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Kindergarten Teachers' Information Technology Competencies in Supporting Teacher Professionalism

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Abstract

This study aims to analyze kindergarten teachers' competencies in information technology (IT) to support teacher professionalism in Moncongloe District, Maros Regency, a suburban area facing limitations in digital infrastructure. A descriptive qualitative approach was employed, involving 12 teachers from four kindergartens—TK Al-Madani, TK Al-Insyirah, TK Az-Zehan, and TK An-Nur—with school principals and an educational supervisor serving as supporting informants. Data were collected through participant observation, semi-structured interviews, questionnaires, and documentation, and subsequently analyzed using the interactive analysis model developed by Miles, Huberman, and Saldaña. The findings indicate that all teachers (100%) were able to operate basic digital devices, 92% utilized technology in lesson planning, and 83% integrated technology into classroom instruction. The use of technology, including Canva, ChatGPT, Grok, and Claude, primarily supported instructional preparation, administrative tasks, and the development of visual learning materials. However, its classroom application remained largely focused on visual enrichment and had not yet demonstrated substantial interactive pedagogical transformation. The main challenges included limited access to digital facilities (92%) and unstable internet connectivity (100%), alongside the need to align technology use with young children's developmental characteristics. Support from the educational supervisor also contributed to strengthening teachers' digital adaptation. This study highlights the importance of enhancing digital literacy, improving infrastructure, and providing practice-oriented supervisory support. Given that the study was limited to 12 teachers across four institutions in a single district, its findings are context-specific and are not intended to be generalized to all early childhood education institutions.

Keywords: teacher competencies; information technology; teacher professionalism; early childhood education; digital literacy.

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INTRODUCTION

The development of information and communication technology (ICT) has brought significant changes to various aspects of life, including education. Digital transformation requires educational institutions and educators to adapt to technological advancements in order to provide learning experiences that are relevant to students' needs. Technology serves not only as an instructional tool but also as a means of supporting educational planning, implementation, evaluation, and administration. Therefore, information technology proficiency has become an essential competency that teachers need to develop to improve the quality of their professional practice.

In early childhood education, particularly at the kindergarten level, the integration of information technology presents both opportunities and challenges. Audiovisual media, animations, and interactive learning applications can help teachers present learning materials in more concrete, engaging, and varied ways. However, their use must be aligned with the developmental characteristics of young children, who require learning experiences involving play, environmental exploration, physical activities, and direct social interaction. Accordingly, technology should be used selectively as a supplementary learning resource rather than as a substitute for teacher–child interactions or hands-on learning experiences (Mauluddia & Yulindrasari, 2024).

From the perspective of Islamic education, the development of teacher competencies is an integral part of educators' intellectual and professional responsibilities. Islam places great importance on knowledge, as reflected in Surah Al-Mujadilah (58:11), which emphasizes the elevated status of those who believe and possess knowledge. Furthermore, Surah Al-Jathiyah (45:13) explains that Allah has subjected what is in the heavens and on earth to humankind as signs for those who reflect. These verses provide a value-based foundation for educators to continuously develop their knowledge and utilize technological advancements wisely. In early childhood education, information technology competencies should therefore be directed toward supporting beneficial and responsible learning practices while maintaining moral values and considering children's developmental needs.

The development of teacher professionalism is also closely related to national education policies. Regulation of the Minister of Primary and Secondary Education Number 23 of 2026 concerning Standards for Educational Personnel in Early Childhood Education, Primary Education, and Secondary Education serves as a relevant regulatory foundation for discussing educational personnel standards (Ministry of Primary and Secondary Education, 2026). In the context of digital transformation, information technology proficiency can be understood as a supporting competency that enables teachers to perform their educational responsibilities effectively. This competency involves not only the ability to operate digital devices but also the appropriate application of technology for pedagogical purposes and professional development.

Gilster (1997) defines digital literacy as the ability to understand and use information from various sources accessed through digital devices. This concept indicates that digital literacy extends beyond the technical skills required to operate digital tools; it also encompasses the ability to understand, evaluate, and critically process information. In educational practice, digitally literate teachers must do more than operate laptops, smartphones, or educational applications. They must also be able to select relevant information, verify the accuracy of sources, and adapt digital information to instructional objectives and learners' characteristics.

This understanding is consistent with the digital literacy framework presented by Law et al. (2018) in *A Global Framework of Reference on Digital Literacy Skills for Indicator 4.4.2*, published by the UNESCO Institute for Statistics. The framework conceptualizes digital literacy as a set of competencies involving the use of technology to access, manage, understand, integrate, communicate, evaluate, and create information safely and appropriately. In relation to teacher professionalism, these competencies are essential for supporting lesson planning, developing educational media, managing educational information, and utilizing digital learning resources. Thus, the concepts proposed by Gilster (1997) and Law et al. (2018) provide a theoretical foundation for understanding teachers' digital competencies as encompassing both operational skills and the critical use of information.

