



Integrating Digital Videowall in Early Childhood Education: Pedagogical Strategies and Challenges in Letter and Number Recognition

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Abstract

The integration of digital technology into early childhood education has created opportunities to transform conventional learning into more interactive and meaningful experiences. However, previous studies have predominantly examined digital applications, educational games, and audiovisual media, while limited attention has been given to the pedagogical use of digital videowalls in supporting early literacy and numeracy development. This study aims to explore teachers' pedagogical strategies in introducing letters and numbers through a digital videowall and to identify the challenges encountered during its implementation in early childhood classrooms. A descriptive qualitative approach was employed at TK Negeri Pembina Ciledug, Indonesia. Data were collected through classroom observations, semi-structured interviews with the principal and classroom teachers, and documentation. Data validity was ensured through source triangulation, while the data were analyzed using the stages of data reduction, data display, and conclusion drawing. The findings reveal that the videowall supports children's engagement through interactive visual activities, enables teachers to implement more child-centered instructional strategies, and facilitates letter and number recognition by integrating images, animations, sounds, and educational games. The main challenge identified is the limited availability of videowall facilities, requiring teachers to apply effective classroom management and rotational learning strategies. These findings contribute to the growing literature on digital pedagogy in early childhood education by highlighting the importance of combining technological innovation with appropriate instructional practices to enhance children's early literacy and numeracy learning experiences.

Keywords: Digital Technology; Videowall; Letter Recognition; Number Recognition; Early Childhood Education

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INTRODUCTION

مقدمة

The rapid advancement of digital technology has transformed various aspects of education, including early childhood education (ECE). Digital technology is no longer limited to computers and mobile devices but has expanded to interactive learning media that facilitate children's active participation through visual, auditory, and kinesthetic experiences. In ECE, the integration of digital technology is expected to create learning environments that are more engaging, meaningful, and developmentally appropriate (Supriyono, 2020; Lindriany et al., 2022). Various forms of educational technology, including educational applications, animated videos, projectors, and interactive displays, have been increasingly utilized to support children's cognitive development and improve learning quality (Adiati et al., 2023; Apriyanti et al., 2022;

Fajarwati & Irianto, 2021; Karunianingsih et al., 2022; Melviana et al., 2023; Omega & Salsabila, 2021).

The integration of digital technology into early childhood classrooms has attracted increasing attention because children in the early years require learning experiences that are concrete, interactive, and enjoyable. During this developmental period, children construct knowledge more effectively when learning activities actively involve them rather than relying solely on teacher explanations. Consequently, teachers are encouraged to integrate digital media that provide opportunities for exploration, interaction, and immediate feedback during classroom learning (Nasution, Ramadani, et al., 2024; Nugroho et al., 2025).

Among the essential competencies developed in early childhood education are letter recognition and number recognition. These abilities constitute the foundation of children's early literacy and numeracy development and significantly influence their readiness for subsequent educational levels. Letter recognition enables children to identify alphabet symbols and connect them with corresponding sounds, whereas number recognition supports children's understanding of numerical symbols and their relationship to quantities (Hayati et al., 2023; Pratiwi et al., 2024; Afifah et al., 2024). Therefore, teachers require instructional media that are capable of presenting abstract concepts in concrete, attractive, and developmentally appropriate ways.

Numerous previous studies have demonstrated the positive contribution of digital media to children's learning. Interactive digital storytelling has been shown to improve children's understanding of moral values through engaging visual experiences (Suharni et al., 2025). Audiovisual media have also been reported to increase children's interest in learning letters and numbers while simultaneously improving their participation during classroom activities (Nuraeni & Yuniawati, 2025). Similarly, Adobe Flash-based learning media have been found to facilitate the introduction of letters and numbers through interactive visual representations (Nasution, Ritonga, et al., 2024). Other studies have revealed that digital alphabet media positively influence children's literacy development (Muthmainnah et al., 2025), while educational games such as Wordwall effectively improve children's cognitive development and learning motivation (Hasanah & Gudnanto, 2023).

