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Utilization of Wordwall Applications in Cognitive Development in Early Childhood

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Absract

This study aims to describe the use of the Wordwallapplication in developing the cognitive abilities of early childhood students at BA Aisyiyah Kalimandi. The background of this research is based on the importance of cognitive stimulation during the golden age, which requires teachers to present engaging, contextual, and technology-based learning experiences. Wordwall, as an interactive digital learning medium, is believed to create enjoyable learning experiences through educational game-based activities. This research employed a descriptive qualitative approach involving teachers and group B students at BA Aisyiyah Kalimandi. Data were collected through observation, interviews, and documentation, and analyzed using the interactive Miles and Huberman model, including data reduction, data display, and conclusion drawing. The results indicate that the implementation of Wordwall enhances children's logical thinking, pattern recognition, and problem-solving abilities. Moreover, it increases learning motivation and encourages active participation in the learning process. These findings affirm that interactive digital media such as Wordwall can serve as an effective alternative for early childhood education when aligned with children's developmental stages and characteristics.
Keywords: Early Childhood, Cognitive Development, Wordwal

Introduction

Early childhood development is a very fundamental period and is often referred to as the golden age because between the ages of 0 and 6, rapid development occurs in all aspects of development, including physical-motor, social-emotional, language, moral, and cognitive. At this stage, children have a high level of curiosity and learn through various forms of direct experiences they encounter in their daily lives (Ubaida et al., 2024)Cognitive development, in particular, is an important part because it relates to a child's ability to think, remember, understand symbols, and solve problems (Fitriana, 2022) Jean Piaget described this age as the preoperational stage, which is the period when children begin to use mental representations, such as interpreting pictures, understanding simple concepts, and imitating patterns they see. Young children not only need appropriate stimulation, but also a learning environment that helps them build knowledge gradually through interesting and meaningful concrete experiences (Ahsanul Huda Susanto et al., 2024).

In the context of cognitive development, the most effective way for young children to learn is through play. Play is not only a recreational activity, but also an important means for children to explore, experiment, and build understanding of the world around them. (Anggrian & Saefurahman, 2025)When children engage in educational games, they indirectly learn to develop their attention span, memory, decision-making skills, and logical thinking abilities. Therefore, providing the right learning media is important for children to develop their cognitive structures to the fullest (Astuti et al., 2024) . Vygotsky emphasized that children's cognitive development is greatly influenced by social interactions with teachers, peers, and the environment. Teachers play a role in providing scaffolding or learning support that enables children to move from their actual abilities to their potential abilities. Thus, good learning media must be able to facilitate interaction, exploration, and proportional guidance (Sahgal, 2024)

As digital technology develops, early childhood education has begun to utilize various technology-based media as a means of cognitive stimulation. Digital media provides a multimodal learning experience that combines visual, audio, movement, and immediate response elements, thereby capturing children's attention and increasing their motivation to learn (Olvah et al., 2024)The use of interactive digital media has been proven to help children recognize symbols, remember information, and understand basic patterns and concepts more quickly. Wordwall is one of the most popular digital learning applications widely used by educators because it provides various types

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of educational games that can be easily adapted to learning needs, such as matching words, finding picture pairs, answering simple quizzes, and completing interactive puzzles (Ningrum et al., 2024) The Wordwall app is not only visually appealing, but also provides instant feedback that helps children understand whether their answers are correct or incorrect, encouraging them to reflect and improve (Nida, 2024)

Previous studies have shown that digital media such as Wordwall can increase learning motivation, strengthen memory, and make learning more enjoyable. However, in Indonesia, especially in early childhood education institutions located in non-urban areas, the use of digital media still faces challenges in the form of limited facilities, teacher readiness, and variations in children's abilities to use digital devices. In addition, although many studies highlight the effectiveness of Wordwall in improving learning outcomes, there are still few studies that specifically analyze how Wordwall affects the core cognitive development of early childhood, such as symbolic abilities, pattern recognition, problem solving, and digital independence.