Digital literacy alone, however, does not explain how teachers combine technology with teaching. The Technological Pedagogical Content Knowledge (TPACK) framework proposed by Mishra and Koehler (2006) describes effective technology integration as the interaction of three forms of knowledge: knowledge of technology, knowledge of pedagogy, and knowledge of the content being taught. A teacher may be skilled at operating a laptop or a design application, but meaningful integration occurs only when that skill is linked to an understanding of how children learn and of what they are expected to learn. In early childhood education, the content is organised around developmental aspects and themes rather than subjects, so TPACK in kindergarten requires teachers to judge which digital media suit a theme, a developmental goal, and the attention span of young children.

The European Framework for the Digital Competence of Educators (DigCompEdu) offers a complementary view by placing educators' digital competence within their professional roles (Redecker, 2017). The framework distinguishes competences related to professional engagement, the selection and creation of digital resources, teaching and learning, assessment, empowering learners, and facilitating learners' own digital competence, and it describes a progression from newcomers to more advanced users. Applied to kindergarten teachers, this perspective suggests that digital competence should be examined not only through device operation but also through the ways teachers use technology for collaboration, lesson preparation, classroom activities, and communication with parents and colleagues.

The relevance of digital literacy has increased further with the development of artificial intelligence (AI) technologies in education. Applications such as ChatGPT, Grok, and Claude can assist teachers in generating activity ideas, designing instructional plans, and exploring alternative teaching materials. Meanwhile, digital design applications such as Canva can support the development of engaging visual learning resources. Nevertheless, the use of these applications requires pedagogical judgment and the ability to evaluate information critically. AI-generated information is not always accurate or appropriate for young children's developmental needs and must therefore be reviewed and adapted by teachers before being incorporated into instructional activities. Studies of early childhood teachers' perceptions of AI have reported generally positive views of its use (Riana et al., 2025) and have identified teachers' readiness and attitudes as determining factors in its adoption (Reswari, 2025). In this regard, the digital literacy concepts proposed by Gilster (1997) and Law et al. (2018) remain relevant because they emphasize the importance of understanding, evaluating, and using information responsibly. Accordingly, AI should be positioned as a tool that supports teachers' professional responsibilities rather than as a replacement for educators' professional judgment.

Despite the opportunities offered by technology, its implementation in early childhood education institutions continues to face several challenges. Teachers need the ability to select digital media that align with instructional objectives, manage the use of technological devices, and integrate technology-based activities with direct learning experiences. Beyond individual competencies, technology integration is also influenced by the availability of facilities and infrastructure, including laptops, projectors, smart TVs, and internet connectivity. Previous research in early childhood settings has reported that limited ICT use is related to teachers' abilities and motivation and that teachers often require guidance and mentoring (Priyanti & Haryanto, 2023). Limited access to these resources may affect teachers' opportunities to integrate technology consistently into classroom activities. These conditions are particularly important to examine in kindergartens located in suburban areas, including Moncongloe District, Maros Regency, which serves as the setting of the present study.

Research on technology integration has long distinguished between two kinds of barriers. Ertmer (1999) described first-order barriers as external conditions, such as the availability of equipment, internet access, time, and technical support, and second-order barriers as internal factors, such as teachers' beliefs about teaching, their confidence, and their willingness to change established practices. Removing first-order barriers does not automatically lead to integration if second-order barriers remain, and conversely, teachers with strong motivation may still be limited by inadequate facilities. This distinction is useful for examining kindergarten teachers in suburban areas, where both the condition of facilities and teachers' own competencies and attitudes may shape how technology is used.

Several previous studies have examined digital literacy and technology integration in early childhood education. Novitasari and Fauziddin (2022) analyzed the digital literacy of early childhood educators and its role in supporting learning activities. Their study provided insights into educators' digital literacy competencies in carrying out their professional responsibilities. Furthermore, Sudarso et al. (2024) examined the transformation of early childhood education through digital marketing strategies aimed at enhancing institutional image and the professionalism of early childhood educators. Their findings demonstrated that technology utilization is also relevant to educational institution management and development. Meanwhile, Ulfah and Fauziyah (2025) investigated the improvement of early childhood teachers' digital literacy competencies in information distribution through in-house training (IHT). Their study highlighted the importance of targeted training in supporting teachers' digital competency development.

