Digital Pedagogy in Early Childhood Education: Exploring Teacher and Parent Knowledge, Expectations, and Problems

Jumiatmoko[*], Upik Elok Endang Rasmani, Bambang Winarji, Nurul Shofiatin Zuhro, Anjar Fitrianingtyas, & Novita Eka Nurjanah

Department of Early Childhood Teacher Education, Universitas Sebelas Maret, Indonesia

*Corresponding email: jumiatmoko@staff.uns.ac.id

Abstract: Digital Pedagogy in Early Childhood Education: Exploring Teacher and Parent Knowledge, Expectations, and Problems. Objectives: This study identifies teachers' and parents' knowledge, expectations, and problems related to the implementation of digital pedagogy in ECE. **Methods:** A mixed-methods approach was used to present quantitative and qualitative data in an explanatory design. The main respondents in this study were teachers. Data related to parents were obtained from teachers' answers, which were also filled in the questionnaire. There were 196 respondents of ECE teachers from 5 provinces in Indonesia. Quantitative data analysis with SPSS version 25 software was used to examine perceptions, abilities, and correlations between both. Qualitative data using thematic analysis to identify expectations and problems related to digital pedagogy implementation. **Findings:** Teachers have positive perceptions but low digital pedagogy implementation capabilities. The quantitative data findings regarding low teacher capabilities (average score <3.0) are confirmed by the qualitative data findings regarding challenges to the implementation of digital pedagogy in the teacher training needs and infrastructure limitations as the most significant potential factors. Several expectations were found related to improving teacher competency and technical understanding of the use of digital devices. Other challenges to implementing digital pedagogy include a lack of parental support and several issues related to children's physical, social, and psychological health. **Conclusion:** Teachers' knowledge of digital pedagogy confirms paradoxical interactions. Positive perceptions are not yet in line with teachers' abilities in implementing digital pedagogy. Play-based Digital Pedagogy (PBDP) and Domestication theory have excellent potential to be considered in this context. This theory is able to provide clear guidelines to improve teachers' abilities in implementing digital pedagogy ideally. Furthermore, the phases recommended by domestication theory are expected to be able to meet expectations and resolve obstacles to the implementation of digital pedagogy.

Keywords: pedagogy, digital, early childhood, teacher competency, domestication theory.

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■ INTRODUCTION

Digital technologies have created a new paradigm, fundamentally altering societal processes and activities in global human life (Tatarenko, Melentieva, Polyanskaya, Schaitarova, & Tereshchenko, 2021). 21st-century education is one of the systems that must be able to adapt to the development of digital technology (Nehring, Charner-Laird, & Szczesiul, 2019). Education providers, especially

teachers, face serious challenges in adapting the use of digital technology in teaching (Albion, Tondeur, Forkosh-Baruch, & Peeraer, 2015; Roza, Lufri, Andromeda, & Mufit, 2022). The implementation of digital technology in education has given birth to a new approach. This synergy is in line with the principles of constructivism, which emphasize active learning while freeing learning from various traditional constraints and obstacles (Smirnova, Lazarevic, & Malloy, 2018). The successful integration of digital devices in education requires alignment between pedagogical principles and learning objectives. This alignment is to ensure that digital devices have a positive impact on education (Abduvalieva, Barsanaeva, Kenenbaeva, Kozub, & Aghayeva, 2024).

Learning that integrates digital devices requires an appropriate pedagogical approach. This pedagogical approach requires a teacher to have adequate digital competencies (Tammaro & D'Alessio, 2016). This pedagogical approach is known as digital pedagogy. Digital pedagogy is the use of digital devices to improve the quality of teaching and learning (Sadiku, Omotoso, & Musa, 2019). In another explanation, digital pedagogy refers to a pedagogical process in which electronic elements are used to enhance or change the educational experience (Ruokamo, 2021). Digital pedagogy is also referred to as the use of digital technology within the framework of pedagogical goals (Ruokamo, 2021). Finally, Kivunja presents a more detailed definition of digital pedagogy. Digital pedagogy consists of the skills of using digital technology to enhance the process of learning, teaching, assessment, and curriculum development in educational contexts (Kivunja, 2013; Ruokamo, 2021). Therefore, digital pedagogy can be explained as the use of digital devices and materials implemented in learning, teaching, assessment, and curriculum development activities to improve the effectiveness and quality of learning.

The use of digital devices has enormous potential for stimulating all aspects of early childhood development. For example, the use of digital devices plays an important role in stimulating the character development of early childhood (Jumiatmoko et al., 2024) while realizing Early Childhood Education for Sustainability (ECEfS) (Wolff et al., 2020). The ECEfS framework prepares early childhood to have self-respect, respect for others, and respect for the environment. Several related studies have found the impact of using digital devices for preserving ECEFS, including successful in stimulating moral development (Frentzel-Beyme & Krämer, 2022), promoting ethical values (Vrabec, Polievková, & Moravèíková, 2013), and enhancing students' moral reasoning skills (Carmichael, Schwartz, Coyle, & Goldberg, 2019). A study conducted by Tang and her colleagues had shown that using tablets combined with digital game-based learning approaches can significantly enhance preschool children's literacy skills, including handwriting and active learning behaviors (Tang, Chu, & Chang, 2024). The study demonstrated that using a tablet learning model combined with a Digital Game-Based Learning Approach significantly enhanced preschool children's English alphabet handwriting skills. The study suggests that integrating digital game-based learning with traditional handwriting practice can provide an innovative and engaging platform for young children. This approach has the potential to lead to better educational outcomes by making learning more interactive and enjoyable. Although digital devices provide great potential benefits for early childhood learning, teachers recommend that there needs to be a clear curriculum and adequate training for optimal results (Otterborn et al., 2019).

Related to this potential, the use of digital devices such as smartphones in Indonesia has experienced a significant increase over the past few years. More than 100 million active users in

2018. This makes Indonesia ranked fourth in smartphone users globally after China, India, and the United States (Sari, Suryani, Rochsantiningsih, & Suharno, 2020). Students in Indonesia use smartphones for an average duration of more than 6 to 7 hours every day to collect information and download learning materials (Sari et al., 2020). In line with these facts, the Indonesian government has implemented a number of strategies to support digital transformation in the field of education. Among others, by preparing a digital transformation roadmap, developing digital infrastructure, improving human resources, and collaborating with education companies (Machmud et al., 2024).