Based on this phenomenon, this study aims to describe the use of the Wordwall application in supporting the cognitive development of early childhood at a private Early Childhood Education Institution in Purwareja Klampok District, Banjarnegara Regency. The focus of this study is not only to see the extent to which children are able to use Wordwall in learning activities, but also to observe how this application helps children understand symbols, recognize patterns, solve problems, and develop independence in using digital devices. This study is expected to contribute to the development of effective digital learning strategies that are relevant to the developmental needs of early childhood, as well as provide practical recommendations for teachers in optimizing the use of digital media.

Methodology

This research methodology uses a descriptive qualitative approach that aims to obtain an in-depth description of the use of the Wordwall application in supporting the cognitive development of early childhood (Ilyas, 2024) . The research was conducted at a private Early Childhood Education Institution in Purwareja Klampok District, Banjarnegara Regency, Central Java, Indonesia. This approach emphasized direct observation of learning activities that took place naturally, so that researchers could understand the context, interactions, and children's responses comprehensively. The main data collection techniques in this study included participatory observation and semi-structured interviews. Observations were made by recording children's behavior when using the Wordwall application, including symbolic abilities, pattern recognition abilities, problem-solving strategies, and levels of digital independence. The observation also involved recording the forms of support or scaffolding provided by teachers during the activities. Semi-structured interviews were conducted with teachers to explore their understanding of learning strategies, perceptions of Wordwall, technical challenges, and changes in children's behavior observed during the digital learning process. With this approach, the data obtained is not only factual but also interpretive, providing a comprehensive picture of the learning process.

The data analysis process was carried out through coding stages that followed the principles of open coding. All observation notes, interview transcripts, and activity documentation were thoroughly reviewed to identify important parts related to children's cognitive development. At this stage, the researchers broke down the data into smaller units of meaning, then labeled them based on initial themes such as symbolic representation, logic and patterns, problem-solving strategies, digital engagement, and teacher scaffolding patterns. These units of meaning were then regrouped into larger thematic categories to facilitate interpretation. Data analysis followed Miles and Huberman's interactive model, which includes data reduction, data presentation, and conclusion drawing (Qomaruddin & Sa'diyah, 2024). Data validity is maintained through triangulation of methods by comparing the results of observations, interviews, and documentation to ensure consistency of findings (Moderasi et al., 2025) Through this systematic analysis process, the study was able to produce a credible and in-depth picture of the role of the Wordwall application in the cognitive development of early childhood.

Research Results

The results of the study show that the use of the Wordwall application in learning activities elicits a wide range of responses in early childhood, especially in terms of understanding basic concepts, including the ability to match images, understand instructions, and recognize simple symbols. During observation, it was seen that a child with high cognitive abilities was able to respond to the Wordwall game quickly and accurately, for example, when asked to choose the image that matched the word or identify certain letters that appeared on the screen. This child was able to complete several levels of the game without showing confusion and maintained focus throughout the activity. Meanwhile, children with moderate abilities seemed to understand the instructions but needed more time to process the information before determining the answer. The child occasionally showed hesitation but was still able to continue the game independently after being given time. On the other hand, a child who still needed intensive assistance seemed to have difficulty understanding the flow of the game and often looked to the teacher

for help. This shows that the cognitive abilities of early childhood children do vary and Wordwall provides space for children to display their basic abilities naturally.

In terms of problem solving, the Wordwall game appears to facilitate children in developing reflective thinking strategies, particularly through the direct feedback mechanism provided by the system each time a child selects an answer. Children with high problem-solving abilities appear to be able to correct their mistakes independently through a process of trial and error, for example, when they select the wrong image and then immediately try again until they find the correct answer. These children appear confident and able to control their emotions when they make mistakes, demonstrating good self-regulation skills. Children with moderate abilities show problem-solving patterns that still require verbal encouragement from the teacher, such as "Try again" or "Look at the picture carefully," after which the children begin to be able to arrive at the answer themselves. Meanwhile, a child who still needs help appears to depend on the teacher's instructions, especially in choosing the first step, so that their problem-solving process has not developed optimally. This difference confirms that Wordwall can be a platform for identifying children's analytical abilities more clearly.