These three studies contribute to an understanding of digital literacy, educator competency development, and technology utilization in early childhood education institutions. However, their research focuses differ from that of the present study. Novitasari and Fauziddin (2022) emphasized educators' digital literacy, Sudarso et al. (2024) focused on digital marketing and institutional image development, while Ulfah and Fauziyah (2025) concentrated on improving teachers' competencies through training. These differences indicate a continuing need for research that connects information technology proficiency with the professional responsibilities of kindergarten teachers within specific institutional contexts. Such research should consider technology use in lesson planning, pedagogical activities, and educational administration, as well as the infrastructural constraints affecting its implementation.

The novelty of the present study lies in its examination of kindergarten teachers' information technology competencies through several interconnected dimensions,

including their ability to operate digital devices, their use of technology in instructional planning and implementation, their adoption of artificial intelligence applications, and the limitations associated with technological facilities and internet connectivity. The study also incorporates the perspectives of school principals and a kindergarten education supervisor as supporting informants to provide insights into institutional conditions and the development of teacher professionalism. The research was conducted in four kindergartens in Moncongloe District, Maros Regency, namely TK Al-Madani, TK Al-Insyirah, TK Az-Zehan, and TK An-Nur. This context provides empirical insights into information technology utilization in early childhood education institutions with varying levels of access to digital facilities and infrastructure.

Based on the preceding discussion, this study aims to analyze kindergarten teachers' competencies in mastering and utilizing information technology to support teacher professionalism in Moncongloe District, Maros Regency. Specifically, it examines the use of technology in lesson planning, the implementation of pedagogical activities, and educational administration; identifies infrastructural constraints; and explores the perspectives of school principals and a kindergarten education supervisor regarding the role of technology in supporting teacher professionalism.

METHODS

Research Design and Participants

This study employed a descriptive qualitative research design to analyze kindergarten teachers' competencies in mastering and utilizing information technology to support teacher professionalism. This approach was selected because it enabled the researchers to gain an in-depth understanding of teachers' abilities, experiences, and practices in using information technology within naturally occurring educational settings, without manipulating research variables. The study focused on teachers' proficiency in operating digital devices, their use of technology in instructional planning and implementation, educational administration, and the challenges they encountered when integrating technology into educational activities.

The study was conducted at four kindergartens in Moncongloe District, Maros Regency, namely TK Al-Madani, TK Al-Insyirah, TK Az-Zehan, and TK An-Nur. The primary participants consisted of 12 kindergarten teachers, while the supporting informants included four school principals, one from each institution, and one kindergarten education supervisor at the district level. Participants were selected purposively based on their active involvement in early childhood education and their access to information technology devices used in educational activities. Teachers served as the primary data sources because they were directly involved in instructional planning, implementation, and administration. School principals were included to provide information on institutional support, the availability of facilities, and the conditions surrounding technology integration in their respective schools. Meanwhile, the kindergarten education supervisor provided insights into competency development and teacher professionalism in the use of information technology. To protect the informants' confidentiality, they are referred to by their roles rather than by their names.

Data collection was carried out in several stages. In the first stage, the researchers visited each kindergarten to obtain permission from the principal, explain the purpose of the study, and identify the devices and facilities available. In the second stage, classroom observations were conducted during regular learning activities in each institution. In the third stage, interviews were held with teachers, principals, and

the supervisor, and the questionnaire was distributed to the 12 teachers. In the final stage, the researchers collected supporting documents and conducted follow-up conversations when information from different sources needed clarification. This sequence allowed observations to inform the interview questions and allowed interview findings to be checked against documents.

Research Instruments and Data Collection Techniques

Data were collected through direct classroom observation, semi-structured interviews, questionnaires, and document analysis. Classroom observations were conducted during instructional activities to directly examine the use of hardware and software, the suitability of digital media for young children's developmental characteristics, and children's engagement and responses throughout the learning process. Observations also provided insights into the consistency between teachers' reported technological competencies and their actual practices in integrating technology into classroom instruction.

Semi-structured interviews were conducted with teachers, school principals, and the kindergarten education supervisor to explore information technology competencies, the use of digital applications in educational activities, the benefits of technology for professional responsibilities, and the challenges encountered. The interviews addressed the use of applications such as Canva, ChatGPT, Grok, and Claude in preparing instructional materials and developing educational media. Interviews with school principals focused on institutional facilities, school policies, and the implementation of technology-supported learning. Interviews with the kindergarten education supervisor emphasized professional development support and perspectives on the utilization of information technology in early childhood education. Document analysis was used as an additional source of evidence concerning technology use in educational activities.

In addition, questionnaires were administered to the 12 teachers to obtain descriptive information regarding their basic digital device operation skills, technology utilization in instructional planning and implementation, and the challenges they faced. Questionnaire data were analyzed using frequency distributions and percentages based on the number of respondents for each indicator. Percentages were calculated by dividing the number of teachers meeting a particular indicator by the total number of questionnaire respondents (12 teachers) and multiplying the result by 100. The questionnaire findings were used as supporting descriptive data to clarify patterns emerging from the qualitative findings, rather than for hypothesis testing or statistical generalization.