Studies on early childhood digital pedagogy highlight the transformative potential of digital technologies in teaching practices. The review also emphasizes the need for further research to understand the practical characteristics and design of effective digital pedagogies for implementation in ECE (H. Li, He, Luo, & Li, 2024). Studies from countries such as Finland, China, and Spain provide insights into the different ways in which digital technologies are integrated into early childhood education. These studies highlight the opportunities and challenges faced by teachers in different cultural contexts (Brinck, Leinonen, Lipponen, & Kallio-Tavin, 2023; Luo, Berson, Berson, & Li, 2021; Urbina, Ferrer-Ribot, & Moral, 2025). China, Finland, and Spain face a range of issues related to teacher training, resource creation, policies, and curriculum development. Meanwhile, Indonesia faces more complex challenges, including technology, pedagogy, infrastructure, and alignment with cultural values and local wisdom (Dewi, Justicia, Putri, & Bayuni, 2024).

Unfortunately, in the Indonesian context, the digital competencies of ECE teachers in using digital devices, integrating digital applications for learning, producing learning materials, and implementing evaluations are still low (Winarti et al., 2022). Therefore, it is necessary to continuously improve digital competencies for teachers and parents (Álvarez, Bobo-Pinilla, & Perera, 2023; Singh & Ishrat, 2025). This is to ensure their ability to utilize technology in the learning process. Improving the digital competencies of teachers and parents should consider the analysis of needs and factual conditions regarding the practice of integrating digital devices in the learning process, teaching, assessment, and curriculum development in the context of ECE. Tailoring training programs to the specific needs and profiles of teachers can significantly enhance their digital competencies (Henning-Kahmann & Hellmann, 2025). There has been no specific survey of teachers or parents in Indonesia that explores knowledge, expectations, and barriers in implementing digital devices in the context of ECE. Research related to the implementation of digital pedagogy in ASEAN countries, especially Indonesia, for example, still focuses on issues related to ICT integration in schools, infrastructure problems, digital literacy, and access to the internet (Prajaknate, 2016).

This survey can contribute to the preparation of solutions for developing teacher and parent competencies and the preparation of policies related to digital pedagogy in a sustainable manner (Baiges, Lázaro-Cantabrana, & García, 2024). In addition, with the projection of educational reform towards digital pedagogy-based education in Indonesia, identifying the knowledge, expectations, and challenges of teachers and parents is a vital effort. For example, the Merdeka teaching and the education report program. These programs are part of Indonesia's digital education transformation policy, which aims to improve Education for Sustainable Development (ESD) outcomes (Sholeh et al., 2025). Both programs encourage the use of digital tools and resources to support learning as a concrete manifestation of digital transformation in education. It is a broader, centrally digital education policy aimed at improving access,

equity, and quality of education through digital means (Gilimani, Marevhula, & Schmidt, 2015). As a program that is implemented centrally, ECE is fully involved in actions related to the two programs. This initiative program is particularly focused on addressing the educational needs in rural and remote areas. It encourages ECE to increase the use of digital learning tools and resources in learning.

Digital technologies can significantly enhance ESD by providing innovative teaching methods and improving access to sustainability education (Aljaradin, Alzouebi, & Alkaabi, 2024). National and international policies play a pivotal role in integrating digital transformation with ESD (Ftacnik, Sveda, & Kires, 2020). The results of this study are expected to provide alternative solutions to problems and formulate policies that are more relevant to the implementation of digital pedagogy in the context of ECE in Indonesia. Based on these gaps, a recent study focusing on three main questions, including: 1) What is the knowledge profile of ECE teachers in Indonesia regarding digital pedagogy, which includes perceptions and self-evaluation of implementation capabilities? 2) What do teachers and parents face the main expectations and problems in implementing digital pedagogy in the ECE context? 3) Is there any relationship between teachers' perceptions of digital pedagogy and their ability to implement it?

■ **METHOD**

Research Design and Procedure

This study used a mixed-methods design. This design combines qualitative and quantitative approaches (Creswell, 2015). An explanatory design is explicitly used to examine teachers' knowledge related to the implementation of digital pedagogy. Quantitative findings related to knowledge are explained or expanded using qualitative data. This helps in understanding the relevant context, examples, and arguments (Palinkas, 2022). The research design is able to

provide strong coverage and analytical capabilities on the knowledge, expectations, and barriers of teachers and parents (Timans, Wouters, & Heilbron, 2019).

The study adopted 3 (three) components of the research design implemented by Forsner (2021). First, the selection of participants with specific criteria. Second, the collection and analysis of qualitative and quantitative data simultaneously. Qualitative data focuses on the experiences of teachers and parents related to the implementation of digital pedagogy. Quantitative data focuses on identifying perceptions and self-evaluations related to teachers' abilities for the implementation of digital pedagogy. Third, comprehensive data analysis to describe the knowledge, expectations, and challenges of teachers and parents in implementing digital pedagogy.

Instrument Validity and Reliability

The instrument in this study was a questionnaire consisting of a combination of open- and closed-ended questions (Bahtiæ & Višnjiæ Jevtiæ, 2020). Open-ended questions were used to collect qualitative data. Examples of open-ended questions were used to collect qualitative data: 1) Mention examples of integration of digital devices in play activities that you have implemented at school! (You can mention more than one), 2) Mention the obstacles that you have faced so far regarding the use of digital devices in the learning process for early childhood. (You can mention more than one), and 3) mention important input, criticism, or expectations from parents regarding the use of digital devices that have been conveyed to you! (You can mention more than one.) As a note, this third question was asked to teachers and not to parents directly because the researcher had access constraints.

Closed questions were used to collect quantitative data on teachers' knowledge about the implementation of digital pedagogy. Items are divided into 2 (two) dimensions. Items that

measure perception consist of P1, P3, P6, P8, P10, P11, and P12. Items that measure ability consist of P2, P4, P5, P7, and P9. Especially for closed-ended questions, their validity and reliability have been tested using the SPSS version 25 software.

Validity was tested using Pearson Product-Moment (PPM) (Lee, 2021). The results of the instrument validity test are seen in Table 1.

Reliability was tested using the Cronbach's alpha formula (Kotian, Varghese, & Rohith, 2022; Taber, 2018). The instrument is declared a reliability criterion if the Cronbach's alpha score threshold is equal to or higher than 0.70 (Kamaruzaman, Ismail, & Mat Daud, 2021). The Cronbach's Alpha reliability test score for perception is 0.786, and for ability is 0.839.

