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Learning Through Screens: A Literature Review on the Role of Visual and Digital Media in Early Childhood Education

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ABSTRACT

The use of visual and digital media in early childhood education has emerged as a pedagogical response to technological advancements that demand innovation in the learning process. However, prior research often addresses fragmented aspects, such as specific tools or short-term effects, without offering a comprehensive synthesis. To address this gap, the present study systematically reviews the roles, effectiveness, challenges, and implementation strategies of visual and digital media in ECE. A descriptive qualitative method was employed, using a systematic literature review guided by the PRISMA framework. Data were collected from several scientific databases such as Google Scholar, SINTA, and ResearchGate, focusing on publications from the last five years. The analysis reveals that visual and digital media such as animated videos, interactive flashcards, digital storybooks, and smart boards significantly support children's cognitive, linguistic, motor, literacy, numeracy, and socio-emotional development. These media enhance engagement, motivation, and conceptual understanding through multisensory, interactive experiences. However, several challenges persist, including infrastructure limitations, low digital literacy among educators and parents, and psychological risks such as screen addiction and reduced social interaction. Addressing these issues requires strategies such as using age-appropriate content, regulating screen time, fostering teacher–parent collaboration, and ongoing teacher training. The study concludes that visual and digital media are effective pedagogical tools when implemented thoughtfully and contextually. It offers practical insights and evidence-based recommendations to help educators and policymakers integrate digital media in early learning environments responsibly and sustainably.

Introduction

Technological advancements have brought significant changes to the field of education, including early childhood education. Visual and digital media are now widely used to enhance the effectiveness and appeal of learning. Various devices, applications, and digital platforms enable educators to deliver materials in more engaging, interactive, and developmentally appropriate ways. The use of visual media such as images, animated videos,

and digital applications has been shown to facilitate concept comprehension, boost motivation, and stimulate literacy and cognitive skills in young children (Herawati & Rahmansyah, 2023; Satriana et al., 2022)

However, the effectiveness and challenges of utilizing these media remain subjects of debate among education practitioners and researchers. On one hand, technology provides broader access and flexibility to learning resources, allows for personalized learning, and promotes collaboration and active engagement among children (Asti & Arismunandar, 2024; Bintang et al., 2024). Asti & Arismunandar (2024) emphasize that technology can serve as a catalyst for inclusive and relevant transformation in early childhood education, provided its use is wisely supervised by educators and parents. Other studies also indicate that digital media, such as educational apps and interactive videos, are effective in increasing learning motivation, active participation, and basic conceptual understanding in young children—under the condition that usage remains balanced and under supervision (Zebar & Sembiring, 2022).

The application of visual media in early childhood education has proven to facilitate children's understanding, improve memory retention, foster creativity, and support language development (Herawati & Rahmansyah, 2023). Herawati & Rahmansyah (2023) affirm that visual media are particularly important for helping young children—who have high absorption capacity but still struggle to grasp abstract concepts. Similarly, research by Haerudin & Gustiana (2023) found that using application-based visual media, such as Canva, significantly increased children's motivation and learning engagement. A study conducted at Nusa Kindergarten in Makassar showed that visual media use enhanced children's learning interest, as evidenced by increased average scores in learning interest before and after the intervention (Lismayani & Khalisah, 2023). Safitri et al. (2024) reported that digital media use had a significant impact on learning outcomes, contributing to 24.2% of the variance in results, while individual use of digital media contributed to a 12.67% increase in outcomes. Likewise, Farida et al. (2023)observed a significant +6.75-point improvement following the audiovisual media intervention.

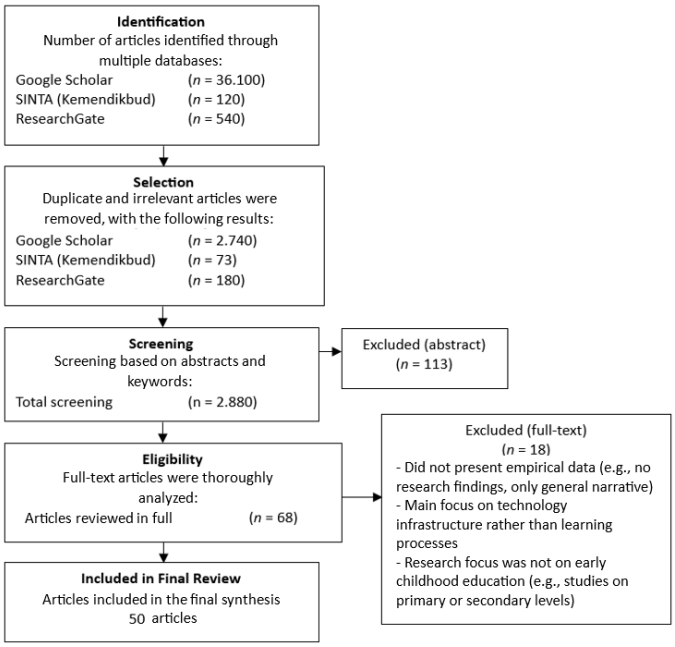
Nevertheless, key challenges in the use of visual and digital media in early childhood education include limited infrastructure, lack of teacher training, risk of exposure to inappropriate content, and potential decline in children's social interaction if technology use is not well-regulated. Salim (2024) also highlighted the importance of balancing digital interaction with physical, social, and emotional activities to ensure holistic development. While visual and digital media offer many benefits, their use also demands supervision, guidance, and the development of teacher capacity and sufficient infrastructure. A wise and well-directed integration of technology may be the key to maximizing children's potential in this digital age.

