

Implementation of Teacher Competency in Utilizing it Technology for Indonesian Language Learning in 3t Madrasahs, Indragiri Hilir Regency

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ABSTRACT

This study explores the implementation of teacher competency in utilizing it technology for Indonesian language learning in 3T Madrasahs, Indragiri Hilir Regency by examining teachers' competencies in utilizing information technology (IT) in Indonesian language learning within 3T (frontier, outermost, and underdeveloped) madrasahs in Indragiri Hilir Regency, Indonesia. Using a qualitative descriptive approach, the research involved classroom observations, in-depth interviews, and document analysis conducted at three madrasahs: MIS Islamiyah, MI Nurul Wathan, and MI Nurul Islam. Thematic analysis was applied to interpret the findings. The results indicate that although several teachers have begun integrating digital tools—such as laptops, projectors, or mobile devices—into their teaching, the overall use of technology remains basic and fragmented. Teachers primarily employ technology for visual presentations rather than for interactive learning. Key inhibiting factors include limited infrastructure, insufficient digital literacy, lack of institutional support, and geographical constraints. However, the study also reveals promising efforts made by teachers, including self-directed learning, informal peer collaboration, and adaptive use of simple technologies. These findings emphasize the need for systemic interventions, such as contextual digital training, provision of adequate infrastructure, and the establishment of a supportive school culture. Strengthening teacher capacity in IT usage is crucial not only for enhancing students' engagement in Bahasa Indonesia learning but also for achieving equitable digital transformation in remote educational settings.

KEYWORDS Digital Literacy, Indonesian Language, Remote Education, Teacher Competence, Technology Integration.



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INTRODUCTION

The use of information technology in education has become an important indicator in assessing the readiness of educational institutions in facing the digital era. The Indonesian government, through various policies, including the implementation of the Independent Curriculum, has encouraged the integration of technology in the learning process (Rahayu, 2025; Zainuddin, Nafisah, & Muttaqin, 2025). However, the implementation of these policies has not been evenly distributed, especially in the 3T areas (frontier, outermost, and disadvantaged).

The 3T phenomenon represents a critical educational challenge that can be understood through multiple theoretical lenses (Hilmi & Maryana, 2025; Somantri & Herlambang, 2025). From a constructivist perspective, learning in 3T areas requires students to actively construct knowledge through meaningful interaction with their environment—a process that technology can significantly enhance by providing access to diverse learning resources and interactive experiences that transcend geographical limitations. Meanwhile, cognitivist theory emphasizes

how technology can support mental processes such as attention, memory encoding, and information retrieval, which are essential for language learning (Blake, 2025; Sharma & Mahavidhyalaya, 2023).

In resource-constrained 3T settings, technology becomes not merely a pedagogical tool but a cognitive scaffold that compensates for limited access to conventional educational materials, enabling students to process and internalize Indonesian language concepts more effectively through multimedia presentations, visual aids, and interactive digital content (Lubis, Permatasari, & Huda, 2024; Praheto, Andayani, & Wardani, 2020). Inequality of access to technology has a direct impact on the quality of learning, especially in Indonesian subjects that require an interactive and contextual approach to build students' literacy and critical thinking skills (Putri, 2025; Widiastuti, 2025).

This issue aligns closely with global educational agendas, particularly UNESCO's Education 2030 Framework for Action and Sustainable Development Goal 4 (SDG 4), which emphasizes ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. The OECD's 2023 report on digital readiness in education highlights that digital divides between urban and remote areas remain a persistent barrier to educational equity, with teachers in disadvantaged regions often lacking both the infrastructure and professional development needed to effectively integrate technology. Indonesia's 3T educational challenges exemplify these global concerns, where geographical isolation intersects with socioeconomic disadvantages to create compounded barriers to digital transformation, making the achievement of SDG Target 4.c—ensuring qualified teachers in developing countries—particularly urgent and challenging (Gai, Ernan, Barus, & Fauzi, 2025; Union, 2025).