Table 1. Instrument validity test results

Code	Indicator	R	*p-Value*	Status
P1.	Integration of digital devices with play activities at school.	.552**	.000	Valid
P2.	Teachers' ability to integrate digital devices into play activities at school.	.690**	.000	Valid
P3.	The ability of digital devices to support teacher competence in organizing play activities at school.	.657**	.000	Valid
P4.	Teachers' ability to utilize digital devices to improve their competence in organizing play activities for early childhood.	.691**	.000	Valid
P5.	Teachers' ability to select digital materials that are appropriate for the needs of early childhood development stimulation.	.369*	.015	Valid
P6.	The ability of digital devices to support the process of assessing early childhood development in schools.	.479**	.001	Valid
P7.	Teachers' ability to utilize digital devices to support the early childhood development assessment process.	.628**	.000	Valid
P8.	Utilization of digital devices to support the ECE curriculum development process.	.634**	.000	Valid
P9.	Teachers' ability to utilize digital devices to support the ECE curriculum development process.	.540**	.000	Valid
P10.	The positive impact of digital devices on early childhood development.	.412**	.006	Valid
P11.	Ease of providing digital materials that suit the learning needs of early childhood.	.481**	.000	Valid
P12.	Parents' responses regarding the use of digital devices for early childhood learning.	.557**	.000	Valid

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

Data Collecting Technique and Participants

Data collection was carried out using Google Forms via the link https://bit.ly/pedig_PAUD/. Google Forms was chosen because of the practicality of filling it out, the breadth of respondent reach, and the ease of

documenting and analyzing data (Jaiswal, 2024). The Google form link was shared with a target of 196 (one hundred and ninety-six) respondents. Based on the research design used, in the first stage, the researcher selected respondents who were in accordance with the research needs. The selection was based on specific prerequisites. The prerequisites set were "respondents have implemented digital devices for learning purposes, competency development, assessment, and curriculum development in the context of ECE". Based on these prerequisites, 43 (forty-three) respondents were obtained who met the criteria for further data analysis. A total of 153 respondents did not fully implement the four components of digital pedagogy, consisting of learning, teaching, assessment, and curriculum.

Table 2. Respondent demographic data

Component	%
Sex	
Female	100.0
Male	0.0
Age	
< 20 y/o	2.3
20-30 y/o	18.6
31-40 y/o	34.9
41-50 y/o	37.2
> 50 y/o	7.0
Certification	
Yes	37.2
No	62.8
Teaching experiences	
< 5 y/o	18.6
5-10 y/o	30.2
11-15 y/o	37.2
16-20 y/o	9.3
> 20 y/o	4.7
Place of origin	
Central Java	48.9
South Sumatera	32.5
East Java	11.6
West Java	4.7
Yogyakarta	2.3

Data Analysis Technique

Data analysis was carried out on qualitative and quantitative data. Qualitative analysis focused on identifying teachers' and parents' expectations and problems in implementing digital pedagogy. Thematic Analysis is used to analyze qualitative data (Braun & Clarke, 2006). All authors were involved in every stage of data analysis. First, familiarization with data. Researchers read and re-read the data related to expectations and problems in implementing digital pedagogy, then noted down initial ideas. Second, generating initial codes. Researchers systematically code interesting features of the data about expectations and problems. Third, searching for themes. In this stage, researchers collated all codes into potential themes. Fourth, reviewing themes. Researchers are checking the themes' alignment with code and data. Fifth, defining and naming themes. Researchers are refining each theme to identify the essence of what each theme is about. The theme is related to the components of digital pedagogy, which consist of learning, teaching, assessment, and curriculum development using digital devices and materials. Lastly, produce the report. Researchers write up a detailed account of the themes, supported by data extracts, and a narrative concerning the research question. To strengthen trustworthiness, all researchers were involved in discussions at each stage of data analysis. Finally, to ensure the transparency of the analysis process and the credibility of the research data, quotations from the respondent's narrative answers are presented (Timans et al., 2019).

Quantitative data analysis focused on identifying ECE teachers' knowledge regarding the implementation of digital pedagogy. Respondents' answers to the closed questions were quantified. The results were then processed by computer using IBM SPSS software version 25 (Forsner et al., 2021). Data analysis was carried out on teachers' knowledge, which

includes teachers' perceptions of the implementation of digital pedagogy, self-evaluation of teachers' abilities in implementing digital pedagogy, correlations between question items, and regression analysis to predict the variables that have the most influence on the ability to implement digital pedagogy.

■ **RESULT AND DISCUSSION**

All respondents who completed the questionnaire via Google Forms were female. The majority were within the age ranges of 31–40 years (34.9%) and 41–50 years (37.2%). More than half of the participants (62.8%) had not yet obtained formal teaching certification.

Nevertheless, a substantial proportion (67.4%) reported having between 5 and 15 years of teaching experience. The respondents represented five different provinces, with the highest concentration originating from Central Java (48.9%).

Knowledge Related to the Implementation of Digital Pedagogy

The identification of teacher knowledge was conducted through the measurement of perceptions and self-evaluations regarding their competencies in implementing digital pedagogy within early childhood education (ECE) settings. In addition, statistical analyses were performed to examine the correlations among questionnaire items representing key elements of teacher knowledge related to digital pedagogy. As illustrated in Figure 1, the majority of teachers expressed positive perceptions across nearly all items assessed.

The highest proportion of "strongly agree" responses (34.9%) was recorded for items related to the integration of digital devices into play activities at school (P1) and the perceived ability of digital tools to support teachers' competence in organizing such activities (P3). Meanwhile, the item receiving the highest

percentage of "agree" responses (86%) pertained to parental responses regarding the use of digital devices in early childhood learning (P12). Conversely, the highest percentage of "disagree" responses (23.2%) was associated with the perceived positive impact of digital devices on early childhood development (P10). Results from the self-evaluation of teachers' competencies in implementing digital pedagogy in early childhood education are presented in Figure 2.
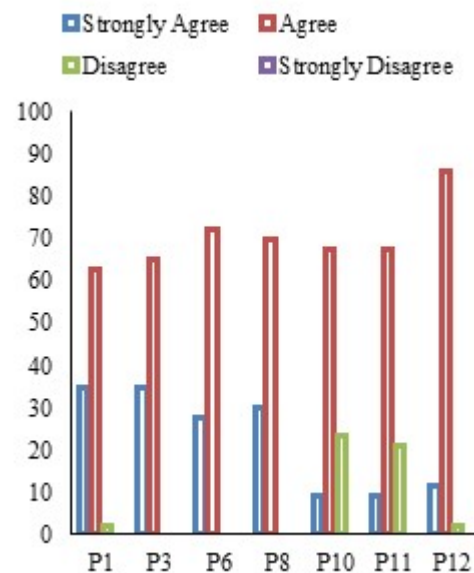

Figure 1. Teachers' perceptions about digital pedagogy
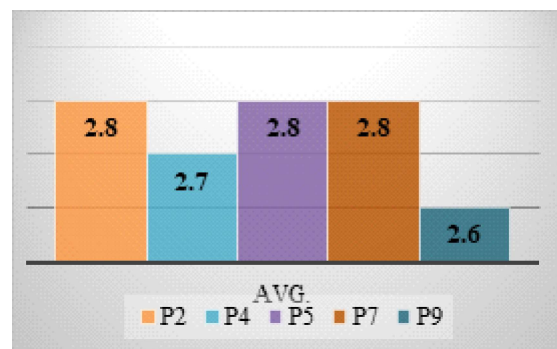

Figure 2. Teachers' abilities for digital pedagogy implementation

In general, teachers hold favorable perceptions toward the implementation of digital

pedagogy in early childhood education. However, a subset of respondents conveyed reservations, noting that the integration of digital devices does not automatically lead to positive developmental outcomes for young children.

