key ability that should be introduced and nurtured from an early age.

Children can begin reading activities by recognizing and remembering letters, then combining them into syllables. Through mastery of syllables, children can gradually read words and eventually simple sentences. Early reading skills form a crucial foundation for building children's literacy skills in early childhood education (PAUD). These skills include recognizing letters, identifying letter sounds (phonemes), matching letters with pictures, arranging letters into simple syllables, and understanding the relationship between symbols and meaning (Kusuma et al., 2025). These skills further develop through activities such as recognizing and remembering letter symbols, understanding letter sounds, identifying the initial sounds of words, and distinguishing between the shapes and sounds of letters. Children also begin to learn to combine syllables into simple words, distinguish various sounds made by animals and objects in their surroundings, and match words with corresponding pictures (Ganarsih et al., 2022).

Early reading skills play a crucial role in early childhood development as they serve as a foundation for supporting the learning process in subsequent stages. During this phase, children begin to develop basic literacy skills, such as recognizing and distinguishing letter symbols and associating letters with their sounds. Mastery of these skills not only supports language development but also contributes to the development of children's thinking and communication skills (Rahayani et al., 2026). Introduction to reading activities should begin at an early age without waiting until children enter elementary school. For Group A, with children aged 4–5 years, early reading instruction should be conducted gradually through simple activities appropriate to the children's developmental characteristics. Learning at this stage is focused on mastering basic reading skills, ranging from recognizing letter symbols and sounds to developing the ability to understand the meaning or content of simple texts (Rengganis et al., 2026).

However, literacy skills remain a widely discussed issue in the Indonesian education sector. According to the 2022 PISA results, the reading literacy skills of Indonesian students still show relatively low scores compared to those of students in other participating countries (OECD, 2022). This situation indicates that literacy must be strengthened starting in early childhood education, as this is the initial stage in building the foundation for reading skills. At the early childhood education (PAUD) level, various studies also indicate that the early reading skills of 4–5-year-olds still need improvement. Children still struggle to recognize letters, distinguish between vowels and consonants, and match letters with sounds that begin the same way (Kusuma et al., 2025).

Low early reading skills can be influenced by various factors, including a lack of motivation and interest in reading among children, the use of unengaging teaching methods, and children's difficulty in maintaining concentration during the learning process. Early reading instruction that still relies on monotonous and non-interactive reading materials or media can also cause children to become easily bored (Kusuma et al., 2025). These conditions

highlight the importance of early childhood education (PAUD) teachers' role in selecting learning strategies and media that align with children's developmental characteristics. Learning should be designed in a fun and engaging environment so that children have positive experiences with literacy activities. Fostering a love for books and helping children understand the meaning of words and sentences are key foundations for developing children's literacy skills (Herawati et al., 2025).

In the digital age, children's interest in using electronic devices is on the rise. This trend presents an opportunity for teachers to incorporate technology into the learning process. However, the use of technology in early childhood education has not yet been optimized because not all available applications are suitable for the characteristics and developmental stages of young children (Mardhiah & Maryatun, 2026). Therefore, the selection of technology as a learning medium must take into account children's needs, characteristics, and learning styles to ensure its use continues to optimally support their developmental process. Digital media used in early childhood education must be interactive, engaging, easy to use, and provide opportunities for children to actively participate in learning activities.

One such medium that can be used in learning is Wordwall, a web-based learning platform that offers various interactive formats utilizing text, images, animations, sound, and video (Hiya et al., 2026). This platform also provides various interactive game templates such as quizzes, matching games, anagrams, scrambled words, spinning wheels, and word searches that can be customized to meet learning needs (Fibriana et al., 2025). The diversity of these game formats allows teachers to develop more varied learning activities so that children do not merely receive information passively but are also engaged in enjoyable learning activities.

The use of Wordwall in early reading instruction can be directed toward various visual and interactive activities for letter and sound recognition. The various games available can be utilized for activities such as recognizing letter symbols, matching letters with pictures, distinguishing letter shapes, and identifying the initial sounds of words. Presenting material through games can provide a more engaging learning experience while encouraging children's active participation in the learning process. Thus, Wordwall has the potential to serve as a learning medium that supports the development of early reading skills in young children. Previous research has demonstrated the potential of Wordwall in supporting literacy learning and early reading skills. However, studies specifically examining the implementation of Wordwall through Classroom Action Research (CAR) to improve the early reading skills of 4–5-year-olds in the context of early childhood education remain limited. This study aims to fill this gap by directly implementing Wordwall in the learning process through the stages of planning, action, observation, and reflection in each cycle. This implementation is expected to provide insight into the process and improvement of children's early reading skills through the use of interactive digital games.