Preliminary data from the MIN 3 KKM in Indragiri Hilir Regency shows that MIS Islamiyah only has three computer devices for learning purposes, while MI Nurul Wathan and MI Nurul Islam each have only one device. With more than 70 students in each madrasah, this limitation hinders the optimal use of technology. In addition, only 20% of teachers have basic skills in using digital learning applications, and only 10% have personal devices such as laptops. Although about 80% of students have smartphones, the rate of their use for learning purposes is very low, so technology has not been fully part of the meaningful learning process (Aslan, 2025; Gezin, Türk Kurtça, Mihci, Lin, & Griffiths, 2025).

The urgency of this research emerges from both academic and practical imperatives (Dua & Almutairi, 2025; Dwivedi, 2025). Academically, there exists a significant knowledge gap regarding how teachers in Indonesia's most marginalized educational settings navigate digital transformation amid severe resource constraints—a context-specific understanding that cannot be extrapolated from studies conducted in better-resourced urban or suburban schools. Practically, with Indonesia's demographic transition showing that 3T regions house approximately 20% of the nation's student population yet receive disproportionately limited educational investment, understanding current implementation realities becomes critical for evidence-based policy formulation (Leung, 2025).

The practical urgency is further amplified by the post-pandemic recognition that digital competency is no longer optional but fundamental to educational resilience, as remote and blended learning models have become permanent features of Indonesia's educational landscape. Without systematic documentation of how 3T teachers currently utilize technology,

what barriers they face, and what adaptive strategies they employ, educational policymakers and institutional leaders lack the empirical foundation needed to design effective, contextually appropriate interventions that can bridge the digital divide and ensure that students in 3T madrasahs receive education quality comparable to their urban counterparts.

This research is supported by constructivism theory and cognitivism theory, which emphasizes the importance of students' active participation in building understanding through experience and interaction with the learning environment. Technology, in this case, is an important bridge in creating interactive, authentic, and relevant learning experiences. Constructivism holds that knowledge is actively constructed by students, while cognitivism emphasizes the role of mental processes in managing the information students receive. Therefore, teachers' competence in managing technology-based learning is a determining factor for the success of technology integration in the classroom, including in the context of madrasahs in the 3T area.

Several previous studies have shown that the use of technology in learning has great potential in improving the quality of education. Irtiyah (2024) found that the use of technology contributes to improving teacher performance, although age factors, limited training, and lack of infrastructure are still the main obstacles. Research by Kamilah et al. (2025) also shows that the use of technology in Indonesian learning is able to increase student motivation and involvement. However, low teacher competence and digital access gaps remain unresolved challenges, especially in remote areas.

The novelty of this research lies in its specific focus on the intersection of three critical yet underexplored dimensions: Indonesian language learning pedagogy, teacher technology competency in resource-constrained environments, and the unique sociocultural context of Islamic educational institutions (madrasahs) in Indonesia's 3T regions. While existing studies have examined technology integration in urban schools or general teacher competency in rural areas, this research uniquely investigates how madrasah teachers—who operate within distinct religious-educational frameworks and face compounded challenges of geographical isolation, infrastructural deficits, and limited professional development access—navigate digital transformation specifically for language instruction. Furthermore, this study contributes methodological novelty by employing in-depth qualitative exploration across multiple madrasahs within a single 3T district, allowing for nuanced understanding of within-region variation that quantitative or single-site studies cannot capture. This granular, context-specific investigation addresses a critical gap in the literature, as most Indonesian educational technology research has concentrated on Java-based or urban contexts, leaving the realities of 3T Islamic schools largely undocumented and undertheorized.

Based on this background, this research aims to: 1) Describe the implementation of teachers' abilities in utilizing information technology in Indonesian language learning in 3T madrasahs in Indragiri Hilir Regency; 2) Identify factors that affect the low utilization of technology by teachers; and 3) Explore the efforts made by teachers in overcoming the challenges of using technology in Indonesian learning in the madrasah.