Although previous studies consistently report the benefits of digital technology in early childhood learning, most research has focused on educational applications, animated videos, digital storytelling, audiovisual media, or educational games. Comparatively limited attention has been devoted to the pedagogical implementation of digital videowall technology, particularly regarding how teachers integrate videowalls into instructional practices for introducing letters and numbers and how they manage the pedagogical challenges emerging during classroom implementation. Consequently, the existing literature has not adequately explained teachers' instructional strategies, classroom interactions, and institutional support required for effective videowall-assisted learning in early childhood education.

This study seeks to address this gap by investigating the implementation of digital videowall technology at TK Negeri Pembina Ciledug. Unlike previous studies that primarily examined the effectiveness of digital media in improving learning outcomes, this research focuses on teachers' pedagogical strategies, classroom interactions, and challenges encountered during videowall-assisted instruction. The study therefore contributes to the growing body of literature on digital pedagogy by providing a qualitative understanding of how interactive digital technology supports early literacy and numeracy learning in authentic classroom settings.

Accordingly, this study aims (1) to describe teachers' pedagogical strategies in introducing letters and numbers through a digital videowall and (2) to identify the challenges encountered during its implementation in early childhood classrooms. The findings are expected to contribute theoretically to the development of digital pedagogy in early childhood education and practically to provide recommendations for teachers and educational institutions seeking to integrate interactive digital technology into developmentally appropriate learning practices.

METHOD | منهج

This study employed a descriptive qualitative approach. According to Waruwu (2023), qualitative research is defined as a research procedure that produces descriptive data in the form of written or spoken words from individuals and observed behaviors. Furthermore, Creswell, as cited in Murdiyanto (2020), defines qualitative research as a process of investigating a social phenomenon and human problems. This research was conducted at TK Negeri Pembina Ciledug. Data were collected through observation, interviews, and documentation.

The researcher conducted observations to directly examine how teachers introduced letters and numbers using the videowall and to identify the challenges encountered in its implementation. The researcher observed the learning process carried out by teachers using the videowall at TK Negeri Pembina Ciledug. Interviews were conducted with the principal and classroom teachers. The interviews focused on the teachers' instructional processes in introducing letters and numbers through the videowall and the challenges they experienced. The purpose of these interviews was to obtain information regarding the teaching process and the difficulties encountered. Documentation was also utilized to collect school data, including photographic records of classroom learning activities. This study also involved interviews with the school principal to obtain more in-depth data. This was because the principal plays a strategic role in planning, decision-making, and supervising the utilization of digital videowall technology within the school. Through interviews with the principal, the researcher was able to determine whether teachers had received specific training on the use of the videowall and assess their level of preparedness after participating in such training. In addition, the researcher was able to gather information regarding school policies related to the integration of videowall technology into the learning process, the procedures for monitoring its use, and the methods used to evaluate its effectiveness. Therefore, the information obtained was derived both from the perspective of teachers as learning facilitators and from school management as the party responsible for decision-making and the development of more innovative learning strategies.

Source triangulation techniques were employed in this study to ensure data validity. Source triangulation was conducted by comparing observational findings regarding the process of introducing letters and numbers through digital videowall technology, lesson planning, and the challenges encountered with the interview results obtained from the principal and classroom teachers. Furthermore, source triangulation was performed by comparing interview findings with relevant documents, such as the curriculum, Daily Lesson Plans (RPPH), and learning activity documentation, as well as comparing interview results between the principal and classroom teachers. The data obtained from this study were analyzed using descriptive qualitative analysis through the stages of data reduction, data presentation, and conclusion drawing. Data analysis was conducted to obtain a clear description of the teachers' process in introducing letters and numbers to children using the videowall, as well as the challenges experienced by teachers in utilizing this digital technology at TK Negeri Pembina Ciledug.

Pedagogical Integration of the Digital Videowall into Classroom Instruction

The findings indicate that the digital videowall was systematically integrated into classroom instruction rather than functioning merely as an additional learning device. Teachers incorporated videowall-based activities into the Daily Lesson Plan (Rencana Pelaksanaan Pembelajaran Harian—RPPH) by determining instructional objectives, selecting appropriate learning materials, and designing interactive classroom activities before the learning process began. This preparation demonstrates that the videowall was positioned as an instructional medium that supported pedagogical planning instead of being used solely for technological purposes.