Based on the above discussion, early reading skills are a crucial aspect in building the foundation of literacy for young children; therefore, learning strategies that are engaging, interactive, and aligned with children's learning characteristics are essential. One alternative

medium that can be utilized is the digital interactive game Wordwall. Consequently, this study aims to improve the early reading skills of 4–5-year-old children through the use of the digital interactive game Wordwall at Sabilina Islamic Kindergarten.

METHODS

This section should be written in paragraphs. It explains the research approach, the type of research, the data collection technique, and data analysis. These elements should appropriately reflect and describe the purpose of the study. In the following paragraph, the author must present the research framework using a concept map or diagram (García, 2020). This study employs a mixed-methods approach (qualitative and quantitative) using Classroom Action Research (CAR) as the research design. CAR was chosen because it aims to directly improve and enhance the learning process through actions taken by teachers in the classroom. The implementation of Classroom Action Research (CAR) involves various procedures outlined by experts. However, in general, there are four main stages that are easy to understand and implement: planning, action, observation, and reflection (Utomo et al., 2024). The study was conducted at Sabilina Islamic Kindergarten in May 2025 with the research subjects being children in Group A aged 4–5 years. The study was carried out in three cycles, each comprising the planning, implementation, observation, and reflection stages. The intervention involved the use of the interactive learning tool WordWall to improve early reading skills in young children. The data collection techniques used included observation, documentation, and assessment of the children's early reading skills. Observations were conducted to monitor the activities of teachers and children during the learning process. Documentation was used to obtain supporting data in the form of activity photos, field notes, and learning documents. Meanwhile, the assessment of early reading skills was conducted using an observation sheet containing indicators of early reading skills in accordance with the developmental levels of young children.

Data analysis was conducted using both quantitative and qualitative descriptive methods. Quantitative data were obtained from the results of assessments of the children's letter recognition skills, and the percentage of achievement was calculated for each cycle. Qualitative data were obtained from observations and documentation, which were analyzed through the stages of data reduction, data presentation, and drawing conclusions. The results of the analysis were used as a basis for reflection to determine improvements for the next cycle so that the research objectives could be optimally achieved.