Document analysis was used to complement the other techniques. The documents examined included teachers' instructional plans and teaching modules, digital learning materials prepared by teachers, such as presentation slides and designs made with Canva, and photographs of learning activities. These documents were used to verify teachers' statements about how technology was used in planning and to identify the types of digital materials prepared for children. The questionnaire, interview, and observation guides were developed from the indicators of digital competence described in the Introduction, namely device operation, the use of technology in planning, the use of technology in classroom activities, and the constraints experienced by teachers.

Data Analysis Techniques

Data analysis followed the interactive model developed by Miles et al. (2019), which consists of three stages: data condensation, data display, and conclusion drawing and verification. During data condensation, information obtained through observations, interviews, questionnaires, and documentation was selected, focused, and categorized according to the research dimensions, including information technology proficiency, technology utilization in instructional planning and implementation, educational administration, and infrastructural constraints.

The categorized data were subsequently presented through narrative descriptions and summary tables to illustrate patterns of technology utilization and differences in institutional conditions. During conclusion drawing and verification, the researchers interpreted the findings by examining the relationships among teachers' digital competencies, instructional practices, institutional support, and challenges identified in the field. Conclusions were developed by considering the consistency of information obtained from multiple data sources.

Trustworthiness of the Data

The trustworthiness of the data was examined through methodological and source triangulation. Methodological triangulation was conducted by comparing information obtained from teacher interviews and questionnaires with direct observations of classroom instruction. Through these observations, the researchers examined the consistency between teachers' statements regarding their information technology proficiency and utilization and the practices demonstrated during instructional activities.

The aspects examined included the use of digital devices and media, teachers' approaches to integrating technology into classroom instruction, and children's engagement and responses to the media employed. Meanwhile, source triangulation was conducted by cross-checking information provided by teachers against statements obtained from school principals during interviews. This process covered technology utilization practices, the availability of facilities and infrastructure, and the challenges encountered by teachers at each institution.

By employing both forms of triangulation, the researchers examined the consistency and correspondence of information obtained through different techniques and sources, ensuring that the interpretation of research findings was grounded in complementary empirical evidence.

RESULTS

Research Findings

This study was conducted at four kindergartens in Moncongloe District, Maros Regency, namely TK Al-Madani, TK Al-Insyirah, TK Az-Zehan, and TK An-Nur. The study involved 12 teachers as primary respondents, four school principals, and one kindergarten education supervisor as supporting informants. Data were collected through classroom observations, interviews, questionnaires, and documentation. The findings revealed variations in the use of information technology, children's responses during learning activities, and the availability of facilities and infrastructure across the four institutions.

Table 1. Profile of research sites in Moncongloe District.

No.	*Educational institution*	*Location*	*Research participants*
1	TK Al-Madani	Moncongloe, Maros Regency	Teachers and school principal
2	TK Al-Insyirah	Moncongloe, Maros Regency	Teachers and school principal
3	TK Az-Zehan	Moncongloe, Maros Regency	Teachers and school principal
4	TK An-Nur	Moncongloe, Maros Regency	Teachers and school principal

Information Technology Utilization at TK Al-Madani

Observations at TK Al-Madani indicated that teachers used laptops and projectors to display thematic educational videos. Digital media were used approximately two to three times per week. During learning activities, children demonstrated enthusiasm and actively participated in classroom activities. Audiovisual presentations helped teachers deliver learning materials visually in accordance with the themes being studied. Nevertheless, technology-supported learning could not be implemented optimally because it remained dependent on device availability and stable internet connectivity, which occasionally disrupted video playback.

Information Technology Utilization at TK Al-Insyirah

Observations at TK Al-Insyirah revealed that teachers had integrated information technology into instructional planning and implementation. Teachers used laptops and digital applications, including Canva, ChatGPT, Grok, and Claude, to assist in preparing instructional materials, identifying relevant learning resources, and developing engaging educational media.

During classroom instruction, teachers utilized digital media from the beginning of learning activities, particularly to introduce information and familiarize children with the topics being studied, through to the main learning activities, which included educational games that actively engaged children.

Based on direct observations, children demonstrated highly positive responses to technology-supported learning. They appeared enthusiastic, interested, and motivated when teachers presented learning materials through digital media. These responses became particularly evident during educational games, in which all children participated actively and showed enthusiasm for the activities. Technology use in these activities therefore served not only as a means of presenting information but also as an integral component of learning experiences that encouraged children's participation.