Interview findings revealed that lesson preparation included arranging learning scenarios, preparing the videowall, and determining children's interaction with digital activities. One classroom teacher explained:

"Including it in the RPPH, preparing the videowall, and providing instructions to children on how to play." (Mrs. N, 2026)

The observation results further confirmed that teachers intentionally synchronized videowall activities with curriculum objectives. Learning sessions were not limited to displaying digital content but involved structured teacher guidance throughout the instructional process. Consequently, the videowall became an integral component of classroom pedagogy rather than simply functioning as presentation media.

These findings indicate that successful implementation of digital technology depends not only on technological availability but also on teachers' pedagogical readiness to integrate technology into meaningful learning experiences.



Figure 1. Interview with the Classroom Teacher

Interactive Learning Enhances Children's Engagement in Letter and Number Recognition

Observational findings demonstrated that the videowall created interactive learning experiences that encouraged children to participate actively in recognizing letters and numbers. Rather than receiving information passively, children interacted directly with learning materials by selecting, identifying, matching, and sequencing alphabet and number symbols displayed on the interactive screen.

The classroom teacher explained:

"Children search for letters or click on each letter, then they identify the letter. When learning numbers, children directly click on the numbers and then mention them sequentially from 1 to 10." (Mrs. N, 2026)

During classroom observations, children consistently demonstrated high enthusiasm while participating in videowall-assisted learning. Most children voluntarily answered teachers' questions, eagerly waited for opportunities to interact with the screen, and remained attentive throughout the instructional activities. Animated images, colorful visual displays, educational games, and audio feedback successfully attracted children's attention for longer periods compared with conventional learning activities.

Another teacher statement supports this observation:

"The children are very happy when using the videowall. They feel as though they are playing, so they recognize letters and numbers more quickly." (Mrs. N, 2026)

These findings suggest that the videowall creates learning situations that correspond to young children's developmental characteristics, where play-based and interactive experiences promote greater motivation and classroom participation.

School Support Strengthens the Implementation of Digital Pedagogy

The implementation of videowall-assisted learning was supported by institutional policies that prepared teachers before digital technology was introduced into classroom instruction. Interviews with the principal indicated that teachers participated in training and socialization programs organized before the videowall was implemented.



Figure 2. Interview with the Principal

The principal stated:

"The videowall was provided by the government, and there was a socialization program for it, which has already been conducted." (Mrs. W, 2026)

The principal further explained that after attending the training program, teachers possessed better knowledge regarding the pedagogical use of the videowall. Continuous monitoring and evaluation were also conducted to ensure that digital technology was utilized appropriately during classroom instruction.

Observation findings confirmed that institutional support increased teachers' confidence in integrating digital media into daily learning activities. School management therefore played an important role in facilitating the implementation of innovative digital pedagogy through teacher preparation, monitoring mechanisms, and ongoing evaluation.

Classroom Management Becomes the Main Challenge in Videowall Implementation

Despite its pedagogical benefits, videowall implementation also presented practical challenges related to classroom management. The primary difficulty identified by classroom teachers was the limited availability of videowall equipment relative to the number of children participating in learning activities.

As explained by the classroom teacher:

"The challenge is that there is only one videowall in the classroom, so the children must be instructed to take turns using it." (Mrs. N, 2026)

To overcome this limitation, teachers implemented rotational learning strategies by allowing children who had completed classroom assignments to use the videowall sequentially.

The teacher further explained:

"Children who have completed their activities neatly may continue by playing with the videowall, taking turns with their friends." (Mrs. N, 2026)

Interestingly, the principal presented a different perspective by stating that no significant institutional barriers existed because the videowall facilities remained operational and adequately supported classroom learning.

"There are no obstacles." (Mrs. W, 2026)

This difference illustrates that the identified challenge was pedagogical rather than technological. From the teachers' perspective, the limited number of devices required more effective classroom organization and time allocation, whereas school management perceived the available facilities as sufficient to support instructional activities.