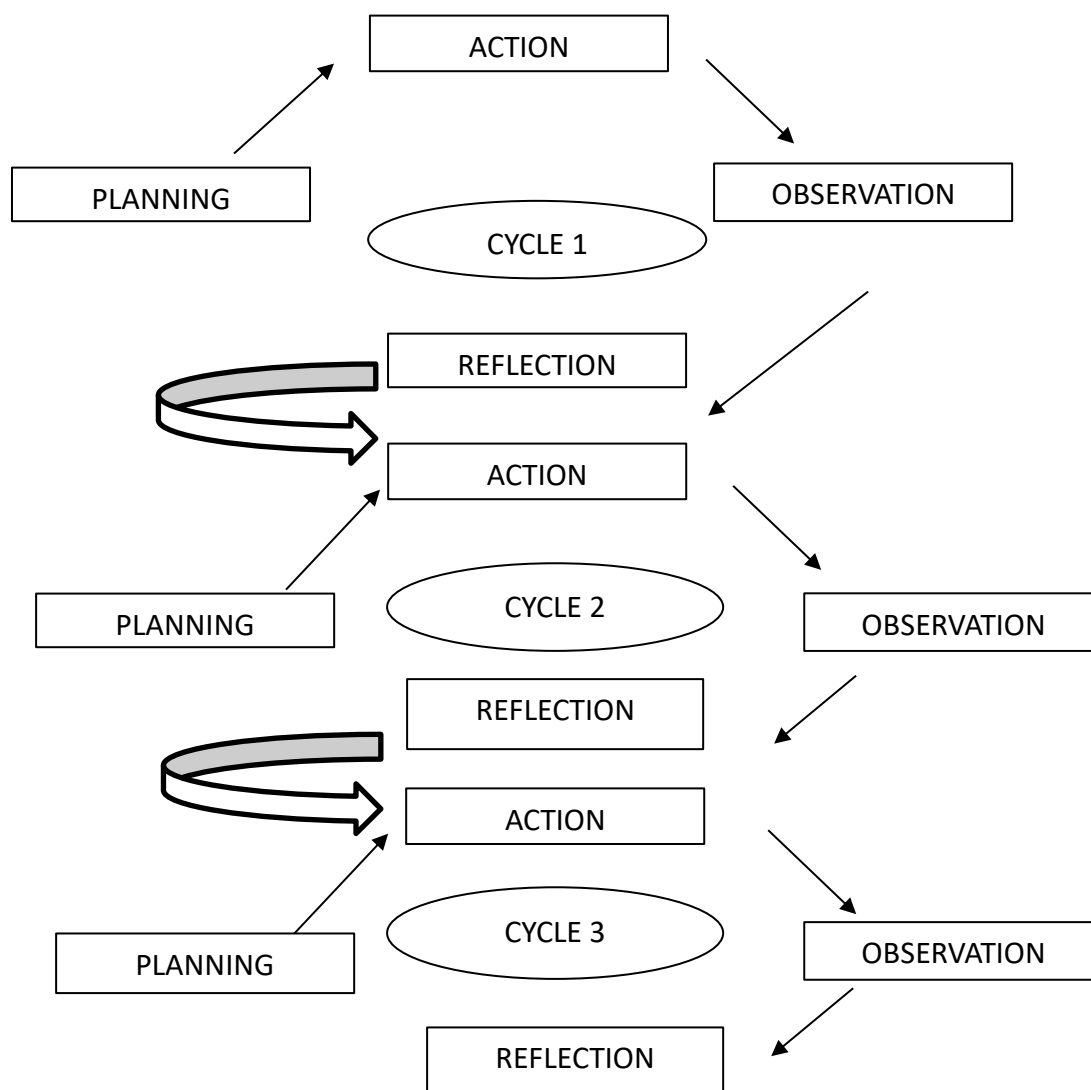


Figure 1. Framework Classroom Action Research Framework

Data analysis was conducted qualitatively and reflectively: qualitatively through data reduction, data presentation, and drawing conclusions; quantitatively by calculating the average score and the percentage of classical mastery using the formula:

$$P = \frac{N}{F} \times 100\%$$

F

Explanation:

P = Percentage

F = Number of children who met the indicator

N = Total number of children

Results

This classroom action research was conducted in three cycles, each consisting of the planning stage, implementation of actions, observation, and reflection. The study aimed to improve the early reading skills of children aged 4–5 years through the use of the Wordwall interactive digital game on the theme of professions. The observed indicators of early reading skills included: (1) recognizing images and vocabulary related to professions, (2) recognizing letter symbols, (3) matching images with words, (4) reading simple words, and (5) correctly

repeating the names of professions. Initial Conditions (Pre-Intervention) Based on the results of the initial observation, the children's early reading skills were still low. Most children were only able to recognize images of professions but were not yet able to connect the images with written words. The learning activities conducted by the teacher still relied on simple picture cards, causing the children to lose focus quickly. The results of the initial assessment showed that only two children had reached the "Very Well Developing" (VWD) category, while the majority of children were in the "Beginning to Develop" (BD) and "Not Yet Developing" (ND) categories.

Table 1. Pre-Intervention Results

No	Child's Name	Score
1	O	45
2	K	55
3	S	50
4	G	60
5	A	55
6	O	45
7	B	50
8	K	60
9	A	55
10	O	45

Average = 52.0 Mastery Rate = 20% These results indicate that children's early reading skills still need to be improved through activities that are more engaging and tailored to the learning characteristics of young children. Cycle I Implementation Cycle I was conducted using the Wordwall game, which involved matching pictures of words representing professions with corresponding pictures. The teacher introduced various professions, such as doctor, teacher, police officer, pilot, chef, firefighter, farmer, fisherman, soldier, and nurse. The children were asked to select the appropriate picture of a word using the Wordwall digital platform displayed on an LCD screen. Throughout the activity, the children appeared enthusiastic because the platform provided audio feedback whether the answer was correct or incorrect. However, some children still needed the teacher's assistance while operating the game.

Table 2. Results of Cycle 1

No	Child's Name	Score
1	O	65
2	K	70
3	S	65
4	G	75
5	A	70
6	O	60
7	B	65
8	K	75
9	A	70
10	O	60

Average = 67.5 Mastery Rate = 50% There was an increase of 15.5 points compared to the initial condition.