The emotional involvement of children during Wordwall activities varied greatly, but generally showed positive patterns. Most children appeared enthusiastic when the game started; they laughed, moved closer to the screen, and expressed curiosity about the images and sounds that appeared in the application. Children with high self-confidence showed happy expressions when they answered correctly, such as smiling broadly or jumping up and down. Meanwhile, some children seemed to quickly lose focus when the game became more difficult, but they regained their enthusiasm when the teacher gave them praise or simple encouragement. Some more sensitive children appeared slightly frustrated when they answered incorrectly, but became motivated again after the teacher calmed them down and gave them extra time. These findings show that Wordwall not only functions as a cognitive medium, but also as a means of strengthening children's emotional regulation during the learning process.

From the perspective of digital independence, this study found significant developments in children's ability to operate digital devices, especially in using basic features such as selecting menus, pressing game buttons, understanding navigation sequences, and playing games independently. A child who had previous experience with digital devices appeared very confident in navigating the game; he could select a game, start a level, and press the "next" button without needing additional instructions. Children with moderate abilities sometimes still asked for guidance, but showed improvement over time, especially after trying the same game several times. Meanwhile, a child who still needs intensive assistance appears to have difficulty selecting buttons or understanding certain features, such as the "repeat" or "continue" icons. However, this child gradually shows improvement after receiving repeated guidance and modeling from teachers and peers. Overall, Wordwall has proven effective in supporting the digital independence of young children in the context of modern learning.

Aspects of social interaction and collaboration among children also emerged clearly during learning activities using Wordwall. Some children took the initiative to help their friends who were having difficulty, such as showing them which buttons to press or giving examples of how to answer. These children seemed to enjoy the process of working together and showed simple empathy, for example by saying "This is this..." or "Try it like this." Children with independent tendencies were still able to collaborate when asked to, for example when the teacher asked them to work in pairs. Meanwhile, some more passive children seemed to prefer to observe and only became actively involved after being encouraged by the teacher. This pattern of interaction shows that Wordwall is not only a medium for improving cognitive abilities, but can also enrich children's social skills through cooperation, communication, and mutual assistance in completing game challenges.

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Data triangulation conducted through observation, interviews, and documentation shows consistent findings that the Wordwall application is effective in improving several aspects of early childhood cognitive development, including symbolic abilities, simple logic, problem solving, learning motivation, and digital independence. All data show the same pattern that children are more engaged, more active, and quicker to understand concepts when playing while learning using Wordwall. Documentation in the form of photos and videos of learning shows children's enthusiastic expressions, focus, and ability to maintain attention for longer periods of time compared to non-digital methods. Thus, the use of Wordwall can be said to make a real contribution to early childhood learning, especially when implemented with appropriate teacher guidance.