The findings of this study are expected to provide significant theoretical, practical, and policy benefits. Theoretically, this research will enrich the existing body of knowledge on technology adoption in education by providing empirical evidence from an underrepresented context—Islamic elementary schools in Indonesia's most disadvantaged regions—thereby

contributing to more inclusive and globally representative educational technology theories that account for extreme resource constraints and sociocultural diversity. Practically, the detailed documentation of teachers' adaptive strategies and challenges will inform the development of contextually appropriate professional development programs, helping educational practitioners and teacher trainers design interventions that build on existing teacher initiatives rather than imposing external models that may be incompatible with 3T realities. For policymakers at district, provincial, and national levels, this research will provide evidence-based recommendations for infrastructure investment prioritization, teacher capacity-building program design, and regulatory frameworks that support rather than hinder technology integration in remote Islamic schools, ultimately contributing to the achievement of educational equity goals articulated in Indonesia's national education strategic plans and international commitments to SDG 4.

RESEARCH METHOD

This study used a qualitative approach with a descriptive design to explore the implementation of teachers' abilities in utilizing information technology in Indonesian language learning in 3T madrasahs. The research was conducted in Indragiri Hilir Regency, Riau Province, Indonesia, focusing on three madrasahs under the supervision of KKM MIN 3: MIS Islamiyah (Kempas District), MI Nurul Wathan (Mandah District), and MI Nurul Islam (Kateman District). These madrasahs were purposively selected as typical 3T educational institutions characterized by geographical remoteness, limited infrastructure, and minimal access to professional development. The research took place over four months, from August to November 2024.

The study population comprised all Indonesian language and primary grade teachers (grades I–VI) working in 3T madrasahs within the KKM MIN 3 Indragiri Hilir jurisdiction, totaling about 45 teachers across 15 madrasahs. A purposive sampling technique selected participants based on these criteria: (1) actively teaching Indonesian language or responsible for Indonesian instruction in grades IV–VI; (2) at least two years of teaching experience in the madrasah; (3) experience or interest in using technology for teaching, regardless of proficiency; and (4) willingness to participate and provide informed consent. The final sample included 9 key informants: 3 Indonesian language specialist teachers and 6 classroom teachers distributed evenly among the three madrasahs.

Data collection combined three complementary methods for triangulation and validity. First, in-depth semi-structured interviews were conducted with each of the 9 teachers, lasting 45–90 minutes, focused on experiences, perceptions, challenges, and strategies in using technology for Indonesian language instruction. Interview questions were based on themes from the Technological Pedagogical Content Knowledge (TPACK) framework and teacher competency standards. Second, non-participant classroom observations were conducted across 18 Indonesian language lessons (6 per madrasah) to observe technology integration, documenting usage frequency, types of digital tools, pedagogical approaches, student engagement, and technical challenges. Third, document analysis examined lesson plans, teaching materials, infrastructure inventories, teacher training records, and institutional policies related to technology use, providing contextual understanding of technology implementation.

Primary data sources included verbal data from teacher interviews, observational data of classroom practices, documentary data from institutional records, and field notes capturing contextual details and researcher reflections. Secondary data sources consisted of government reports on 3T education, madrasah statistics, and relevant policy documents from the Ministry of Religious Affairs.

The main instrument was the researcher, supported by interview guidelines and observation sheets developed from teacher competency indicators and technology use in learning. Informants were purposively selected based on their involvement in Indonesian learning and access to digital devices. Data analysis followed Braun and Clarke's (2006) thematic analysis procedure, performed iteratively during data collection. The six phases included: (1) familiarization with data through repeated reading of transcripts and notes; (2) generating initial codes identifying meaningful segments on technology use, challenges, and strategies; (3) searching for themes by grouping codes into broader patterns; (4) reviewing themes to ensure coherence and distinctness; (5) defining and naming themes aligned with research objectives; and (6) producing the final analysis with illustrative examples linked to research questions and literature. To enhance trustworthiness, member checking was conducted by sharing preliminary findings with 3 teacher participants for validation, and peer debriefing involved two experienced educational researchers to examine interpretations and reduce bias. Data analysis identified patterns, categories, and themes emerging from the field findings.