Nevertheless, the implementation of technology-supported learning continued to face limitations in device availability. The school had only one smart TV or interactive digital board (*Papan Interaktif Digital*, PID), which was shared among classrooms. When the device was being used by another class, teachers utilized laptops as alternative instructional media. Consequently, the use of digital devices had to be adjusted according to the availability of facilities and the needs of individual classrooms.

Information Technology Utilization at TK Az-Zehan

Observations at TK Az-Zehan showed that teachers used laptops and smart TVs to display educational videos. These devices were employed to present learning materials through clear audiovisual displays. During classroom activities, children appeared active and enthusiastic. Teachers were also able to manage classroom conditions effectively when digital media were used. Technology utilization was

adjusted according to the learning themes. However, the limited number of smart TVs meant that the devices had to be shared among classrooms.

Information Technology Utilization at TK An-Nur

The findings at TK An-Nur indicated that information technology utilization still relied primarily on teachers' personal devices, particularly smartphones and laptops. The school did not yet provide Wi-Fi facilities, requiring teachers to use their personal mobile data plans to access digital learning resources. Teachers used these devices to display simple animated videos at the beginning of classroom activities.

Observations revealed that children showed interest in digital presentations. However, their attention was not evenly sustained because of the relatively small smartphone screen. Children seated at the back of the classroom appeared less focused when the content was displayed on the device. Teachers subsequently continued the learning activities using printed worksheets.

Table 2 summarizes the observation findings across the four kindergartens and allows the institutional conditions to be compared directly.

Table 2. Cross-case summary of information technology utilization in the four kindergartens.

Aspect	*TK Al-Madani*	*TK Al-Insyirah*	*TK Az-Zehan*	*TK An-Nur*
Main devices	Laptop and projector	Laptop and one shared smart TV/PID	Laptop and smart TV	Teachers' personal smartphones and laptops
Applications and media	Thematic educational videos	Canva, ChatGPT, Grok, and Claude for preparation; digital educational games in class	Educational videos	Simple animated videos
Use in learning	Visual presentation of themes	Introductory and main activities, including educational games	Visual support during selected activities	Opening activity, followed by printed worksheets
Frequency of use	2–3 times per week	About 2–3 times per week, depending on themes and devices	Adjusted to learning themes	Not reported
Children's responses	Enthusiastic and active	Enthusiastic, interested, and motivated; all children joined the games	Active and enthusiastic; classroom well managed	Interested, but children at the back were less focused
Main challenge	Unstable internet connectivity disrupted video playback	Only one smart TV/PID shared among classrooms	Limited number of smart TVs shared among classrooms	No school Wi-Fi; personal mobile data and small screens

The cross-case comparison shows that all four kindergartens used digital media in some form and that children generally responded positively. The differences lay mainly in the type and ownership of devices, the stage of learning in which technology was used, and the kind of constraint that teachers had to work around.

Overview of Teachers' Information Technology Competencies

To complement the observation and interview findings, this study employed a questionnaire completed by 12 teachers from the four participating institutions. The questionnaire provided descriptive information regarding teachers' basic digital device

operation skills, technology utilization in instructional planning and implementation, and the challenges they encountered.

Table 3. Summary of questionnaire results on teachers' information technology competencies (N = 12).

No.	*Competency and challenge indicators*	*Number of teachers*	*Percentage*
1	Able to operate basic digital devices (laptops/smartphones)	12	100%
2	Utilized technology in preparing instructional plans (RPPM/RPPH or Modul Ajar)	11	92%
3	Integrated technology into classroom instruction	10	83%
4	Experienced limitations in institution-provided technological devices	11	92%
5	Experienced unstable internet connectivity	12	100%

Note. Percentages were rounded to the nearest whole number based on 12 respondents.

As shown in Table 3, all teachers (100%) were able to operate basic digital devices. Eleven teachers (92%) utilized technology in preparing instructional plans, while ten teachers (83%) integrated technology into classroom instruction. These findings indicated that all respondents possessed basic device operation skills, although not all teachers had applied technology in their instructional practices. Furthermore, 11 teachers (92%) experienced limitations in institution-provided technological devices, while all respondents (100%) reported challenges related to unstable internet connectivity.

An interview with the Moncongloe District kindergarten supervisor provided additional information regarding teachers' information technology competencies. The supervisor expressed a positive assessment, indicating that kindergarten teachers in the supervised area generally demonstrated a good level of information technology proficiency and had applied these competencies in early childhood education activities. This assessment complemented the observation and questionnaire findings, which showed that teachers possessed basic digital device operation skills despite ongoing limitations in facilities and connectivity.