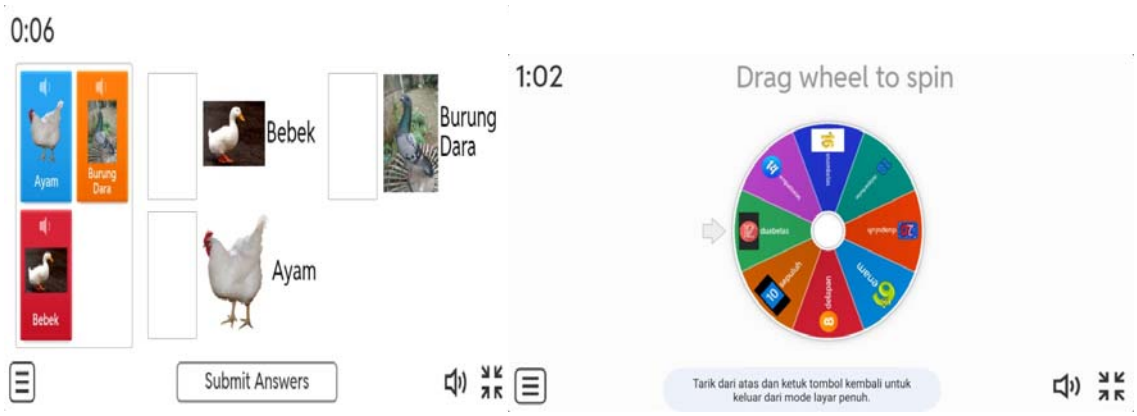

Figure 1. Example of a wordwall game

Figure 2. Children playing Wordwall collaboratively

Figure 3. Children playing independently

Discussion

The results show that young children are able to understand commands, recognize symbols, and actively respond to Wordwall games, which is in line with Piaget's cognitive development theory in the preoperational stage. At this stage, children begin to be able to make mental representations through symbols, pictures, and language, so visual-interactive learning media such as Wordwall are very suitable for their developmental characteristics. As stated in (Feronika Worembay et al., 2025) which reveals that children's ability to match images, choose the correct answers, and understand game instructions shows that the digital stimulation provided by Wordwall helps children reinforce basic concepts. The instant feedback mechanism in the application also accelerates the process of internalizing information, where children can identify their mistakes and correct them through repetition. These findings are in line with (Rahmadania et al., 2025) which makes it clear that Wordwall not only provides games, but also creates learning experiences that support the formation of new cognitive structures through meaningful symbolic activities.

Children's ability to correct answers through trial and error demonstrates developing problem-solving skills, especially when children try new strategies after their first mistake. This process demonstrates cognitive flexibility as part of executive function development. Research (Nabila Zakiyyatul Af'idah, 2024) found that the use of Wordwall encourages children to explore, correct mistakes, and choose more appropriate strategies in completing game tasks. Internationally (Behnamnia et al., 2023) states that digital game-based learning provides a safe environment for children to experiment, test simple hypotheses, and obtain quick responses that aid in understanding cause and effect. These findings show that Wordwall is not just a medium for play, but a vehicle for cognitive stimulation that strengthens problem-solving skills.

Observations show that children display positive emotional expressions such as enthusiasm, curiosity, and joy when using Wordwall, which is an indicator of intrinsic motivation in early childhood learning. These positive emotions facilitate the information processing and improve knowledge retention. Hibana et al., (2024) emphasizes that game-based learning in Early Childhood Education increases learning motivation because games provide challenges that are appropriate for children's development. Meanwhile, a study by (KAVAK, 2022) menegaskan bahwa digital game-based learning menciptakan kondisi emosional yang mendukung keterlibatan aktif anak dan meningkatkan fokus selama pembelajaran berlangsung. Hal ini menunjukkan bahwa Wordwall berperan penting dalam memfasilitasi pengalaman belajar yang menyenangkan sekaligus bermakna.

The development of children's digital independence can be seen from their ability to operate devices, press buttons according to instructions, and navigate Wordwall games without full assistance from teachers. This shows that technology can be a means of developing basic digital literacy in early childhood. Researchers Hasanah & Gudnanto, (2023) found that using Wordwall gradually increased children's confidence in operating digital devices. And researchers (Huynh et al., 2021) emphasizes that digital educational games that focus on visualization encourage the development of independence through independent exploration and simple decision-making. Thus, Wordwall serves as a means of strengthening essential early digital skills in the modern era.

The social interactions that occurred during Wordwall activities, such as children helping friends, asking questions, and showing how to play, demonstrate that digital media can still support cooperative learning. These mutual assistance activities reflect Vygotsky's principle regarding the importance of social support in the Zone of Proximal Development (ZPD). Research conducted by Abdul Sakti, (2023) found that interactive digital activities can improve children's collaboration and communication during the learning process.. Endah et al., (2025) also explain that collaboration-based educational games improve children's social skills through discussion and cooperation in completing game tasks. Thus, Wordwall not only builds children's cognition but also develops their social skills.

