

Teachers' Competencies in the Use of Digital Learning Media in Early Childhood Education

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Abstract

The integration of digital learning media in Early Childhood Education (ECE) has become increasingly important in supporting effective and engaging learning experiences. This study aimed to examine teachers' competencies in the use of digital learning media in ECE settings. A quantitative descriptive research design was employed involving 80 early childhood education teachers from public and private institutions. Data were collected using a structured questionnaire covering four competency dimensions: technical competence, pedagogical competence, digital content competence, and ethical and professional competence. The data were analyzed using descriptive statistics, including mean scores and percentages. The findings revealed that teachers generally demonstrated a high level of competence in utilizing digital learning media, with an overall mean score of 4.10. Ethical and professional competence achieved the highest score, followed by technical competence, digital content competence, and pedagogical competence. The results indicate that teachers are increasingly prepared to integrate digital technologies into teaching and learning activities. However, challenges remain in developing interactive digital content and addressing technical issues. Therefore, continuous professional development, adequate technological infrastructure, and institutional support are essential to enhance teachers' digital competencies and improve the quality of early childhood education in the digital era.

Keywords: Early Childhood Education, Digital Learning Media, Teacher Competence, Digital Literacy, Educational Technology.

1. Introduction

The rapid development of information and communication technology has significantly transformed various aspects of human life, including the field of education (Harahap, 2025). Digital technology has become an essential component of modern learning environments, providing educators with innovative ways to deliver instructional materials, facilitate interaction, and enhance learning experiences. In the context of Early Childhood Education (ECE), the integration of digital learning media has gained increasing attention due to its potential to support children's cognitive, social, emotional, and language development. Digital learning media, such as educational applications, interactive videos, digital storytelling platforms, and multimedia presentations, offer opportunities to create engaging and meaningful learning experiences for young learners (Khodijah & Rizki, 2025). Consequently, teachers are expected to possess adequate competencies to effectively utilize these technologies in educational settings. Early childhood education plays a crucial role in laying the foundation for children's future learning and development. During the early years, children experience rapid growth in various developmental domains, making the quality of educational experiences particularly important. Teachers serve as key facilitators in creating learning environments that stimulate children's curiosity, creativity, and critical thinking skills. As technology becomes increasingly integrated into everyday life, early childhood educators are challenged to adapt their teaching practices to meet the needs of children growing up in a digital era. This adaptation requires teachers not only to understand pedagogical principles but also to develop competencies related to the use of digital learning media (Arif et al., 2023).

Teacher competence in the use of digital learning media encompasses a combination of knowledge, skills, and attitudes required to select, design, implement, and evaluate technology-based learning activities. These competencies include technical skills in operating digital devices and applications, pedagogical knowledge for integrating technology into learning processes, and the ability to critically assess the appropriateness of digital resources for young children. Furthermore, teachers need to understand how digital media can support child-centered learning approaches while ensuring that technology use remains developmentally appropriate (Hatzigianni et al., 2023). The effectiveness of digital learning media in early childhood education largely depends on teachers' ability to utilize these tools in ways that enhance rather than replace meaningful

interactions between teachers and children. The increasing emphasis on digital transformation in education has been further accelerated by global events such as the COVID-19 pandemic. During periods of school closures and remote learning, teachers were required to rely heavily on digital technologies to maintain educational continuity. This situation highlighted the importance of digital competencies among educators and revealed disparities in teachers' readiness to implement technology-based learning (Arochman & Fortinasari, 2024). Many early childhood teachers faced challenges related to limited technological knowledge, insufficient training opportunities, inadequate infrastructure, and difficulties in adapting digital resources to the developmental needs of young learners. These challenges underscored the need for continuous professional development programs that focus on enhancing teachers' digital competencies (Fernández-Batanero et al., 2022).