Overall, the findings revealed that teachers across the four institutions utilized information technology in different forms and with varying levels of frequency. Children's responses to digital media were generally positive, although the observed level of engagement was influenced by the types of activities and the conditions of the devices used. At TK Al-Insyirah, children's engagement was demonstrated through active participation in technology-supported educational games. At TK Al-Madani and TK Az-Zehan, children showed enthusiasm during audiovisual learning activities. Meanwhile, at TK An-Nur, the small smartphone screen reduced the attention of some children. These differences provide a basis for discussing the relationships among teachers' digital competencies, children's responses, and instructional infrastructure.

DISCUSSION

Teachers' Digital Competencies in Supporting Teacher Professionalism

The findings indicated that kindergarten teachers in Moncongloe District possessed basic competencies in using information technology. This was reflected in the questionnaire results, which showed that all respondents were able to operate laptops or smartphones. However, these abilities were not consistently accompanied

by the integration of technology into instructional planning and implementation. The gap between device operation skills and their practical application suggests that teachers' digital competencies should be understood more broadly than technical proficiency alone. A similar distinction has been reported among kindergarten teachers elsewhere, who may accept digital technologies yet remain uncertain about how to integrate them effectively into classroom activities (Leung et al., 2026).

Gilster (1997) explains that digital literacy involves the ability to understand and use information from various digital sources. Similarly, Law et al. (2018) developed a digital literacy framework encompassing information management, communication, digital content creation, and problem-solving in technological environments. Within the context of this study, teachers' ability to operate digital devices represents a foundational competency, whereas their capacity to prepare instructional plans, develop learning media, and adapt technology use to children's needs reflects the application of digital competencies in professional practice.

These findings are related to the study by Novitasari and Fauziddin (2022) concerning digital literacy among early childhood educators. Technological proficiency needs to be developed beyond the ability to access and operate devices so that it can meaningfully support instructional activities. Therefore, teacher professionalism in the use of information technology should emphasize the integration of digital skills with pedagogical considerations appropriate to young children's developmental characteristics.

The TPACK framework helps to interpret these findings (Mishra & Koehler, 2006). The questionnaire showed that technological knowledge at the level of device operation was present among all respondents, but the classroom observations showed that the combination of technology with pedagogical decisions varied. At TK Al-Insyirah, teachers used digital media at several stages of learning and connected them with educational games on the interactive board, which reflects a closer integration of technological and pedagogical knowledge. In other institutions, digital media were used mainly to display videos, which supports attention and introduces a topic but offers fewer opportunities for children to interact with the material. From the perspective of DigCompEdu, most teachers appear to be at the stage of using digital resources and teaching with them, while competences related to assessment and empowering learners through technology were not yet visible in the data (Redecker, 2017). These differences suggest that professional development should focus less on basic operation and more on pedagogical design.

Technology and AI Utilization in Instructional Planning

The use of Canva, ChatGPT, Grok, and Claude at TK Al-Insyirah demonstrated teachers' adaptation to developments in digital technology, including artificial intelligence (AI). These applications were employed to assist in preparing instructional plans, expanding references for teaching materials, and developing visual learning resources. The findings suggest that information technology serves not only as a means of delivering instructional content but also as a tool supporting teachers' professional responsibilities during lesson preparation. This is in line with the view that teachers' digital literacy contributes to the quality of early childhood lesson planning (Dwijantie et al., 2025).

The use of AI in instructional planning should be distinguished from the direct use of digital media in children's learning activities. At TK Al-Insyirah, teachers utilized AI applications to prepare learning materials, while children participated in classroom activities involving digital media and educational games. Thus, the observed

engagement of children should not be interpreted as direct interaction with AI applications.

AI utilization also requires teachers to review and adapt generated materials before incorporating them into classroom instruction. This is particularly important because kindergarten learning activities must consider instructional objectives, children's developmental stages, and the suitability of learning materials for concrete learning experiences. This perspective is consistent with the importance of continuous digital literacy development discussed by Ulfah and Fauziyah (2025). Within the context of this study, AI utilization represents one aspect of developing teachers' professional competencies that must be accompanied by the ability to critically evaluate instructional materials.

The use of AI also raises questions of accuracy and responsibility. Generated texts, songs, or activity ideas may contain errors, content that does not fit the local culture, or language that is too complex for young children. Teachers therefore remain responsible for the final material and need to check its suitability before using it with children. Teachers should also avoid entering children's personal information, such as names, photographs, or assessment notes, into public AI applications. These considerations are in line with concerns raised in studies of early childhood teachers' perceptions of AI adoption (Reswari, 2025; Riana et al., 2025) and indicate that guidance on the ethical use of AI should be part of teachers' digital literacy training.