This ambivalence is closely associated with one of the persistent barriers to effective digital pedagogy, namely, concerns regarding the potential adverse effects of technology on early childhood development. Despite the prevailing positive attitudes, the overall level of teacher competence in implementing digital pedagogy remains suboptimal. This discrepancy highlights a critical gap between perception and practice, emphasizing the need for targeted efforts to strengthen teachers' digital literacy and their ability to pedagogically integrate information and communication technologies (ICT) into developmentally appropriate learning experiences. The findings offer a critical insight that adequate implementation capabilities do not always match positive attitudes toward digital pedagogy. Several contextual factors may explain this disparity. First, the policy-driven push for digitalization in education may lead to a compliance-oriented mindset, where teachers feel compelled to express optimism despite lacking sufficient training (Gustafsson, 2021). Second, Indonesia's archipelagic geography poses substantial challenges for equitable ICT infrastructure development and access, particularly in remote and rural areas (Hermawan, Deswila, & Yunita, 2018). Lastly, entrenched adherence to traditional teaching practices may also hinder the transition toward digital pedagogical approaches (Q. Li, 2007).

For comparison, a large-scale survey of early childhood education teachers in the UK, Luxembourg, Malta, Greece, and Kuwait in 2016 actually showed the same problem regarding the lack of teacher competence to integrate digital devices into learning practices. The leading cause is thought to be due to the strong ideology that prioritizes traditional game-based pedagogy over

digital integration (Palaiologou, 2016). The conceptual foundation of game-based pedagogy often emphasizes direct, hands-on experiences rather than structured engagement with digital games or devices. This ideological ambiguity has led to uncertainty among teachers regarding the appropriateness of integrating digital technologies within game-based pedagogical frameworks. Consequently, some educators question whether digital tools align with the core principles of game-based learning and whether their pedagogical efficacy in such contexts has been empirically validated.

All measured indicators of teacher ability in implementing digital pedagogy fell below the "good" category threshold (mean score < 3.0). The highest average scores were observed in three areas: teachers' ability to integrate digital devices into play activities at school (P2), to select digital materials appropriate for the stimulation of early childhood development (P5), and to utilize digital devices in supporting the child development assessment process (P7), each with a mean score of 2.8. These findings indicate that while specific competencies are relatively more developed, overall proficiency in implementing digital pedagogy remains limited.

In light of the findings, it is recommended that structured and continuous professional development programs be established to support teachers in implementing digital pedagogy within early childhood education. Such initiatives should aim to strengthen teachers' competencies in both understanding and applying relevant pedagogical theories to optimize the educational use of digital technologies (Abduvalieva et al., 2024). Teachers themselves have explicitly articulated the need for competency enhancement as a fundamental prerequisite for the successful adoption of digital pedagogy (Otterborn, Schönborn, & Hultén, 2019). Strengthening pedagogical competence in digital contexts is also critical for mitigating one of the most frequently cited barriers to implementation: concerns regarding the potential

negative impact of digital devices on early childhood development. Notably, the demographic profile of the study's respondents reveals that a substantial proportion were under the age of 40 (55.8%), and nearly all had less than 15 years of teaching experience (86%). This suggests that the majority of participating teachers were relatively young and had substantial access to digital devices. Despite these favorable conditions, the study found that their overall digital competence remained below the "good" category threshold (mean score < 3.0).

This phenomenon aligns with previous findings by Sánchez et al. (2020), who emphasized that digital competence development should be extended to all teachers, regardless of age or professional tenure, including those often classified as part of the "digital native" generation. Targeted competency-building efforts have been shown to enhance teachers' self-efficacy and adaptive capabilities in utilizing digital pedagogy (Pongsakdi, 2021). Therefore, sustained investment in professional development remains a critical strategy for ensuring the effective, confident, and responsible integration of digital technology in early childhood learning environments.

The profile of teachers' knowledge regarding the implementation of digital pedagogy is presented using an explanatory approach. Quantitative data on teachers' abilities are complemented by narrative descriptions derived from qualitative responses, providing contextual insights into the patterns observed. The data are organized into four thematic categories: the use of digital devices and materials for learning, teaching, assessment, and curriculum development.

Digital Devices and Materials for Learning

Teachers' ability to integrate digital devices into play activities at school (P2) and their ability to select digital materials appropriate for the stimulation of early childhood development (P5)

obtained the highest average scores, both with a mean of 2.8. To further illustrate the implementation of digital pedagogy in early childhood education (ECE), the following section presents examples of how digital devices are utilized to support learning activities in practice. *First, the use of laptops and LCD projectors in play activities.* Laptops and LCD projectors are used to provide video displays that are relevant to play activities. The use of these devices is reported by teachers to stimulate all aspects of early childhood development. As quoted from the following description of answers from several respondents. "... (We) use (LCD) projectors and interactive videos. In thematic play activities, children watch interactive educational videos (such as recognizing letters, numbers, or animals) through an LCD projector. After that, they are invited to imitate animal sounds or arrange letters using blocks. This combines visual and motor learning." (R22) "... (the) story is displayed on the screen using a laptop or projector. (We) sing, dance, do gymnastics, and use religious materials using applications such as YouTube and YouTube Kids. (These displays) are supported by (the use of) speakers..." (R13). *Second, the use of tablets in play activities.* The use of tablets for play activities is focused on cognitive stimulation, creativity, and early childhood art. Direct quotations from the participants, such as "Children play simple educational games on tablets, such as puzzles, matching shapes, or games to recognize colors and numbers. These activities are carried out in turns to train cognitive abilities and the positive use of technology (R4 & R22). "... (tablets are used to) create digital illustrated stories using the Drawing for Kids application." (R22). *Third, the use of smartphones.* This digital device is used to download and run certain applications according to the needs of playing activities, as stated, "(Smartphones are used) to operate educational Augmented Reality (AR) applications. Children are allowed to scan images from books or special cards to display 3D objects

(e.g., animals or celestial bodies)." (R22). "...using Bee-Bot or Augmented Reality (AR) based games to stimulate children's thinking skills..." (R5).