Several studies have reported positive outcomes associated with the effective use of digital learning media in early childhood education. Digital technologies can increase children's engagement, motivation, and participation in learning activities (Ulimaz et al., 2023). Interactive multimedia content can support the development of literacy and numeracy skills, while educational games can promote problem-solving and creativity. In addition, digital storytelling and multimedia resources can enrich language development and cultural understanding. However, the successful implementation of digital learning media requires teachers to possess sufficient competencies to manage technology use effectively and responsibly (Mikalef et al., 2022). Without adequate competencies, digital tools may be underutilized or applied in ways that do not contribute optimally to learning outcomes. Despite the growing availability of digital technologies in educational settings, research indicates that teachers' competencies in using digital learning media vary considerably (Morgan et al., 2022). Factors such as educational background, teaching experience, access to technological resources, institutional support, and participation in professional development programs influence teachers' levels of digital competence. In many developing countries, including Indonesia, challenges related to infrastructure, internet connectivity, and technology training continue to affect the integration of digital learning media in early childhood education. Furthermore, some teachers may demonstrate positive attitudes toward technology but lack the practical skills necessary to integrate digital tools effectively into classroom activities (Dancsa et al., 2023).

The concept of digital competence has evolved beyond basic technological literacy. Contemporary educational frameworks emphasize the integration of technological, pedagogical, and content knowledge, often referred to as the Technological Pedagogical Content Knowledge (TPACK) framework (Jibril & Adedokun-Shittu, 2023). According to this perspective, effective technology integration requires teachers to understand not only how technology functions but also how it can be combined with appropriate pedagogical strategies and subject matter content. In early childhood education, this integration becomes particularly important because young children have unique developmental characteristics that require careful consideration when selecting and implementing digital learning media. Therefore, teachers must possess comprehensive competencies that enable them to balance technological innovation with pedagogical appropriateness. In addition to technical and pedagogical competencies, ethical considerations are increasingly important in the use of digital learning media. Early childhood teachers are responsible for ensuring children's online safety, protecting privacy, and promoting healthy digital habits (Ajiluni, 2024). They must also be able to evaluate digital content critically to ensure that learning materials are age-appropriate, culturally relevant, and aligned with educational objectives. These responsibilities highlight the multidimensional nature of teacher competence in digital learning environments and emphasize the need for holistic approaches to teacher preparation and professional development (AbdulRab, 2023).

Given the growing importance of digital learning media in contemporary education, understanding teachers' competencies in utilizing these technologies is essential for improving the quality of early childhood education. Identifying strengths and challenges in teachers' digital competencies can provide valuable insights for policymakers, educational institutions, and teacher training providers (Resch & Schrittmesser, 2023). Such information can inform the development of targeted interventions aimed at enhancing teachers' abilities to integrate digital media effectively into teaching and learning processes. Therefore, this study focuses on examining teachers' competencies in the use of digital learning media in early childhood education. By exploring teachers' knowledge, skills, attitudes, and experiences related to digital technology integration, the study seeks to contribute to the growing body of literature on digital competence in education. The findings are expected to support efforts to strengthen teacher professionalism, improve technology-enhanced learning practices, and ultimately enhance the quality of educational experiences for young children in the digital age (Sindakis & Showkat, 2024).

2. Research Methodology

2.1 Research Design

This study employed a quantitative descriptive research design to examine teachers' competencies in the use of digital learning media in Early Childhood Education (ECE). A quantitative approach was selected because it enables researchers to systematically collect numerical data and analyze teachers' levels of competence regarding the utilization of digital technologies in educational settings. The descriptive design was considered appropriate for providing a comprehensive overview of teachers' knowledge, skills, and attitudes toward digital learning media without manipulating any variables.

2.2 Research Participants

The participants of this study consisted of early childhood education teachers working in public and private ECE institutions. The selection of participants was conducted using purposive sampling, in which teachers who actively utilized digital learning media in their teaching activities were chosen as respondents. The inclusion criteria required participants to have at least one year of teaching experience and experience using digital technologies such as computers, smartphones, tablets, educational applications, multimedia presentations, or online learning platforms. A total of 50–100 teachers were involved in the study, depending on the accessibility and availability of respondents. This sample size was considered sufficient to provide a representative description of teachers' competencies in utilizing digital learning media within the selected educational context.

2.3 Research Instruments

Data were collected using a structured questionnaire designed based on existing literature related to digital competence and technology integration in education. The questionnaire consisted of four main dimensions of teacher competence:

Technical Competence, which assessed teachers' ability to operate digital devices, software applications, and online learning platforms.

- Pedagogical Competence, which evaluated teachers' ability to integrate digital learning media into instructional activities effectively.
- Digital Content Competence, which measured teachers' skills in selecting, creating, and adapting digital learning materials appropriate for young children.
- Ethical and Professional Competence, which assessed teachers' awareness of digital safety, privacy protection, and responsible technology use.