Therefore, this study aims to conduct an in-depth literature review on how visual and digital media are utilized in early childhood education, the proven benefits and effectiveness based on prior research, and the challenges encountered in their implementation. This review also discusses various strategies to ensure optimal use of these media, aligned with children's developmental needs and the learning context of the digital era.

Research Methods

This article employs a literature review method by examining various national and international journals published within the last five years. According to Mestika (2004), a

literature review is an activity related to the method of collecting data sourced from various written information, both theoretical and research-based, to establish a solid foundation for the development of scientific knowledge. Literature was collected through databases such as Google Scholar, SINTA, and ResearchGate, and was subsequently analyzed thematically to obtain a comprehensive overview. The literature search process was conducted using relevant keywords such as “visual media,” “digital media,” “early childhood education,” and “PAUD.” Each selected article was evaluated based on its relevance, methodological quality, and contribution to the advancement of knowledge in the field of early childhood education. The article selection stages were carried out using an approach aligned with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework (Siddaway et al., 2019).



This systematic review follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) procedure, which includes four key stages: Identification, Selection, Screening, and Eligibility, culminating in the inclusion of studies in the final synthesis. In the identification stage, a literature search was conducted across three major academic databases: Google Scholar, SINTA (Indonesian Ministry of Education Index), and ResearchGate. The initial search yielded, Google Scholar: 36,100 articles, SINTA: 120 articles, ResearchGate: 540 articles, a total of 36,760 articles were identified. Next, duplicate entries and irrelevant titles were removed based on relevance to the research topic. The articles retained after this step were, Google Scholar: 2,740 articles, SINTA: 73 articles, ResearchGate: 180 articles, this resulted in 2,880 articles selected for abstract screening. At this stage, the abstracts and keywords of the selected articles were reviewed to determine their alignment with the study focus: the use of visual and digital media in early childhood education. Articles that lacked clear relevance were excluded, leaving 2,880 articles for further full-text evaluation. In the eligibility phase, full-text analysis was conducted. Of the 2,880 articles screened, 68 articles met the criteria for in-depth examination. However, 18 articles were excluded due to the following reasons, lacked empirical findings (e.g., purely narrative or conceptual papers), focused mainly on technology infrastructure rather than instructional use, targeted education levels other than ECE (e.g., primary or secondary

school). After completing the PRISMA process, 50 articles were deemed eligible and included in the final synthesis for this review.

The data obtained from various literature sources were then classified into key themes, including: types of visual and digital media used in early childhood learning, their benefits, effectiveness as evidenced by previous research findings, implementation challenges, and strategies for wise and effective utilization. The analysis was conducted in-depth by comparing relevant research findings, identifying similarities and differences, and exploring remaining research gaps. This article is expected to provide a comprehensive synthesis of the use of visual and digital media in early childhood learning from multiple integrated perspectives.

Research Findings and Discussion

The analysis is organized into several thematic areas, including the types of media used, their documented benefits and effectiveness, the challenges in their implementation, and the strategies for effective utilization. Each theme is explored through the synthesis of empirical studies, highlighting patterns, contrasts, and contextual nuances across various research settings. Furthermore, this discussion aims to interpret the findings in light of existing educational theories and practices, identify research gaps, and outline practical implications for educators, policymakers, and future researchers.