If we look closely at the examples given by teachers, Integration of devices and selection of digital materials depend on the availability and alignment of digital tools with existing pedagogical practices (Linuesa, Orellana, Baz, & Domínguez, 2011). This means that new teachers are able to rely on simple devices and materials that are around them. The main challenge is that if the devices and materials around them do not meet their needs, it can cause digital pedagogy not to be implemented, and even potentially result in incorrect stimulation of early childhood.

Digital Devices and Materials for Teaching

The use of digital devices in teaching represents a strategic effort to enhance teachers' competence in organizing learning activities for early childhood education (ECE). Specifically, this component reflects the utilization of digital technologies to support professional growth in designing and managing play-based learning experiences. Teachers' ability to leverage digital devices for improving their competence in organizing play activities (P4) achieved a moderate average score (M = 2.7). Qualitative data indicate that digital tools are commonly employed for various competency-building activities, including participation in training programs, exploration of exemplary play activity models, dissemination of ideas, and professional dialogue among teachers. The qualitative responses revealed various ways in which teachers utilize digital devices to enhance their competence in organizing learning and play activities. One respondent described the use of online platforms for professional development: "(I) can attend online seminars and training through platforms such as Zoom, Google Meet, or LMS (Learning Management System) applications about various relevant and up-to-date play

methods for early childhood. For example: STEAM-based play activities, sensory play, and the Montessori approach." (R33). Another respondent highlighted the use of social media and content-sharing platforms for inspiration: "(Through smartphones, I) seek inspiration for play activities from various platforms such as YouTube, Pinterest, and Instagram." (R22). In addition, teachers reported using digital communication tools to share ideas and engage in collaborative discussions with colleagues: "(I) disseminate and discuss (implementation) of play activities through WhatsApp Groups or ECE teacher social media forums." (R22). These responses suggest that digital devices play a key role in facilitating access to updated pedagogical practices, peer learning, and resource sharing among early childhood educators.

The activities undertaken by teachers in utilizing digital devices and materials to support the teaching process indicate that the Digital Learning Ecosystem (DLE) (Tammets, Khulbe, Sillat, & Ley, 2022) has effectively contributed to fostering teacher professional growth. This ecosystem facilitates competency-based professional development planning tailored to the needs of early childhood education (ECE) teachers. Nevertheless, for such growth to be sustainable and impactful, it is essential to implement a systematically designed pedagogical framework that emphasizes student-centered learning. Furthermore, reflective teaching practices must be integrated to inform future instructional planning and ensure continuous, comprehensive professional advancement.

Digital Devices and Materials for Assessment

Teachers' ability to utilize digital devices to support the early childhood development assessment process (P7) obtained the highest average score among all assessed competencies (M = 2.8). Digital technologies were employed in various aspects of the assessment process,

including conducting daily evaluations, documenting children's portfolios, presenting assessment outcomes, and communicating results to parents. Respondents reported the use of diverse applications, software, and techniques tailored to specific assessment purposes. Notably, several teachers described utilizing specialized platforms such as Si-PAUD, ClassDojo, and Alcapap to facilitate assessment activities. As one teacher noted, "...Usually (conducting assessments) with the ClassDojo application..." (R5). Another added, "...through Si-PAUD, parents can access their child's assessments through the application above, and teachers also do not need to bother writing it manually." (R24). Similarly, "...using the Alcapap application, to create child assessment reports." (R28). One of the digital applications reported by respondents in the context of assessment practices is *ClassDojo*. *ClassDojo* emerged as one of the most preferred applications utilized by teachers in conducting digital assessments. Its primary advantages include facilitating real-time communication between teachers and parents, as well as enabling the creation of digital student portfolios (DiGiacomo, Greenhalgh, & Barriage, 2022). The platform also supports teachers in monitoring and documenting children's developmental progress over time, thereby enhancing the continuity and personalization of assessment practices.

In addition to specialized platforms, respondents also reported using more general digital tools such as Google Forms and Microsoft Excel. These were primarily used for recording observations and analyzing developmental progress. For example, one teacher stated, "(I) conduct daily assessments (of child development) using the application Google Forms. I (also) utilize the Microsoft program Excel to summarize daily, weekly, and monthly observation results... I use the table and graph features to see trends (of each child's development) visually and systematically."

(R22). Digital devices were also employed in the creation of digital portfolios, comprising children's work samples, photographs of play activities, and developmental notes. Tools such as PowerPoint and Canva were commonly used in this context: "(I) use a play activity design application (such as Canva or PowerPoint)." (R7).

Additionally, teachers incorporated digital tools to design motivational rewards, such as visually engaging star icons, as part of their assessment practices. "...through digital devices I create assessment sheets (which) are typed using (Microsoft) Word or Excel... besides that we create interesting images for children's rewards such as star images." (R43). Finally, digital devices also facilitated the dissemination of assessment results to parents. Several respondents described using smartphones to document and send reports in portable digital formats: "...usually using a smartphone (to document) and then sending a summary of the child's development report in PDF format via WhatsApp Parent Group." (R22).

Digital Devices and Materials for Curriculum Development

Among the competencies assessed, the lowest mean score (M = 2.6) was observed in teachers' ability to utilize digital devices to support early childhood education (ECE) curriculum development (P9). Nevertheless, qualitative data revealed various practices in which teachers engaged digital technologies to enhance curriculum-related tasks. "I downloaded and studied the curriculum documents, related laws, and other guidelines in PDF format from official sites such as (https://kemdikbud.go.id/). This makes it easier (for us) to understand the latest policies without having to print physical documents." (R22). Second, teachers utilized digital platforms as sources of inspiration and references for innovative curriculum design. Platforms such as Telegram and the *Merdeka*

Belajar portal were frequently accessed for curricular examples and peer-shared practices: "I use the internet to find references for curriculum development... various information (curriculum development) in the Telegram group... (then I also used) the Merdeka Belajar application (https://guru.kemdikbud.go.id/) to find examples of ECE curriculum." (R13).

Third, digital technologies enabled teachers to participate in professional learning activities such as training sessions and webinars conducted via platforms like Zoom and YouTube. These platforms provided access to diverse curricular practices shared by educators across regions and countries: "(I) learn from various learning videos on YouTube, Instagram, from various fellow teachers from various regions, even from abroad, many... (who share examples of curriculum development)." (R15). Fourth, teachers utilized creative design applications such as Canva to produce curriculum-related materials, including infographics, thematic schedules, and visual teaching aids. These digital outputs were perceived to enhance the clarity and appeal of curriculum documents. Finally, teachers reported the use of tools like Planbook to compile and manage digital curriculum documentation,

indicating a growing shift towards paperless and structured curriculum planning in ECE settings.