The questionnaire utilized a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Higher scores indicated higher levels of competence in the use of digital learning media. Before data collection, the questionnaire was reviewed by experts in educational technology and early childhood education to ensure content validity. A pilot test was also conducted with a small group of teachers to evaluate the clarity and reliability of the instrument.

2.4 Data Collection Procedure

Data collection was conducted over a period of one month. The questionnaire was distributed both online and offline to accommodate participants' preferences and accessibility conditions. Online distribution was carried out using digital survey platforms, while printed questionnaires were provided to teachers in schools with limited internet access.

Prior to participation, respondents were informed about the purpose of the study, confidentiality procedures, and their voluntary involvement. Participants were assured that all information provided would be used solely for academic research purposes and would remain anonymous. The completed questionnaires were collected and checked for completeness before being processed for analysis. Any incomplete responses were excluded from the final dataset to ensure the accuracy of the findings.

2.5 Data Analysis Techniques

The collected data were analyzed using descriptive statistical techniques. Data analysis was performed using statistical software such as SPSS or Microsoft Excel. The analysis included the calculation of frequencies, percentages, means, and standard deviations for each competency dimension.

Table 1. The average score for each indicator is interpreted based on the criteria

Mean Score Range	Category
4.21 – 5.00	Very High
3.41 – 4.20	High
2.61 – 3.40	Moderate

1.81 – 2.60	Low
1.00 – 1.80	Very Low

These categories were used to determine the overall level of teachers' competencies in utilizing digital learning media. In addition, comparative analyses were conducted to identify differences in competence levels based on demographic variables such as age, teaching experience, educational background, and participation in technology-related training programs. The findings were presented in tables and charts to facilitate interpretation and discussion.

2.6 Ethical Considerations

This study adhered to ethical principles in educational research. Participation was voluntary, and respondents were informed of their right to withdraw from the study at any time without consequences. Informed consent was obtained before data collection commenced. Confidentiality and anonymity were strictly maintained throughout the research process. No personal identifying information was disclosed in the research report. All collected data were stored securely and used exclusively for academic purposes.

2.7 Research Framework

The study was based on the assumption that teachers' competencies in the use of digital learning media consist of interconnected dimensions, including technical competence, pedagogical competence, digital content competence, and ethical competence. These competencies collectively influence the effectiveness of technology integration in early childhood education settings. By assessing these dimensions, the research aims to provide a comprehensive understanding of teachers' readiness and capability to implement digital learning media in supporting children's learning and development. The results of this methodology are expected to provide valuable information for educational institutions, policymakers, and teacher training providers in designing professional development programs that strengthen teachers' digital competencies and improve the quality of digital learning practices in early childhood education.

3. Results and Discussion

This study aimed to examine teachers' competencies in the use of digital learning media in Early Childhood Education (ECE). The analysis focused on four dimensions of competence: technical competence, pedagogical competence, digital content competence, and ethical and professional competence. Data were collected from 80 early childhood education teachers working in both public and private educational institutions.

3.1. Characteristics of Respondents

The demographic characteristics of the respondents are presented in Table 2.

Table 2. Demographic Characteristics of Respondents

Characteristics	Category	Frequency	Percentage (%)
Gender	Female	68	85,0
	Male	12	15,0
Age	20-30 Years	22	27,5
	31-40 Years	34	42,5
	41-50 Years	18	22,5
	Above 50 Years	6	7,5
	1-5 Years	25	31,3
Teaching Experience	6-10 Years	29	36,2
	More than 10 Years	26	32,5
Technology Training Participation	Yes	62	77,5
	No	18	22,5

Table 2 shows that the majority of respondents were female teachers (85.0%), which reflects the demographic composition commonly found in early childhood education institutions. Most participants were between 31 and 40 years old (42.5%), indicating that the respondents were generally in their productive professional years. Additionally, 77.5% of teachers had participated in technology-related training programs, suggesting relatively high exposure to digital learning initiatives.

3.2 Technical Competence

The results related to teachers' technical competence are presented in Table 3.