Reflection on Cycle I The observation results revealed several challenges, namely: the children were still focusing on the pictures and not paying attention to the text, some students were still waiting for the teacher's help, time management was not yet optimal, and the teacher was still providing instructions too frequently. Therefore, in Cycle II, the teacher designed more challenging activities by linking pictures and words. Cycle II Implementation In Cycle II, the activity was modified to involve matching pictures of professions with their corresponding words. The children were introduced to simple written forms representing the profession pictures. The teacher provided an introduction using a song about professions, after which the children took turns playing Wordwall.

Table 3. Results of Cycle II

No	Child's Name	Score
1	O	80
2	K	85
3	S	80
4	G	90
5	A	85
6	O	75
7	B	80
8	K	90
9	A	85
10	O	75

Average = 82.5 Mastery Rate = 80% An increase of 15 points compared to Cycle I.

Reflection on Cycle II Although most children were already able to match pictures with words, there were still two children who were not yet proficient at recognizing written forms. The teacher then provided reinforcement through vocabulary repetition and more opportunities for play.

Cycle III implementation in Cycle III, the children engaged in activities matching words with words without the aid of pictures. This activity aimed to assess the children's ability to recognize written forms independently.

Table 4. Results of Cycle III

No	Child's Name	Score
1	O	90
2	K	95
3	S	90
4	G	100
5	A	95
6	O	90
7	B	90
8	K	100
9	A	95
10	O	90

Average = 93.5 Achievement Rate = 100% All children have met the study's success indicators.

The research results show an improvement in the early reading skills of 4–5-year-old children after the implementation of the Wordwall interactive digital game. This improvement in early reading skills is evident from the mean scores and the percentage of classical mastery from the initial condition through Cycle III.

Table 5. Improvement in Children's Early Reading Skills at Each Research Stage

No	Research Stage	Average Score	Classical Mastery Rate
1	Initial Condition	52,0	20%
2	Cycle 1	67,5	50%
3	Cycle 2	82,5	80%
4	Cycle 3	93,5	100%

Source: Research results, 2026

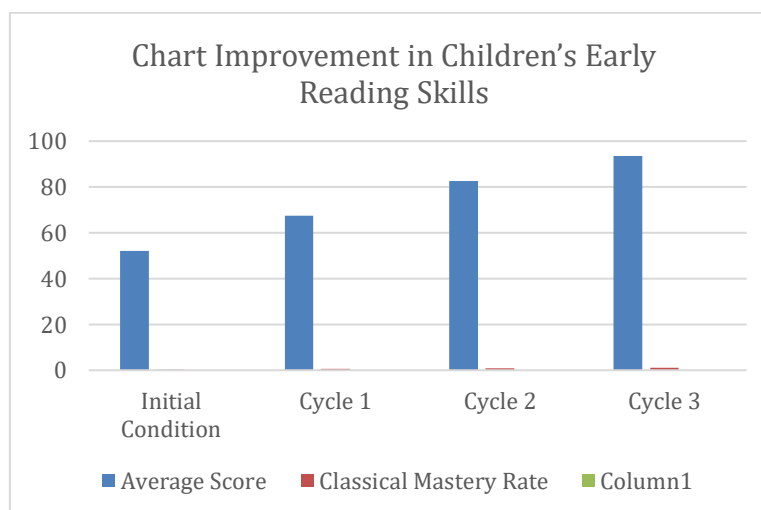


Figure 2. Improvement in the Average Early Reading Proficiency Score of Children at Each Research Stage

At the initial stage, the average score for children's early reading skills was 52.0, with a classical mastery rate of 20%. These results indicate that the majority of children had not yet met the established success criteria. The initial conditions served as the basis for the researcher to implement an intervention using the interactive digital learning tool Wordwall.

After the intervention in Cycle I, the average early reading ability score increased to 67.5, with a classical mastery rate of 50%. Although there was an improvement, these results had not yet met the study's success target. Therefore, a reflection on the learning process was conducted, and the intervention was refined for the next cycle.

In Cycle II, the average score for early reading skills increased to 82.5, with a classical mastery rate of 80%. This improvement indicated that the children were beginning to engage more effectively with the Wordwall activities. The children also demonstrated more active participation during the learning process.