These findings indicate a notable shift in the utilization of social media as part of the curriculum development process in early childhood education. Social media platforms have effectively facilitated informal professional development by enabling teachers to engage in self-directed learning, participate in professional learning networks, and receive immediate peer feedback. This dynamic has contributed meaningfully to teachers' ongoing efforts in early childhood curriculum design and innovation (Mercado & Shin, 2022).

How is the Correlation Between Items?

Correlation analysis was conducted to examine the relationships between items in the closed-ended questionnaire. As presented in Table 3, several item pairs demonstrated statistically significant correlations. Notably, teachers' ability to integrate digital devices into play activities at school (P2) was strongly correlated with their ability to utilize digital devices to enhance their competence in organizing play activities for early childhood (P4), with a correlation coefficient of $r = 0.611$ ($p < 0.01$).

Table 3. Correlations between items

R	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
P1	1.000											
P2	243	1.000										
P3	.484**	.282	1.000									
P4	.134	**.611****	.168	1.000								
P5	.134	.296	.072	.320*	1.000							
P6	.411**	.240	.524**	.007	.215	1.000						
P7	.022	**.715****	.139	**.708****	.425**	.278	1.000					
P8	.370*	.170	**.793****	.316*	.039	.494**	.099	1.000				
P9	.020	.421**	.059	**.715****	.359*	-.165	.580**	.297	1.000			
P10	.241	.112	.273	.116	-.165	-.031	-.032	.166	-.020	1.000		
P11	.271	.097	.297	.107	-.168	.218	.039	.217	.020	**.741****	1.000	
P12	.461**	.312*	.486**	.365*	-.150	.127	.115	.531**	.331*	.181	.231	1.000

**. Correlation is significant at the 0.01 level (2-tailed)
*. Correlation is significant at the 0.05 level (2-tailed)

This result suggests a meaningful association between the practical use of digital tools in instructional contexts and teachers' professional development in play-based pedagogical practices. Teachers who are proficient in using digital devices in their personal lives tend to have

higher confidence and competence in integrating these tools into their professional practice. This competence is crucial for effectively incorporating digital devices into play activities, as it allows teachers to navigate and utilize these tools to enhance learning experiences (Nikolopoulou & Gialamas, 2016). *Second,* a strong positive correlation was identified between teachers' ability to integrate digital devices into play activities at school (P2) and their ability to utilize digital devices to support the early childhood development assessment process (P7), with a correlation coefficient of $r = 0.715$ ($p < 0.01$). This finding suggests that teachers who are proficient in embedding digital tools within play-based learning are also more likely to employ these tools effectively in developmental assessment practices. This correlation is plausibly explained by the fact that teachers who possess strong competencies in integrating digital devices into play-based activities tend to consistently perceive these tools as valuable components of the learning process. Such a perspective fosters a holistic approach, wherein digital technologies are not only embedded in instructional activities but also extended to other pedagogical domains, including assessment (Lindeman, Svensson, & Enochsson, 2021). *Third,* Teachers' ability to utilize digital devices to enhance their competence in organizing play-based activities for early childhood (P4) demonstrates a strong positive correlation with their ability to employ digital tools in supporting the child development assessment process (P7) ($r = 0.708$, $p < 0.01$), as well as with their ability to support early childhood education (ECE) curriculum development through digital means (P9) ($r = 0.715$, $p < 0.01$). These findings suggest an interrelatedness among teachers' digital competencies across key pedagogical domains. These findings underscore the significant potential of digital devices in enhancing teachers' professional competencies, particularly in the execution of pedagogical tasks. Consistent with the results reported by Altinay and colleagues, the integration of digital technologies contributes not only to the improvement of teachers' instructional practices, such as incorporating digital tools into play-based learning, but also to increased self-efficacy and confidence in utilizing these technologies effectively. (Altinay, Beyatli, Dagli, & Altinay, 2020). *Fourth,* a strong positive correlation was found between teachers' ability to utilize digital devices to support the organization of play activities in school settings (P3) and their ability to employ digital technologies in the development of the early childhood education (ECE) curriculum (P8), with a correlation coefficient of $r = 0.793$ ($p < 0.01$). Effective curriculum development necessitates that teachers possess both technical and pedagogical competencies. When adequately equipped with these skills, teachers are better positioned to design and implement curricula that effectively leverage digital technologies to enhance the quality and relevance of early childhood education (Al-Awidi & Aldhafeeri, 2017).

The correlation test revealed an intriguing finding. Teachers' perceptions of digital device integration into play activities (P1) exhibited a relatively low correlation with their actual ability to implement such technologies in practice ($r = 0.243$). One plausible explanation for this discrepancy is the presence of skepticism among some teachers regarding the pedagogical value of digital tools. Concerns persist that technology may potentially replace traditional teaching roles, leading to resistance toward its adoption. This phenomenon aligns with what Li (2007) describes as the "oversold, underutilized" dilemma, wherein technological resources are readily available but remain underused due to limited engagement or acceptance. In addition, barriers such as insufficient training and a lack of time allocated for professional development may further constrain teachers' capacity to integrate digital devices into early learning environments

effectively. To address these challenges, structured professional development programs emphasizing practical application and sustained support are essential (Siddiq & Scherer, 2016), notably to capitalize on the positive perceptions many early childhood educators already hold toward digital technology.

The Most Influential Factor in Teachers' Implementation of Digital Pedagogy

To further examine the predictors of teachers' digital competence, a regression analysis was conducted to estimate the extent to which selected variables predict teachers' overall ability to implement digital pedagogy. The analysis addressed the research question: *What are the most significant predictors of teachers' ability to implement digital competence?* The full results of the regression test are presented in **Table 4**. The analysis revealed that age and perception emerged as the strongest and most significant predictors, jointly accounting for 64.9% of the variance in teachers' digital competence scores. Notably, younger teachers tended to demonstrate higher levels of digital competence, which may be attributed to their alignment with the characteristics of the so-called "digital native" generation. As Calvani et al. (2012) suggest, this cohort typically exhibits higher adaptability and faster acquisition of digital skills due to their extensive and habitual use of technology.

Table 4. Regression analysis results predicting teachers' ability to implement digital pedagogy

Independent Variable	F	R^2	p-Value	Sig.
Age	5.833	.103	.020	ns
+ Certification	3.870	.120	.029	ns
+ Teaching Experience	3.952	.123	.027	ns
+ Perception	39.745	**.649**	**.000**	**s**
Certification	.656	-.008	.423	ns
+Perception	35.157	**.619**	**.000**	**s**
+Teaching Experience	5.661	.182	.007	ns
Teaching Experience	7.364	.132	.010	ns
+ Perception	38.522	**.641**	**.000**	**s**
Perception	71.309	**.626**	**.000**	**s**
+ = and; s = significance (p < .05); ns = not significance (p > .05)				

Furthermore, previous studies have corroborated that younger individuals are generally more motivated to engage in digital empowerment initiatives compared to their older counterparts (Akkoyunlu & Yilmaz, 2011). This intrinsic motivation plays a pivotal role in the development of digital competence and in fostering adaptability to evolving digital environments. Efforts to develop teacher competencies for the long-term implementation of digital pedagogy should consider teachers' initial perceptions toward digital technology as well as their age. These factors have been shown to influence the effectiveness of digital integration significantly and may serve as critical entry points for designing differentiated professional development programs.