Children's Responses to the Use of Digital Devices and Media in Learning

The findings showed that information technology use in classroom instruction elicited positive responses from children across the four participating institutions, although the forms of engagement and the conditions of the devices varied. At TK Al-Madani and TK Az-Zehan, children demonstrated enthusiasm during audiovisual learning activities presented through projectors and smart TVs. Meanwhile, at TK Al-Insyirah, children's engagement was more directly observable through the integration of digital media from introductory activities to the main learning activities. Children not only paid attention to the information presented by teachers but also participated actively and enthusiastically in technology-supported educational games. At TK An-Nur, children similarly showed interest in digital media; however, the limited screen size of smartphones caused some children to lose focus.

These differences indicate that children's responses to technology are influenced not only by the availability of digital devices but also by the types of activities designed by teachers and the conditions of the media used. At TK Al-Insyirah, educational games provided opportunities for children to participate actively in learning activities. This finding suggests that technology can be used not only to present information but also to support activities that encourage children's participation, as has been described for interactive digital games in early childhood learning (Nursarofah et al., 2024). Conversely, the experience at TK An-Nur demonstrated that device limitations may affect the visibility of instructional content and children's attention during classroom activities.

From a pedagogical perspective, technology integration in early childhood education must consider the alignment between instructional media, learning objectives, and children's developmental characteristics. Teachers need to select activities that enable children not merely to observe digital presentations but also to engage in meaningful learning experiences. Technology-supported educational games, as observed at TK Al-Insyirah, provide one example of digital media utilization that encourages children's participation during learning. Nevertheless, the enthusiastic

responses observed do not necessarily demonstrate improvements in learning outcomes, as this study did not specifically measure changes in children's abilities.

The use of digital media must also be balanced with direct learning experiences. Young children continue to require activities involving movement, play, social interaction, and the manipulation of concrete objects. Therefore, technology should be positioned as a supplementary instructional resource rather than as a replacement for all play-based and learning activities (Mauluddia & Yulindrasari, 2024). In this regard, teachers' pedagogical competencies are reflected in their ability to select appropriate devices, design learning activities, and adapt technology utilization to children's needs and responses throughout the learning process.

This principle is consistent with the joint position statement of the National Association for the Education of Young Children and the Fred Rogers Center, which states that technology and interactive media can be effective learning tools when they are used intentionally, within developmentally appropriate practice, and in ways that support active, hands-on, and social learning rather than replacing it (National Association for the Education of Young Children [NAEYC] & Fred Rogers Center, 2012). The statement also emphasises the role of the teacher in selecting media, limiting passive screen use, and using technology to support relationships among children and between teachers and families. The practices observed in this study, in which videos and interactive boards were followed by discussion, games, or other activities, reflect this intentional use, although the balance between screen-based and concrete activities needs to be monitored continuously.

Infrastructural Constraints in Information Technology Utilization

Infrastructural constraints were among the major findings affecting information technology utilization across the four participating institutions. Although teachers possessed basic digital device operation skills, the available facilities did not fully support optimal technology integration. Questionnaire results indicated that 92% of teachers experienced limitations in institution-provided technological devices, while 100% reported unstable internet connectivity. These conditions were also reflected in the observations and interviews conducted at each school.

At TK Al-Madani, unstable internet connectivity disrupted the playback of educational videos through projectors. At TK Al-Insyirah, the main challenge was the limited availability of digital display devices. The school had only one smart TV/PID, which had to be shared among classrooms. When the device was being used, teachers in other classrooms relied on laptops as alternatives. This situation demonstrates that limited facilities do not necessarily prevent technology utilization, but they require teachers to adapt their devices and instructional presentation strategies.

At TK Az-Zehan, the limited number of smart TVs similarly required devices to be shared among classrooms. Meanwhile, TK An-Nur did not provide Wi-Fi facilities, requiring teachers to use personal mobile data plans and privately owned devices. These limitations affected not only access to digital learning materials but also the implementation of classroom activities. The small smartphone screen prevented some children from viewing the presentations clearly, prompting teachers to continue the learning activities using printed worksheets.

The differences across the four institutions indicate that infrastructural constraints cannot be understood solely as problems related to internet connectivity. Device availability, screen size, shared access to facilities, and teachers' dependence on personal resources also influence instructional practices. Therefore, efforts to strengthen teachers' technological competencies must be accompanied by institutional

support through the provision of appropriate facilities, effective management of shared devices, and improved internet access.

These constraints can be interpreted through Ertmer's (1999) distinction between first-order and second-order barriers. The problems identified in this study, namely the limited number of devices, shared smart TVs and interactive boards, small smartphone screens, and unstable internet connections, are mainly first-order barriers. The questionnaire and the supervisor's assessment suggest that teachers were generally willing to use technology, which indicates that second-order barriers related to attitudes were less prominent. However, teachers' dependence on personal devices and mobile data at TK An-Nur may, over time, discourage regular use, because the cost and effort are borne by the teacher. Addressing first-order barriers through institutional planning is therefore likely to have a direct effect on the consistency of technology use in these kindergartens.