Types of Visual and Digital Media in Early Childhood Education

The use of visual and digital media in early childhood education plays a critical role in enhancing the effectiveness and appeal of the learning process. Technology-based media, such as visual and audiovisual tools, assist teachers in delivering content in ways that are easier for children to comprehend and engage with. Visual media—such as images, illustrations, and picture books—support the development of memory, creativity, and cognitive abilities. For example, visual learning media developed using the Canva application has been proven to boost motivation in young learners through its engaging and interactive interface, encouraging children to participate actively in the learning process (Haerudin & Gustiana, 2023). Below are some types of visual and digital media widely used in early childhood education:

(1) Interactive Animation Media and Smart Boards

Interactive digital media enable children to learn in a fun and creative manner through platforms such as digital art applications, which allow them to create art, tell stories, and imagine freely (Pawitri et al., 2025). According to Wahyuni (2022), animated smart boards are effective visual and digital tools in early childhood education. These media combine visual elements like images and animations with interactive features that allow children to engage directly through smart boards. Specifically designed to stimulate cognitive development, they introduce concepts such as numbers, shapes, and colors—highly relevant to early developmental stages. Validity tests reported very high expert scores (≥ 90%), and trials with children reached ≥ 83%, indicating that the media are appropriate and effective. These findings support the use of interactive animated media as engaging, comprehensible, and impactful learning tools. The same study also found that illustrated digital stories

supported by audiovisual content are effective and varied educational tools. Hence, this research shows that digital visual media, such as animated smart boards, are not only visually appealing but also pedagogically effective in the context of early childhood education.

(2) Interactive Multimedia Flashcards

Research by Susantini & Kristiantari (2021) explains that interactive multimedia flashcards are effective visual and digital tools, particularly in teaching foreign language vocabulary (e.g., English) to young children. These tools combine engaging visuals with interactive features such as pronunciation audio, motion animations, and touch responses to stimulate active participation. Unlike conventional flashcards, the multimedia version enables children to see, hear, and interact with content on digital devices such as tablets or touchscreens. This study affirms that interactive multimedia flashcards enhance children's learning experiences and significantly improve their vocabulary acquisition and language skills.

(3) Visual Media for Language and Fine Motor Development

Setiawati (2020) demonstrated that image-based visual media are effective in supporting language and fine motor development in early childhood. Conducted in East Lampung, the study highlighted the use of pictures in early childhood learning to:

a) Expand vocabulary through concrete visual associations.

b) Enhance storytelling abilities as children describe and narrate based on the images.

c) Promote oral communication in both one-on-one and small group settings.

Though not detailed in the summary, activities involving cutting, pasting, or coloring pictures also support hand-eye coordination and fine motor skills—key areas of development in young children. Anita's (2023) study in Reteh provided empirical evidence of the positive impact of visual media on fine motor development. Using structured and progressive interventions, children's fine motor skills increased from 26% in cycle I to 48% in cycle II, and reached 82% in cycle III. These activities—cutting patterns, pasting images, matching shapes, and coloring—help train hand precision and coordination, directly stimulating essential fine motor development.

(4) Audiovisual Media (Video/Multimedia) for Cognition and Numeracy

Rifmasari et al. (2022) found audiovisual media to be highly effective in supporting cognitive development in numeracy among young children. Their research involved teaching activities such as symbol recognition and matching quantities with numbers using multimedia resources. Digital media use in the classroom also encourages collaborative learning, reasoning, and complex problem-solving (Mustadi & Amelia, 2023). Audiovisual tools such as animated videos, multimedia presentations with audio, and interactive applications provide combined visual and auditory stimuli. These methods align well with the characteristics of early learners who are concrete, visual, and require multisensory reinforcement. Therefore, audiovisual media supports numeracy development not only by making information more engaging but also by facilitating meaningful understanding through text, images, sounds, and

motion. These tools encourage active learning and accelerate children's ability to associate numbers with real-life objects.

Following the identification of various types of visual and digital media commonly used in early childhood education, this section continues by presenting the synthesized findings regarding their pedagogical benefits. Drawing from the selected studies in the systematic review, the following discussion highlights how these media contribute to different domains of early childhood development—cognitive, linguistic, motoric, social-emotional, and literacy skills. These benefits reflect recurring patterns across the reviewed literature and form a crucial part of understanding the media's overall impact in ECE contexts.

Benefits of Visual and Digital Media in Early Childhood Learning

Educational technology has significantly transformed early childhood learning practices over the past five years. Numerous studies indicate that the use of visual and digital media—such as images, animated videos, infographics, and interactive applications—offers extensive benefits that support children's learning holistically. These tools not only improve conceptual understanding through visual and auditory representation but also increase motivation and active participation in classroom activities (Herawati & Rahmansyah, 2023).