In Cycle III, the average score for early reading skills increased again to 93.5, with a classical mastery rate of 100%. These results indicate that all children met the established success criteria. Consequently, the research was terminated in Cycle III because the success indicators had been met. Overall, the research results show a gradual improvement in early reading skills from the initial condition through Cycle III following the use of the Wordwall digital interactive game.

Discussion

The research results show that the use of the Wordwall digital interactive game in early reading instruction at Sabilina Islamic Kindergarten was followed by a gradual improvement in the children's abilities from the initial condition through Cycle III. This improvement was evident not only in changes in early reading ability scores but also in changes in the children's engagement during the learning process. At the initial stage, most children still relied on pictures and teacher assistance to recognize vocabulary and connect pictures with written words. After being provided with gradual instruction through the Wordwall game, the children began to identify written symbols, match pictures with words, and recognize simple words with decreasing assistance.

These findings indicate that the use of learning media tailored to the learning characteristics of young children can provide a more engaging and meaningful learning experience. Young children primarily learn through play, exploration, concrete experiences, and interaction with their environment. Therefore, early reading instruction should not only focus on the mechanical mastery of written symbols but also provide experiences that allow children to connect symbols, sounds, images, and meaning. In this study, Wordwall was used not merely as a medium for displaying questions, but as a game that encouraged children to interact directly with the learning material.

Improvements in skills during each cycle were also linked to adjustments in teaching strategies based on reflection. In Cycle I, the children still tended to focus on the pictures and needed the teacher's help when participating in the game. This indicated that the children were not yet fully ready to understand written symbols independently. Based on this reflection, the teaching strategies in Cycle II were refined by providing more structured experiences in connecting pictures with words. The teacher provided introductory activities, vocabulary repetition, and opportunities for children to take turns playing. These refinements gave the children the opportunity to gain more repetitive and structured experiences in recognizing the relationship between visual representations and written words.

In Cycle III, the level of assistance was reduced by providing activities that involved matching words to words without the aid of pictures. This change in the activity format indicated a gradual increase in difficulty. Children who previously received assistance through pictures began to be guided to recognize written forms more independently. Thus, the improvement in early reading skills in this study is not only related to the use of Wordwall but also to the teachers' strategies in increasing the complexity of activities in line with the children's developmental progress. This process demonstrates that digital media is more meaningful when used in conjunction with systematic learning strategies that are responsive to observational findings.

These findings can be explained through Vygotsky's theory of the Zone of Proximal Development (ZPD). Children can achieve higher levels of competence when they receive support from more capable adults or peers through the process of scaffolding (Wijayanti et al.,

2026). In this study, the teacher provided support when children experienced difficulty understanding instructions, selecting answers, or connecting pictures with written words. As the children's abilities improved, this assistance was gradually reduced until they were able to complete the activities more independently. Thus, the use of Wordwall becomes more effective when integrated into pedagogical interactions between teachers and children, rather than when the technology is used independently without guidance.

The results of this study also support the findings (Kerore et al., 2026) which indicate that Wordwall provides various forms of interactive games that can be used to create a more engaging learning experience. In the context of this study, these interactive characteristics are evident in the children's engagement when selecting answers, matching pictures and words, and receiving immediate feedback. This feedback helps children assess the accuracy of their responses and provides them with the opportunity to try again. Thus, the game-like features of Wordwall can foster a more active learning environment compared to learning that relies solely on monotonous print materials.

The findings of this study are also consistent with the view (Nurfaidah et al., 2026) that early reading skills are not limited to the ability to recognize letters but also include the ability to connect symbols with meaning. The activities conducted in this study gradually guided children from recognizing pictures and vocabulary toward recognizing written symbols and simple words. This demonstrates that early reading instruction can be conducted through meaningful and contextual experiences. Children were not immediately directed to read complex texts but were first given the experience of recognizing meaning through pictures and vocabulary closely related to the learning theme namely, professions.

Furthermore, the study's findings support the view (Herawati et al., 2025) regarding the importance of creating learning experiences that foster children's interest in literacy activities. The children's enthusiasm during the Wordwall activity indicates that game-based elements can serve as a strategy to capture children's attention in early reading instruction. Nevertheless, children's interest and engagement cannot be attributed solely to technology. The teacher's role in providing motivation, asking questions, offering examples, reviewing vocabulary, and providing assistance when children encounter difficulties remains a crucial component of successful learning.