Implications for the Professional Development of Kindergarten Teachers

Based on the overall findings, the development of kindergarten teachers' professionalism in information technology requires an integrated approach combining digital competency enhancement, pedagogical capacity building, and infrastructural support. Teachers' basic device operation skills need to be developed into broader competencies involving the selection of appropriate applications, evaluation of digital instructional materials, design of learning activities, and adaptation of technology use to young children's developmental characteristics.

The findings also highlight the importance of support from school principals and educational supervisors in developing these competencies. School principals can contribute by managing facilities, providing appropriate technological devices, and creating opportunities for teachers to improve their digital skills. Meanwhile, kindergarten education supervisors can support professional development through guidance and mentoring focused on instructional practice; coaching within academic supervision, for example, has been used to strengthen teachers' 21st-century competencies in preparing teaching modules (Nurhayati, 2023). Such support is consistent with findings that early childhood teachers often need guidance and mentoring to use ICT in their teaching (Priyanti & Haryanto, 2023). The supervisor's positive assessment of teachers' technological competencies provides a foundation for developing more targeted professional support based on the needs of individual institutions.

Professional development may also be organised in stages that correspond to teachers' current competencies. For teachers who have mastered basic device operation, training can move to the design of digital learning materials, the use of interactive media that require children's participation, and the critical review of AI-generated content. Teachers who are already more advanced, such as those at TK Al-Insyirah, can act as peer mentors for colleagues in other institutions through teacher working groups (*Kelompok Kerja Guru*, KKG). Such peer learning is relatively inexpensive and allows teachers to share practical solutions for local constraints, such as preparing offline media when internet connections are unstable or rotating shared devices between classrooms.

From a pedagogical perspective, technology integration should be implemented proportionately while considering young children's need for concrete learning experiences. The use of videos, projectors, smart TVs/PIDs, digital educational games, and other media can enrich classroom activities when aligned with instructional objectives and children's developmental characteristics. However, these activities

should continue to be combined with opportunities for play, movement, social interaction, and direct exploration.

From the perspective of Islamic education, the use of technology by teachers can be understood as part of the responsibility to seek knowledge and to use what has been made available to humankind for beneficial purposes, as indicated in Surah Al-Mujadilah (58:11) and Surah Al-Jathiyah (45:13). This perspective encourages teachers to develop their digital competence continuously, while also reminding them that technology should be used responsibly and for the benefit of children. In the context of kindergartens with an Islamic identity, such as the institutions in this study, digital media can also be used to support religious and moral learning, for example through short videos, songs, and stories that introduce good character, provided that the content is carefully selected and accompanied by the teacher's guidance.

Thus, this study provides evidence that kindergarten teachers' digital professionalism is determined not only by their ability to operate technological devices and applications but also by their capacity to integrate technology pedagogically and by the availability of school facilities and infrastructure. Variations in instructional practices and children's responses across the four kindergartens in Moncongloe District highlight the importance of contextualized digital competency development that responds to institutional needs and prioritizes the quality of children's learning experiences.

CONCLUSION

Based on the research findings, it can be concluded that kindergarten teachers in Moncongloe District, Maros Regency, possess basic information technology competencies that support their professional practice. All participating teachers were able to operate basic digital devices, while the majority had utilized technology in instructional planning and classroom activities. Technology utilization included laptops, projectors, smart TVs, interactive digital boards (*Papan Interaktif Digital*, PID), digital design applications, and artificial intelligence (AI) applications to support the preparation of instructional materials. The use of digital media in classroom instruction elicited positive responses from children, particularly in terms of enthusiasm and active participation in learning activities, including educational games supported by interactive digital boards. Nevertheless, technology integration remained uneven due to limited device availability, the need to share facilities among classrooms, and unstable internet connectivity. These findings indicate that teachers' digital professionalism depends not only on their ability to operate technological devices but also on their capacity to integrate technology pedagogically in ways that align with young children's developmental characteristics.

This study has several limitations. Its geographical scope was restricted to four kindergartens in Moncongloe District, involving 12 teachers as the primary participants. Furthermore, the descriptive qualitative approach employed did not specifically measure the effects of technology utilization on children's learning outcomes and development. Therefore, future research is recommended to involve a larger number of institutions with diverse infrastructural conditions, examine the effectiveness of digital literacy training and AI utilization among teachers, and investigate children's engagement and developmental outcomes in technology-supported learning through quantitative or mixed-methods approaches. From a practical perspective, the findings recommend strengthening professional guidance and mentoring in teachers' digital competencies, improving the availability of instructional technology devices, and

expanding equitable access to internet connectivity to ensure that technology can be utilized more effectively and in accordance with the needs of early childhood education.

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