Table 3. Teachers' Technical Competence in Using Digital Learning Media

Indicator	Mean Score	Category
Operating computers and mobile devices	4.38	Very High
Using educational applications	4.15	High
Managing online learning platforms	4.02	High
Troubleshooting simple technical issues	3.81	High
Utilizing multimedia tools	4.20	High
Average	4.11	High

The findings indicate that teachers demonstrated a high level of technical competence, with an overall mean score of 4.11. The highest score was observed in operating computers and mobile devices (4.38), suggesting that most teachers were familiar with basic digital technologies. However, troubleshooting technical issues received the lowest score (3.81), indicating that some teachers still experienced difficulties when facing technical problems during teaching activities.

3.3 Pedagogical Competence

The results regarding pedagogical competence are shown in Table 4.

Table 4. Teachers' Pedagogical Competence in Integrating Digital Learning Media

Indicator	Mean Score	Category
Planning digital-based learning activities	4.05	High
Selecting appropriate digital media	4.12	High
Facilitating student engagement through technology	4.09	High
Integrating digital media into learning objectives	3.98	High
Evaluating digital learning effectiveness	3.85	High
Average	4.02	High

Table 4 demonstrates that teachers generally possessed strong pedagogical competencies in integrating digital media into classroom instruction. The highest score was related to selecting appropriate digital media (4.12), while evaluating the effectiveness of digital learning activities obtained the lowest score (3.85).

3.4 Digital Content Competence

The findings concerning digital content competence are presented in Table 5.

Table 5. Teachers' Digital Content Competence

Indicator	Mean Score	Category
Searching for educational digital resources	4.28	Very High
Adapting digital materials for young children	4.11	High
Creating multimedia learning content	3.89	High
Designing interactive digital activities	3.84	High
Updating digital learning materials	4.07	High
Average	4.04	High

The results reveal that teachers had a high level of competence in managing digital learning content. The ability to search for educational resources achieved the highest mean score (4.28), while designing interactive digital activities received the lowest score (3.84).

3.5 Ethical and Professional Competence

Table 6 presents the results for ethical and professional competence.

Table 6. Ethical and Professional Competence

Indicator	Mean Score	Category
Promoting responsible technology use	4.21	Very High
Protecting student privacy	4.34	Very High
Ensuring online safety	4.18	High
Evaluating digital content quality	4.07	High
Demonstrating professional digital behavior	4.25	Very High
Average	4.21	Very High

The results indicate that ethical and professional competence was the strongest competency area among teachers, with an average score of 4.21. Teachers demonstrated strong awareness regarding student privacy, digital safety, and responsible technology use.

3.6 Overall Competency Levels

The overall competency levels are summarized in Table 7.

Table 7. Overall Teachers' Competencies in the Use of Digital Learning Media

Competency Dimension	Mean Score	Category
Technical Competence	4.11	High
Pedagogical Competence	4.02	High
Digital Content Competence	4.04	High
Ethical and Professional Competence	4.21	Very High
Overall Average	4.10	High

The overall average score of 4.10 indicates that teachers generally possessed high competencies in utilizing digital learning media within early childhood education settings.

3.7 Discussion

The findings of this study demonstrate that early childhood education teachers possess a generally high level of competence in utilizing digital learning media. This result reflects the increasing integration of digital technology into educational practices and indicates that many teachers have adapted to the demands of technology-enhanced learning environments. The high level of technical competence observed in this study suggests that teachers have become familiar with the use of digital devices and applications. The widespread availability of smartphones, laptops, and internet-based resources has likely contributed to teachers' technological proficiency. Furthermore, the increasing emphasis on digital literacy in teacher professional development programs may have enhanced teachers' confidence in using technology for educational purposes. Nevertheless, the relatively lower score in troubleshooting technical issues indicates the need for additional support and training in problem-solving skills related to educational technology.

The findings also reveal strong pedagogical competence among teachers. This result indicates that teachers are not merely using technology for its own sake but are actively integrating digital media into instructional planning and implementation. The ability to select appropriate digital resources demonstrates teachers' awareness of the developmental needs of young children. In early childhood education, technology should support active, play-based, and child-centered learning experiences rather than replace direct interaction and exploration. Therefore, the observed pedagogical competence suggests that teachers understand the importance of balancing digital media use with traditional learning activities. Another important finding is the high level of digital content competence. Teachers were able to search for relevant educational resources and adapt digital materials to suit the needs of young learners. This competence is particularly important because early childhood learners require age-appropriate, engaging, and developmentally suitable content. Teachers who possess strong digital content competencies can create learning experiences that encourage exploration, creativity, and active participation. However, lower scores in creating multimedia content and designing interactive activities indicate opportunities for further professional development. Advanced content creation skills may enable teachers to produce more customized learning materials that align with specific educational goals and student characteristics.