RESULT AND DISCUSSION

Implementation of Teachers' Abilities in Utilizing Information Technology in Indonesian Language Learning

The implementation of teachers' ability to utilize information technology (IT) in 3T madrasahs in Indragiri Hilir Regency still shows quite sharp variations. Based on the results of observations and interviews in three madrasahs—MIS Islamiyah, MI Nurul Wathan, and MI Nurul Islam—it is known that some teachers have started to try using technological devices such as projectors and laptops, even though their use has not been thoroughly integrated in the learning process.

At MIS Islamiyah, Indonesian teachers have used laptops and projectors to broadcast image- and video-based material in a simple way. Meanwhile, at MI Nurul Islam, teachers display short story texts or poems using projectors, although they are not accompanied by the use of interactive media. As for MI Nurul Wathan, the use of digital devices is still very limited, even most teachers only rely on personal phones to display images or static text that have been downloaded before. This shows that the use of technology is still sporadic, depending on the initiative and confidence of each teacher.

This condition shows that teachers' competence in utilizing technology has not fully developed as part of professional competence. As stated by Wati and Nurhasannah (2024), digital literacy is a crucial aspect in facing the challenges of 21st century education. Without basic skills in using technology, teachers will have difficulty creating meaningful learning experiences for students. This is in line with the results of research by Kurnia et al. (2024) which emphasized that teachers' mastery of digital media, even if simple, can have a positive impact on the quality of learning if developed sustainably.

The implementation of technology in Indonesian learning in 3T madrasahs has also not been fully directed at strengthening students' literacy skills. Teachers use technology more as

a visual aid than as an interactive or collaborative tool. In fact, as stated by Ramadanti et al. (2024), the integration of technology in Indonesian learning can encourage active student involvement, enrich the learning experience, and build critical thinking skills. The non-achievement of this function shows that some teachers still have difficulties in designing technology-based learning pedagogically.

The following table summarizes the frequency of use of devices and forms of technology implementation by Indonesian teachers in each madrasah:

Table 1. Implementation of Information Technology by Indonesian Language Teachers in Madrasah 3T

Name of Madrasah	Devices Used	Form of Implementation	Frequency of Use	Information
MIS Islamiyah	Laptop. Projector	Presentation media, learning videos	1–2 times per week	Still sharing tools between teachers
MI Nurul Wathan	Android personal teacher	Material images, interactive text	Not routine	Not confident yet, afraid of hitting the wrong button
MI Nurul Islam	Projector (rotating)	Screening of poetry/short story texts	Every once in a while	Teachers are still hesitant to use the tool

The data in the table show that the use of technology is more likely to be a complement to rather than part of a structured learning strategy. This indicates that teachers have not fully implemented digital competency frameworks such as TPACK or DigCompEdu, which can help them in aligning technology with learning content and pedagogy.

Research by Sutarini and Purnamaningsih (2023) revealed that technology training that is applicable and based on school context can increase teachers' confidence in using technology. However, in the case of 3T madrasahs in Indragiri Hilir, such training has not been carried out much. Most teachers admitted to self-taught learning through YouTube or informal discussions with peers. In many cases, this self-paced learning does not sufficiently encourage an in-depth understanding of the use of technology for pedagogical purposes.

In addition to the training factor, psychological factors also affect the implementation of technology. Some teachers are afraid of damaging the device, or are hesitant if the technology does not work as it should during learning. This is reinforced by the results of a study by Hayati et al. (2025) which showed that teachers' perceptions of technology, especially in 3T areas, are influenced by confidence and support of the work environment. Without support from madrasah heads or internal policies that support the use of technology, teachers tend to be passive and risk averted.