Interviews with teachers revealed that Wordwall helps vary learning, improves children's focus, and facilitates the delivery of concepts. Teachers believe that digital games can bridge the gap between children's abilities through automatic feedback. Research by (Dewi & Widyasari, 2022) shows that teachers in Early Childhood Education consider Wordwall to be an effective medium for overcoming children's boredom and increasing learning engagement. Meanwhile, (Sholehati et al., 2025) found that teachers who utilized interactive digital media reported an improvement in the quality of learning and conceptual understanding in early childhood. This reinforces the finding that teacher readiness plays an important role in the successful implementation of Wordwall.Hasil penelitian ini secara keseluruhan menunjukkan bahwa Wordwall sejalan dengan prinsip pembelajaran berbasis permainan yang menekankan kebermaknaan, keterlibatan emosional, dan aktivitas kognitif anak usia dini. Penelitian yang dilakukan (Pascullo, 2025) menegaskan bahwa game edukatif interaktif mampu meningkatkan kemampuan berpikir logis dan memahami konsep dasar secara lebih cepat. Secara internasional, (Amariah, 2024) menjelaskan bahwa pembelajaran digital berbasis permainan mampu memperkaya pengalaman belajar melalui tantangan terstruktur, umpan balik cepat, serta peluang eksplorasi. Dengan demikian, Wordwall dapat dikategorikan sebagai media digital yang efektif, relevan, dan sejalan dengan kebutuhan perkembangan anak usia dini.

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Conclusion

The results of this study indicate that the use of the Wordwall application contributes significantly to the cognitive development of early childhood, particularly in terms of understanding symbols, recognizing patterns, and solving problems. During learning activities, children showed varying responses according to their respective levels of development, ranging from children who were able to complete the game independently to children who still required intensive assistance. These findings indicate that Wordwall is capable of providing a learning environment that is flexible, adaptive, and appropriate for the developmental characteristics of early childhood. Children who are able to understand symbols and game instructions well show that digital stimulation can strengthen the mental representation process as described by Piaget in his preoperational theory. In addition, children's ability to correct mistakes through trial and error shows development in analytical and simple decision-making aspects, which are part of the development of core cognitive functions in early childhood.

Theoretically, this study reinforces Piaget's view of the importance of visual and symbolic stimulation in the development of mental representations in early childhood. The findings also reinforce Vygotsky's theory, which emphasizes the role of social interaction and scaffolding in helping children reach their potential abilities. When children are accompanied by teachers or receive help from peers, the learning process becomes faster and more meaningful. The findings of this study also support digital learning theory, which explains that multimodal media—combining images, colors, sounds, and quick responses—can increase children's cognitive engagement and help them understand basic concepts more concretely. Thus, theoretically, Wordwall is proven to be in line with pedagogical foundations that emphasize the importance of play, interaction, and rich stimulation in children's cognitive development.

From a practical standpoint, this study shows that Wordwall can be used as an engaging, effective, and relevant learning medium for early childhood education, especially in learning contexts that require a variety of methods to maintain children's attention. Teachers can use Wordwall to teach basic concepts such as letters, numbers, patterns, or image categories through interactive and fun educational games. In addition, Wordwall can also help improve children's digital independence through device navigation activities, button operation, and independent answer selection. However, the results of the study also show that teacher assistance remains a key factor for smooth learning, especially for children who still need guidance to understand digital systems. Technology-based education like this also requires the readiness of devices, internet, and the ability of teachers to design digital games that are appropriate for children's development.

This study certainly has several limitations that need to be considered. The first limitation lies in the number of subjects and the scope of the study, which is limited to one private Early Childhood Education institution in Purworejo Klampok District, so the results cannot be generalized to the entire context of Early Childhood Education in Indonesia. The second limitation relates to technological facilities, such as the availability of devices and internet network conditions, which can affect the smoothness of the learning process and children's responses in using the Wordwall application. In addition, this study focuses on descriptive analysis, so it cannot directly compare the effectiveness of Wordwall with other learning media or conventional methods. Family environment factors, digital experiences at home, and variations in children's abilities were also not studied in depth, which could lead to bias in the interpretation of children's digital development.

Given these limitations, future research should involve more early childhood education institutions in various regions, including areas with limited access to technology and areas with more adequate digital facilities. Quantitative or quasi-experimental research can be conducted to compare the effectiveness of Wordwall with other digital media or manual learning methods, thereby providing a more comprehensive picture of the impact of Wordwall on children's cognitive development. In addition, longitudinal research is also needed to determine the long-term development of children's cognitive and digital abilities after being exposed to technology-based learning. Future research can also explore in greater depth the role of parents, teachers' digital readiness, and the most effective forms of scaffolding in supporting digital learning in Early Childhood Education.

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