Audiovisual media, in particular, have been proven effective in enhancing literacy and numeracy skills. Rifmasari et al., (2022) demonstrated that counting videos help children recognize numerical symbols and relate them to concrete objects in an engaging way. Digital media also accommodate diverse learning styles, allowing visual and auditory learners to better grasp material through interactive, stimulating formats. Suriansyah et al. (2021) emphasized the importance of visual elements in children's books. Their model used picture storybooks (big books) with bright illustrations, large fonts, and culturally relevant content to convey moral messages and character values. Expert recommendations further supported the integration of digital illustrations and interactive story applications to enrich learning experiences.

Visual media also aid in cognitive development. Through illustrations, children can enhance memory, analytical skills, and an understanding of cause-effect relationships. For example, at RA Diponegoro Kedungjati, the use of images and real objects improved children's cognitive growth (Yulianti, 2020). Similarly, 3D pop-up books increased children's enthusiasm for storytelling and discussion (Hidayati et al., 2020). The digitalization of folklore—through e-books, animations, or story apps—has proven effective in increasing engagement and moral comprehension. Surandika et al. (2023) stressed the importance of real objects and creative classroom settings to promote readiness to learn. Visual aids such as images and manipulatives ensure meaningful learning aligned with children's real-world experiences. Digital media also support social-emotional development. Interacting with digital characters or playing educational games with peers fosters empathy, collaboration, and other social skills. New technologies like augmented and virtual reality have created interactive, collaborative experiences, including for children with special needs such as autism.

In sum, visual and digital media contribute significantly to creating engaging, developmentally appropriate learning experiences. With proper guidance and supervision, these tools can enhance motivation, engagement, cognitive growth, social-emotional skills, and digital literacy in young children. Given these benefits, integrating visual and digital

media in early childhood education not only enriches teaching methods but also serves as a strategic approach to delivering adaptive and relevant learning experiences.

Effectiveness of Visual and Digital Media Based on Research Findings

The use of visual and digital media in early childhood education has been proven effective in enhancing both the quality of learning processes and outcomes. Numerous studies demonstrate that such media can create engaging and interactive learning environments that align with the developmental characteristics of young children. Pratiwi et al. (2024) found that the use of YouTube applications in early childhood education was effective in increasing motivation and conceptual understanding, particularly when accompanied by supervision from teachers or parents. Iskandar & Syaodih (2022) emphasized the importance of parental involvement in selecting and guiding digital media to ensure its positive impact on children's expressive and receptive language development. In learning contexts that demand active child participation, digital media serve as a bridge that enables exploratory and enjoyable learning experiences.

Among the most widely used forms of media is audiovisual content, particularly instructional videos. A study by Islamiati (2022) demonstrated that the use of video significantly improved children’s learning outcomes. In a sample of 15 students from TKIT Bani Hasyim in Depok, the average test score increased from 32.93 (pre-test) to 70.46 (post-test). This result indicates that video media can enhance conceptual understanding through visually and auditorily engaging presentations. In addition to videos, interactive digital media also play a substantial role in improving children's comprehension and memory. Haryani & Sari (2021) found that children exposed to multisensory digital content scored higher on cognitive assessments than those who did not use such media. This suggests that the interactivity embedded in digital media strengthens children's engagement and concentration during the learning process, thereby deepening their understanding.

Beyond cognitive development, digital media also have a positive impact on children's social-emotional growth. Technology-based educational games designed for group activities have been shown to foster collaboration, communication, and problem-solving skills. Yuliana et al. (2023) reported a significant improvement in the social skills of children who regularly used digital educational media during play-based learning activities. In foundational skills such as numeracy, audiovisual media have also proven effective in stimulating number recognition and basic mathematical operations. Based on interviews and documentation from 25 early childhood educators in Kalimantan, Maghfirah et al. (2022), revealed that media combining text, images, audio, video, and animation successfully captured children's attention while facilitating more contextual and enjoyable math learning.

In conclusion, visual and digital media are highly potential instructional tools in early childhood education. However, their eff4ectiveness is strongly dependent on thoughtful, purposeful, and context-sensitive implementation, supported by educators’ competencies in

selecting and managing appropriate media. A sound pedagogical approach is essential to ensure that media serve not merely as entertainment but as meaningful tools for learning.

Challenges in the Implementation of Digital and Visual Media in Early Childhood Education

Various consequences, such as the decline in the quality of child-teacher interaction and suboptimal learning experiences require thorough attention. Therefore, the following discussion categorizes the challenges into technical, pedagogical, and psychological aspects, and analyzes their respective impacts on early childhood education practices. Understanding the underlying causes of these obstacles is essential for designing appropriate and effective interventions.