Expectation Related to the Implementation of Digital Pedagogy

Thematic analysis of respondents' answers revealed three primary areas of expectation regarding the implementation of digital pedagogy: the enhancement of teacher competence, the development of technical skills in operating digital devices, and the provision of clear guidance for

parents. These themes reflect the multifaceted support perceived as necessary by educators to ensure the effective and meaningful integration of digital technologies in early childhood education.

Training or Competency Enhancement

Respondents expressed a strong expectation for professional development programs aimed at enhancing their competencies in implementing digital pedagogy within early childhood education (ECE). Specifically, they identified nine key areas of competence deemed essential for effective integration of digital tools into teaching and learning practices. *First,* the ability to produce engaging and interactive digital learning materials; second, the ability to create simple educational videos featuring children's stories, songs, or science experiments using applications such as CapCut or Kinemaster; *third*, competence in utilizing child-friendly platforms such as YouTube Kids, educational games, or learning management systems (LMS) to support both in-school and at-home learning. *Fourth,* the ability to introduce digital literacy and ethics in the use of technology among young children; *fifth,* skills in compiling digital portfolios that are informative, visually appealing, and easily shareable with parents; *sixth,* the ability to create digital literature for early childhood, including picture storybooks, comics, and e-books. *Seventh,* competence in introducing foundational coding concepts to young learners through the use of digital tools; *eighth,* the ability to integrate artificial intelligence (AI) applications to support early learning processes; and *ninth,* competence in stimulating children's interest in reading through the use of digital media. These identified areas underscore the multifaceted nature of digital pedagogy in ECE and highlight the need for comprehensive, practice-oriented training programs tailored to contemporary technological developments.

In general, teacher training programs are expected to incorporate practical engagement with various forms of digital technology, including internet-based tools, mobile devices, online social networks, and other contemporary digital resources. These technologies should be selected based on their practicality and effectiveness in supporting pedagogical objectives within early childhood education settings(Chiossi & Costa, 2018).

Technical Use of Digital Devices

Respondents expressed several expectations regarding the technical use of digital devices that had been conveyed by parents to teachers. Parents highlighted several important issues related to the implementation of digital devices in ECE context. *First,* the use of digital devices must be focused on the purpose of stimulating learning and child development. As stated, "...the use of digital devices (must) remains (prioritize) educational purposes. (The use of digital devices is only) for activities that truly support child development. Such as learning letters, numbers, Islamic stories, or educational songs, not just entertainment..." (R22). *Second,* the need for stricter supervision of the use of digital devices and materials based on the age of the child. The selection of digital materials for learning activities must be varied, engaging, and interactive. In addition, the use of digital devices must ensure not contain harmful content. *Third,* the need to provide adequate digital devices. For example, audio-visual devices with a larger size, so that all children can enjoy them together. *Fourth,* parents need to be given guidance and assistance in using digital devices to support learning activities at home. Parents need to be given recommendations for applications that are safe for young children, appropriate schedules and durations for using digital devices, and detailed follow-up descriptions for using digital devices at home so that they can continue learning activities consistently.

This study found intensive criticism conveyed by parents that the use of digital devices

should not be just for entertainment. This criticism can be answered by mentioning that one of the vital factors that is rarely understood in the application of digital devices is the gap in perception of the goals between teachers and children. Petersen (2015) has long stated that teachers perceive and set goals for using digital devices and materials for learning. While children perceive it as entertainment (Otterborn et al., 2019). As a result, learning goals and stimulation of holistic developmental aspects are not achieved. This fact also opens up opportunities for further research to examine the characteristics that digital devices and materials must have so that they can ensure that early childhood children focus on learning. Not distracted by getting entertainment.

Problems Related to the Implementation of Digital Pedagogy

The identified challenges in implementing digital pedagogy emerge from both school and home learning environments. Based on the respondents' statements, these challenges can be categorized into three main themes: (1) infrastructure-related constraints, (2) lack of parental support, and (3) concerns related to child health. These thematic groupings reflect the multidimensional nature of the barriers faced by educators in integrating digital technologies within early childhood education contexts.

Limited Facilities and Infrastructure

Respondents identified limited facilities and infrastructure as one of the primary challenges in the implementation of digital pedagogy. Many early childhood education institutions are not yet equipped with adequate digital devices to support technology-enhanced learning. In addition, several participants reported that unstable internet connectivity poses a substantial barrier to the effective use of digital tools in classroom settings. Another concern expressed was the limited access to digital applications specifically designed

to align with the developmental needs of young children. These constraints highlight the urgent need for attention from relevant stakeholders, particularly government authorities, to ensure equitable access to digital resources and infrastructure across early childhood education settings.

The same case also occurs even in developed countries, such as Sweden. Many ECE institutions do not have the digital devices and resources needed to implement digital pedagogy effectively. This includes hardware (e.g., tablets, interactive whiteboards) and software (e.g., educational applications) (Lindeman et al., 2021). Concerns about the negative impacts of using digital devices are also a significant barrier to implementing digital pedagogy in ECE. These impacts cannot be underestimated. Much evidence has shown that high use of digital devices is negatively correlated with science and mathematics scores (Spiezia, 2011), positively correlated with general learning problems (The Swedish National Agency for Education, 2015), contributes to low reading literacy, and negatively correlates with reading ability for Grade 4 students (Otterborn et al., 2019; Rosén & Gustafsson, 2016).

Lack of Parental Support

The use of digital devices for learning purposes can be extended to the home environment. However, not all parents possess the necessary skills or knowledge to effectively guide their children in the use of digital technologies for educational activities. A more persistent structural issue is the unequal access to digital infrastructure, as not all families are equipped with adequate devices or reliable connectivity to support home-based learning.

For instance, one teacher noted the lack of parental competence in supporting children's use of digital devices for learning: "...lack of parental skills (in assisting children) ... using digital devices for learning." (R16). In the same vein, concerns

about the negative consequences of digital media were also raised: "...parents (do not support), because they often express concerns regarding children's use of digital devices, especially regarding negative impacts such as addiction, health problems, and exposure to inappropriate content." (R16).