Overall, the findings indicate that successful videowall implementation depends not only on the availability of digital technology but also on teachers' abilities to organize learning activities, manage classroom interactions, and ensure equitable learning opportunities for all children.

DISCUSSION

مناقشة

Digital Videowall as a Pedagogical Tool in Early Childhood Learning

The findings demonstrate that the digital videowall functioned not merely as a technological device but as a pedagogical tool that supported teachers in designing more interactive and child-centered learning experiences. The integration of the videowall into lesson planning indicates that teachers intentionally aligned digital technology with instructional objectives rather than using technology solely for presentation purposes. This finding suggests that successful technology integration depends on pedagogical planning and teachers' instructional competence rather than the availability of technology alone.

These findings support the argument of Nasution, Ramadani, et al. (2024), who stated that technology integration positively contributes to children's cognitive development when teachers actively facilitate learning activities. Likewise, Nugroho et al. (2025) emphasized that digital learning environments increase children's learning motivation because interactive technology encourages active participation instead of passive observation.

From the perspective of digital pedagogy, the present findings also indicate that teachers' roles have shifted from knowledge transmitters toward learning facilitators who guide children's interaction with digital media. Rather than delivering information directly, teachers organize learning experiences, provide scaffolding, encourage exploration, and facilitate children's understanding through interactive activities. This pedagogical transformation reflects one of the essential characteristics of technology-supported learning in contemporary early childhood education.

This finding is consistent with the Technological Pedagogical Content Knowledge (TPACK) framework proposed by Mishra and Koehler (2006), which emphasizes that effective technology integration requires teachers to combine technological knowledge, pedagogical competence, and content knowledge simultaneously. Likewise, Tondeur et al. (2017) argued that successful digital transformation in education depends largely on teachers' pedagogical readiness rather than on the availability of technological facilities alone. Therefore, the effectiveness of videowall-assisted learning should be viewed as the result of the interaction between technology and appropriate pedagogical practices.

Interactive Learning Promotes Children's Engagement in Early Literacy and Numeracy

Another important finding concerns children's engagement during videowall-assisted learning. Observation results demonstrated that children actively interacted with letters and numbers through touching, selecting, matching, and identifying symbols displayed on the digital screen. This active participation indicates that the videowall provides learning experiences consistent with children's developmental characteristics.

These findings are consistent with Piaget's preoperational theory, which explains that children aged five to six years construct knowledge most effectively through concrete experiences and symbolic representations (Tursini & Ramadani, 2025). Instead of memorizing abstract symbols, children directly manipulate letters and numbers presented visually, allowing them to establish meaningful relationships between symbols and their corresponding meanings.

The findings also strengthen previous studies conducted by Nuraeni and Yuniawati (2025) and Muthmainnah et al. (2025), who reported that audiovisual and digital alphabet media improve children's literacy development by increasing attention, motivation, and active classroom participation. However, the present study extends previous findings by demonstrating that videowall technology supports not only children's motivation but also continuous interaction between teachers, children, and digital learning media throughout instructional activities.

Similar findings have also been reported internationally. Neumann (2018) demonstrated that interactive digital media can significantly improve young children's emergent literacy by encouraging active participation during learning activities. Likewise, Flewitt et al. (2015) explained that digital interaction provides opportunities for children to construct knowledge collaboratively while increasing motivation, communication, and engagement throughout the learning process. These international findings further support the role of digital videowall technology in creating meaningful learning experiences for early childhood education.

Institutional Support Determines the Sustainability of Digital Learning

The study further revealed that successful videowall implementation was strongly influenced by institutional support provided by the school. Teacher training, supervision, and continuous evaluation increased teachers' confidence in integrating digital technology into classroom instruction.

This finding supports previous research emphasizing that educational technology cannot produce meaningful learning outcomes without adequate teacher preparation. Digital innovation should therefore be accompanied by professional development programs that strengthen teachers' technological and pedagogical competencies.

These results indicate that school leadership plays an essential role in establishing policies that encourage innovation while simultaneously ensuring that digital technology is implemented

appropriately according to children's developmental needs. Consequently, digital transformation in early childhood education should be understood as an institutional process involving teachers, school leaders, infrastructure, and continuous professional learning.