(1) Technical Challenges

Technical barriers, such as low-quality infrastructure and limited access to digital devices, have consistently been identified in recent studies. Budiarti (2024) highlighted that inadequate infrastructure readiness in ECE centers in Depok poses a major obstacle to the implementation of digital media. Additionally, disparities in access between urban and rural areas contribute to inequality in digital learning experiences. Connectivity failures and device shortages can lead to disrupted learning and frustration for both children and teachers. The direct impact of such challenges includes limited opportunities for consistent media use and decreased learner motivation. Without sufficient technical support, digital learning cannot be effectively integrated into the curriculum. Therefore, fulfilling basic infrastructure needs is a fundamental prerequisite for maximizing the potential of digital media in ECE settings.

(2) Pedagogical Challenges

Pedagogical challenges involve educators' preparedness in selecting, designing, and managing digital media while ensuring alignment with learning objectives. Hatzigianni (2018) identified low teacher competence as a key barrier to the meaningful application of technology in classrooms. Iskandar & Syaodih (2022) further emphasized that limited digital literacy among teachers and parents may lead to the selection of developmentally inappropriate media. This misalignment risks reducing digital tools to mere entertainment, thereby undermining their educational value. Moreover, students may experience overstimulation, negatively affecting their attention span and focus. Without adequate pedagogical training, teachers struggle to create deep and purposeful learning experiences. Continuous professional development is therefore crucial to ensure the effective use of digital media in early childhood education.

(3) Psychological and Social Challenges

In addition to technical and pedagogical concerns, there are significant psychological and social challenges related to children's emotional development. Studies by Noble et al. (2024) and research on "technoference" indicate that parents' use of digital

devices during interactions can interfere with emotional bonding and attachment. Excessive or age-inappropriate content exposure may also lead to screen addiction and reduced opportunities for social play. These factors can negatively influence children's long-term language and emotional development. Thus, it is essential to provide clear guidelines for media monitoring by both teachers and parents. Interventions that overlook these aspects may diminish the educational benefits of media use. A comprehensive digital education strategy must also incorporate emotional literacy and wise screen-time management.

Taken together, the technical, pedagogical, and psychological-social challenges have substantial impacts on the effectiveness of visual and digital media in early childhood education. Without adequate infrastructure, teacher training, and parental supervision, the full educational potential of digital media cannot be realized. On the contrary, failed integration may lead to shallow learning or even hinder children's developmental progress. Therefore, implementation strategies must involve technical improvements, enhanced teacher competence, and the establishment of participatory usage regulations. Comprehensive understanding and management of these challenges are critical to the successful and sustainable integration of digital media in quality early childhood education.

Strategies for the Wise and Effective Use of Visual and Digital Media in ECE

Visual and digital media can support children's understanding of new concepts in more engaging, interactive, and comprehensible ways. However, to ensure these tools are optimally beneficial and do not cause unintended negative effects, their use must be guided by thoughtful and structured strategies. According to Maymunah & Watini (2021), Herawati & Rahmansyah (2023), and Damayanti (2023), the following strategies can be implemented:

(1) Use Age-Appropriate and Developmentally Relevant Media

(2) Vary Media to Enrich the Learning Experience

(3) Integrate Interactive Activitiess

(4) Limit and Structure Screen Time

(5) Foster Teacher–Parent Collaboration

(6) Create a Supportive Learning Environment

(7) Conduct Periodic Evaluation and Reflection

By applying these strategies, the use of visual and digital media in early childhood education can be managed wisely and effectively while maintaining a focus on developmental needs. The key lies in proper media selection, consistent supervision, and strong collaboration between educators and parents to create engaging and meaningful learning experiences. Through structured and collaborative approaches, the full potential of visual and digital media in supporting early childhood education can be sustainably realized.

Conclusion

This literature review concludes that visual and digital media play a highly significant In conclusion, the integration of visual and digital media in early childhood education holds significant promise in enhancing learning quality, motivation, and developmental outcomes across cognitive, linguistic, motor, and socio-emotional domains. This systematic literature review reveals that such media—when appropriately selected and applied—can facilitate meaningful, engaging, and developmentally appropriate learning experiences. However, their effectiveness is closely tied to several critical factors, including the availability of infrastructure, educators' digital competence, and active parental supervision. Challenges such as limited access, pedagogical gaps, and psychosocial risks must be addressed through targeted strategies, including capacity building, media literacy, and collaborative planning. The review also emphasizes the importance of selecting age-appropriate media, integrating interactive elements, managing screen time, and fostering teacher–parent partnerships. Without structured guidance and thoughtful implementation, the use of media may fall short of its educational potential or even disrupt children's developmental balance. Therefore, optimizing the pedagogical value of visual and digital media requires a holistic, contextual, and collaborative approach to ensure sustainable and meaningful impact in early childhood learning environments.

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