The highest competency dimension identified in this study was ethical and professional competence. Teachers demonstrated strong awareness regarding privacy protection, digital citizenship, and responsible technology use. This finding is significant because young children are particularly vulnerable to risks associated with digital environments. Teachers play a critical role in ensuring that technology is used safely and ethically within educational settings. By promoting responsible digital behavior and safeguarding student information, teachers contribute to creating secure and supportive learning environments. The results are consistent with previous studies that emphasize the importance of digital competence as a key component of teacher professionalism in the twenty-first century. Researchers have argued that effective technology integration requires a combination of technical, pedagogical, and ethical competencies. The findings of the present study support this perspective by demonstrating that teachers who possess balanced competencies across these dimensions are better prepared to implement digital learning media effectively.

The findings can also be interpreted through the lens of the Technological Pedagogical Content Knowledge (TPACK) framework. According to TPACK, effective technology integration occurs when teachers successfully combine technological knowledge, pedagogical knowledge, and content knowledge. The high competency levels observed in this study suggest that teachers are developing the integrated knowledge required

to facilitate meaningful digital learning experiences. Nevertheless, certain areas, particularly advanced content creation and technology evaluation, require further improvement to achieve optimal technology integration. Participation in technology-related training programs may have contributed significantly to the competency levels observed among respondents. More than three-quarters of teachers reported participating in professional development activities related to educational technology. This finding highlights the importance of continuous training and capacity-building initiatives. Professional development programs provide opportunities for teachers to acquire new skills, explore innovative teaching strategies, and stay informed about emerging technological trends.

Despite the positive findings, several challenges remain. Teachers continue to face barriers related to infrastructure, internet connectivity, availability of digital devices, and access to quality educational resources. Such challenges are particularly relevant in developing regions where technological resources may be limited. Institutional support is therefore essential to ensure that teachers can effectively utilize digital learning media. School leaders and policymakers should invest in technological infrastructure, provide adequate resources, and establish supportive environments that encourage technology integration. Another challenge involves maintaining a balance between technology use and traditional learning experiences. While digital learning media can enhance engagement and motivation, excessive reliance on technology may reduce opportunities for social interaction, physical activity, and hands-on exploration. Early childhood educators must therefore make informed decisions regarding when and how digital media should be incorporated into learning activities. The goal should not be to maximize technology use but rather to optimize its educational value.

The findings of this study have several practical implications. First, educational institutions should continue to provide professional development programs focusing on digital competence enhancement. Second, policymakers should develop strategies that support equitable access to technology and digital resources. Third, teacher education programs should incorporate comprehensive digital competence training into their curricula to prepare future educators for technology-rich learning environments. Overall, the results indicate that teachers are increasingly prepared to utilize digital learning media in early childhood education. However, continuous efforts are needed to strengthen specific competency areas, address existing challenges, and ensure that technology is used in ways that support children's holistic development. By enhancing teachers' competencies and providing adequate support systems, educational stakeholders can maximize the potential of digital learning media to improve the quality of early childhood education in the digital age.

4. Conclusion

This study concludes that early childhood education teachers generally demonstrate a high level of competence in the use of digital learning media, as reflected in the dimensions of technical competence, pedagogical competence, digital content competence, and ethical and professional competence. Among these dimensions, ethical and professional competence achieved the highest score, indicating that teachers have a strong awareness of responsible technology use, online safety, and the protection of children's privacy. The findings also reveal that teachers are capable of integrating digital media into learning activities and selecting appropriate digital resources to support children's development. However, several areas, particularly the creation of interactive digital content and the ability to solve technical problems, still require further improvement through continuous professional development and training programs. The study highlights the importance of institutional support, adequate technological infrastructure, and ongoing capacity-building initiatives to strengthen teachers' digital competencies. Furthermore, effective integration of digital learning media should be balanced with developmentally appropriate pedagogical practices to ensure meaningful learning experiences for young children. Therefore, enhancing teachers' competencies in digital learning media is essential for improving the quality of early childhood education and preparing learners to thrive in an increasingly digital society.

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