Ertmer and Ottenbreit-Leftwich (2010) emphasized that teachers' willingness to integrate digital technology is strongly influenced by institutional support, including leadership commitment, professional development, and continuous mentoring. Consequently, successful implementation of videowall technology requires collaboration between teachers, school leaders, and educational policymakers to ensure that technological innovation contributes meaningfully to children's learning.

Classroom Management Remains the Main Challenge in Digital Technology Integration

Although videowall implementation demonstrated substantial pedagogical benefits, classroom management remained the principal challenge identified by teachers. The limited number of videowall units required teachers to organize rotational learning activities and allocate instructional time carefully to ensure equal participation among children.

Unlike many previous studies that primarily discussed technical barriers such as software limitations or internet connectivity, the present study identifies pedagogical classroom management as the primary issue. This finding suggests that technological innovation alone cannot guarantee effective learning implementation unless teachers possess adequate classroom management skills.

Blackwell et al. (2014) similarly reported that one of the major challenges in implementing digital technology in early childhood classrooms is not the technology itself but teachers' ability to organize classroom interaction, manage instructional time, and ensure equitable participation among children. This finding reinforces the importance of pedagogical competence as a determining factor in successful technology integration.

Interestingly, different perspectives emerged between teachers and school administrators regarding these challenges. Teachers perceived limited equipment as an instructional challenge because it directly affected classroom interaction, whereas the principal considered the available facilities adequate from an institutional perspective. These differing viewpoints illustrate that evaluating educational technology requires consideration of both classroom realities and institutional management.

Therefore, the effectiveness of videowall implementation depends not only on technological infrastructure but also on teachers' professional competence in organizing learning activities that remain equitable, engaging, and developmentally appropriate.

Theoretical and Practical Implications

This study contributes to the literature on digital pedagogy in early childhood education by demonstrating that videowall technology should be understood as a pedagogical innovation rather than merely as digital equipment. The findings emphasize that meaningful technology integration occurs when teachers intentionally combine digital media with developmentally appropriate instructional strategies.

Practically, the study recommends that schools provide continuous professional development programs, increase access to interactive digital facilities, and encourage teachers to integrate digital technology into child-centered learning activities. Such efforts will enable digital technology to support children's early literacy and numeracy development more

effectively while maintaining learning experiences that are enjoyable and appropriate to young children's developmental characteristics.

CONCLUSSION | خاتمة

This study demonstrates that the integration of digital videowall technology into early childhood education extends beyond the use of digital devices and represents a pedagogical innovation that supports children's early literacy and numeracy development. The findings reveal that teachers successfully integrated the videowall into lesson planning and classroom instruction through interactive learning activities that encouraged children to recognize letters and numbers in engaging and meaningful ways. The combination of visual displays, animations, sounds, and educational games increased children's participation, attention, and motivation throughout the learning process.

The study further indicates that effective implementation of videowall-assisted learning depends not only on technological availability but also on teachers' pedagogical competence and institutional support. Teacher training, school supervision, and continuous evaluation contributed significantly to the successful integration of digital technology into classroom practice. Although limited videowall facilities required teachers to implement rotational classroom management strategies, these challenges did not reduce the overall effectiveness of the learning process.

This research contributes to the growing literature on digital pedagogy in early childhood education by demonstrating that digital videowall technology functions as a pedagogical tool that promotes interactive teacher-child learning rather than merely serving as instructional media. The study also extends previous research by highlighting the importance of teachers' instructional strategies and school support in maximizing the educational value of interactive digital technology.

Nevertheless, this study was conducted in a single early childhood education institution using a descriptive qualitative approach. Therefore, the findings cannot be generalized to all educational contexts. Future research is recommended to investigate videowall implementation across different early childhood settings using comparative, mixed-method, or experimental designs. Further studies may also examine the influence of videowall technology on other developmental domains, including language development, social-emotional competence, creativity, collaborative learning, and problem-solving skills.

Overall, digital videowall technology has considerable potential to create more engaging, interactive, and developmentally appropriate learning environments for young children when supported by effective pedagogical practices, adequate institutional policies, and continuous teacher professional development.

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