In response to these challenges, targeted interventions are recommended to enhance effective parental support and involvement in digital learning. Establishing two-way, personalized, and constructive communication between schools and parents is essential to foster mutual understanding and collaboration (See et al., 2020). Moreover, ensuring equitable access to home internet connectivity should become a critical focus for both educational institutions and relevant governmental bodies, as it constitutes a foundational element for the successful implementation of digital pedagogy in early childhood education (Lei & Zhou, 2012).

Physical, Psychological, and Social Health

Physical, psychological, and social health issues are of particular concern to both teachers and parents. The use of digital devices in learning raises particular concerns, including a decrease in the frequency of children's social interactions with their peers, imitation of negative behavior, and addiction to using and being active with digital devices, especially smartphones. "Children are addicted to playing games on smartphones...children access (videos via the application) YouTube that contain harsh words (so that children imitate them)." (R13). While using digital devices, children face excessive intensity of exposure to digital device (smartphone) screens. This has an impact on children's eye health. Interaction with digital devices is also said to cause children to become less active. According to the statement, "...children experience a decrease in activities (involving) physical and social interactions." (R5). The fatal consequences are, "...children experience

problems with physical, emotional, and social development, Such as easily throwing tantrums and lacking focus (in participating in learning activities)." (R26).

A viable approach that may be considered to address this issue is to implement Play-Based Digital Pedagogy (PBDP). Play-based digital pedagogy integrates traditional play with digital technologies to enhance learning experiences for preschool children. As a result of this integration, PBDP has demonstrated effectiveness in delivering balanced stimulation across multiple developmental domains, including cognitive, social-emotional, physical, and language development. Through the deliberate and thoughtful incorporation of digital tools alongside traditional play-based approaches, educators are able to design learning environments that are both developmentally appropriate and pedagogically enriching for preschool-aged children (Lähdesmäki, Maunumäki, & Nurmi, 2024; H. Li et al., 2024). For instance, the implementation of KidSpace, a multimodal artificial intelligence (AI) system that integrates physical and digital learning manipulatives, has shown promising outcomes in delivering personalized learning experiences. Evaluation results indicated that parents reported reduced concerns regarding screen time, alongside a notable increase in their positive perceptions of the pedagogical value of digital play (Aslan et al., 2024). In the context of early childhood education (ECE) in Indonesia, this concept warrants further investigation to explore both the implementation process and its potential impact. A series of experimental studies may be conducted to evaluate its effectiveness in stimulating various aspects of early childhood development.

Given the potential negative impacts, it is necessary to re-understand the relevant phases in the implementation of digital devices in ECE. From the perspective of Domestication Theory, improving teacher competence as users of digital devices can be based on the domestication

phases (Ytre-Arne, 2019). As the name implies, domestication can be explained as the process of making digital devices that were originally "wild" into "tame" (Berker, Hartmann, Punie, & Ward, 2006). The theory plays an important role in understanding the dynamics between technology and its users, the implementation of digital devices and improving teacher competence need to consider the phases consisting of appropriation (building motivation, reasons, and expectations), objectification (setting clear goals and intentions), incorporation (integrating digital devices according to goals), and conversion (adjusting digital devices into new roles and relationships) (Christensen, 2019).

The process of adopting digital technology in early childhood education can be analyzed through the lens of appropriation, objectification, incorporation, and conversion. In the appropriation phase, teachers' positive perceptions and high expectations reflect an emerging motivation to adopt digital tools in their professional practice. At this stage, teachers begin to formulate personal and pedagogical rationales for integrating technology into learning environments. The objectification phase is evident in teachers' attempts to situate technology within their daily routines, for example, by using laptops to present learning videos or employing applications such as Canva for assessment design. However, this phase is often challenged by a misalignment between teachers' instructional goals and children's interpretations of technology use. Many children perceive digital devices primarily as sources of entertainment, which can undermine the intended educational function and hinder the objectification process.

Progressing to the incorporation and conversion phases, successful integration and adaptation of digital tools for educational purposes require systemic support. To support these phases of digital pedagogy implementation, policymakers must formulate evidence-based policies grounded in empirical research.

Concurrently, the government must ensure the provision of adequate infrastructure to facilitate equitable access to digital technologies. In addition, parental understanding of the educational objectives associated with digital device use must be aligned with teachers' pedagogical intentions to foster consistency and coherence in early childhood learning environments. This includes involvement from policymakers, educational authorities, and parents. Training and professional development efforts must extend beyond technical proficiency to encompass pedagogical understanding, ensuring that teachers are not only capable of using digital devices but also of aligning them with developmentally appropriate learning objectives.

The findings of this study provide a substantive contribution to understanding the underlying motivations and expectations of both teachers and parents during the appropriation phase of digital pedagogy implementation. Specifically, the results illuminate how stakeholders conceptualize the integration of digital devices as a means to support the development of effective and meaningful digital pedagogy in early childhood education.

■ **CONCLUSION**

This study provides a comprehensive understanding of the knowledge, expectations, and perceived barriers of teachers and parents in implementing digital pedagogy within early childhood education (ECE) in Indonesia. The findings reveal a paradox: while teachers generally express positive perceptions toward digital pedagogy, their actual competencies in its implementation remain insufficient. This discrepancy highlights the need for targeted professional development that bridges the gap between perception and practice. Digital technologies present both opportunities and risks in early childhood learning environments. Their impact depends largely on the competence and intentionality of users. Improper or uncritical use

of digital devices may pose developmental risks for young children, as evidenced by findings from longitudinal studies in more technologically advanced contexts. To ensure safe and developmentally appropriate digital integration, implementation must be guided by a clear pedagogical framework, such as Play-Based Digital Pedagogy and Domestication Theory, which offers a structured approach to contextualizing technology use in early learning settings. This theoretical lens has the potential to guide both the meaningful adoption and pedagogical alignment of digital tools in ECE. In moving forward, several critical steps must be taken: (1) enhancing teacher competence through sustained and pedagogically grounded training; (2) providing adequate digital infrastructure and resources, which requires strong commitment and investment from government stakeholders; and (3) fostering greater parental awareness and involvement to ensure that digital pedagogy is supported holistically, both at school and at home. Finally, increasing parental understanding and support in the implementation of digital pedagogy emerges as a pivotal issue. The role of parents is critical in extending learning experiences beyond the classroom and in ensuring consistent digital engagement at home. However, this study was limited by the absence of direct data from parents. Therefore, future research should involve parents as primary respondents to obtain a more comprehensive and nuanced understanding of their expectations, capacities, and challenges in supporting digital pedagogy. Such inclusion will strengthen the evidence base and inform the development of collaborative strategies that bridge school-home partnerships in early childhood digital learning environments.

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