One key finding of this study is that skill improvement occurred in tandem with the reflection process in each cycle. This highlights the strengths of action research in the context of early childhood education. Teachers do not merely implement a fixed method but can identify issues that arise during instruction and make adjustments in subsequent actions. Challenges in Cycle I such as children's reliance on pictures, their need for teacher assistance, and suboptimal time management served as the basis for improvements in Cycles II and III. Thus, the contribution of this study lies not only in the use of Wordwall but also in the process of continuous learning improvement through reflective cycles.

Compared to previous studies that have primarily focused on the use of digital media as a learning tool, this study contributes to the application of Wordwall in early reading instruction for 4–5-year-old children through Classroom Action Research. This contribution is evident in the use of media tailored to the children's developmental abilities in each cycle. Activities were not presented at the same level of difficulty but were developed gradually – from picturebased activities and picture-word associations to word recognition without the aid of pictures. This step-by-step approach is a crucial part of the learning process because 4–

5-year-olds are still in the early stages of literacy development, which requires visual support, concrete experiences, repetition, and adult guidance.

Nevertheless, the research findings must be interpreted with several limitations in mind. The study was conducted on only one group of children with a limited number of subjects at a single early childhood education institution. Furthermore, as this classroom action research did not include a control group, it cannot be definitively concluded that the observed improvement in skills was solely due to the use of Wordwall. These improvements may also be influenced by other factors, such as repetition of material, learning experiences over several cycles, interaction with the teacher, and the children's natural development. Therefore, the study's results are best interpreted as evidence that the implementation of Wordwall, accompanied by learning strategies and teacher reflection, can support improvements in early reading skills within the context of the classroom studied.

The use of digital media with young children should also be approached selectively. Teachers need to consider screen time, device availability, children's readiness, and the quality of interaction during learning. Digital media should not replace direct literacy experiences, such as reading storybooks, playing letter cards, singing, conversing, and engaging in phonological activities. In this context, Wordwall is best positioned as one of several supporting tools that complement a variety of children's literacy experiences, rather than as the sole method for teaching early reading.

From a pedagogical perspective, this study suggests that early childhood education teachers can utilize Wordwall to create interactive literacy activities while adjusting the difficulty level of the games to match children's developmental stages. Teachers need to design activities based on learning objectives, provide scaffolding as needed, and reflect on children's responses. The use of technology also needs to be integrated with non-digital activities to ensure comprehensive literacy development. With this approach, technology serves not only as a form of entertainment but also as a pedagogical tool that supports children in establishing connections between images, symbols, sounds, and meaning.

Overall, the research findings indicate that the phased implementation of the Wordwall interactive digital game, accompanied by teacher guidance, can support improvements in the early reading skills of 4–5-year-old children. This improvement is closely tied to the alignment between the media's characteristics, the principles of learning through play, the provision of scaffolding, and the process of reflection and action refinement in each cycle. Therefore, the use of Wordwall can be considered as one alternative medium for early literacy learning in early childhood education, while still taking into account children's developmental characteristics and maintaining a balance between digital and non-digital experiences.

CONCLUSION

Wordwall can improve the early reading skills of 4–5-year-old children. Improvements were observed gradually at each stage of the study: from an average score of 52.0 with a 20% classical mastery rate at the initial stage, increasing to 67.5 with a 50% mastery rate in Cycle I, then to 82.5 with an 80% mastery rate in Cycle II, and reaching 93.5 with a 100% classical mastery rate in Cycle III. With the achievement of 100% classical mastery, the research success criteria were met, and the intervention was discontinued in Cycle III.

This improvement was supported by the gradual implementation of Wordwall in accordance with the children's developmental progress, starting from recognizing pictures and vocabulary, connecting pictures with words, to matching and recognizing words without

the aid of pictures. The use of interactive, game-based media provided children with the opportunity to learn actively, receive immediate feedback, and practice repeatedly in a fun environment. In addition to the use of this media, the process of refining instruction through reflection at each cycle also played a role in adjusting the difficulty level of activities and the form of teacher guidance to meet the children's needs.

Thus, Wordwall can be used as an alternative learning tool to support the development of early reading skills in 4–5-year-olds. Its use should be accompanied by teacher guidance, tailored to the children's learning objectives and developmental stages, and integrated with non-digital literacy experiences such as reading storybooks, playing letter cards, engaging in conversation, and phonological activities. Future research could involve a more diverse range of participants and institutional contexts to gain a broader understanding of Wordwall's use in children's early literacy development.

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