Nonetheless, there are indications that young teachers who have greater access to personal devices such as laptops or smartphones are more likely to try. This shows that the new generation of teachers has great potential in bringing technology-based learning transformation, as long as it is equipped with adequate training and facilities.

These individual efforts are in line with the findings of Rosita & Fatmasari (2023) which affirm the importance of teachers' proactive attitudes in accepting and managing technology in distance and face-to-face digital-based learning. Therefore, top-down (madrasah policy) and

bottom-up (teacher initiatives) interventions need to go hand in hand to create a supportive digital culture.

Overall, the implementation of teachers' ability to utilize technology is still in its early stages and has not touched on the pedagogical aspect in depth. The use of technology is more positioned as a presentation tool, rather than as a medium to build interaction, exploration, and reflection learning. In fact, technology can be an important bridge in presenting contextual, creative, and student-centered Indonesian learning—especially in 3T madrasahs that have limited conventional learning resources.

Factors Affecting the Low Utilization of Information Technology by Teachers

Although there is potential and initiative from some teachers in using information technology (IT), its use in 3T madrasahs is still relatively low and not optimal. Based on field findings, there are four main factors that significantly affect the low utilization of technology by Indonesian language teachers, namely limited infrastructure, low digital competence, unsupportive institutional culture, and regional social and geographical conditions.

a. Infrastructure Limitations

All madrasahs that are the location of the research experience limitations in terms of the availability of digital devices. Teachers have to take turns using one available projector or laptop, and some rely only on personal phones to access digital materials. In addition, an unstable internet connection is an obstacle in accessing online learning resources. This hinders teachers from developing technology-based learning consistently and sustainably.

These findings are consistent with the results of Zein's (2024) research, which shows that schools in the 3T region still face major challenges in terms of infrastructure readiness, especially internet networks and learning devices. Similarly, Dewi et al. (2025) highlight that digital infrastructure inequality between urban and remote areas is a major factor that widens the gap in learning quality.

b. Low Digital Competence of Teachers

The results of the interviews show that most teachers have not received structured technology training. They rely solely on self-paced learning or personal experience in using the device. Proficiency in using applications such as Google Slides, Canva, or LearningApps is still very limited. In fact, some teachers expressed their fear of damaging the device if they tried to operate it without assistance.

This is strengthened by the results of a study by Kasri et al. (2025) which stated that many teachers in the 3T area experience "technological stuttering" due to the lack of formal training and lack of continuous mentoring. They emphasized the importance of local community-based teacher competency development programs as a long-term solution to improve teachers' digital literacy.

Saiman and Kasman (2025) also noted that one of the challenges in the implementation of the Independent Curriculum in the 3T region is the low readiness of teachers, especially in terms of the use of technology as a learning tool. Without adequate digital competence, teachers will find it difficult to adopt the innovative approaches offered in the curriculum.

c. Work Culture and Institutional Support

In most madrasahs, there is no internal policy that encourages the systematic use of technology in teaching and learning activities. Initiatives to use digital devices are still individual and uninstitutionalized. Teachers who are personally motivated tend to try, while

those who lack confidence will tend to shy away because there is no explicit institutional encouragement.

Research by Hayati et al. (2025) underscores the importance of principals' leadership in encouraging technology-based work culture. Without a digital vision from the leaders of educational institutions, teachers will move independently without a clear direction. Khanali (2023) also highlighted that policy-making in madrasahs is still too administrative and has not yet placed digital transformation as a priority.

The absence of regular forums or learning communities between teachers in madrasahs also aggravates the situation. Teachers do not have the space to share experiences or learn technology together. In fact, Azizah et al. (2025) emphasized the importance of the existence of literacy centers or shared spaces in the 3T area to develop a collective digital learning culture.

d. Socio-Geographical Characteristics

The geographical location of Indragiri Hilir Regency which is quite remote, difficult access, and minimal availability of training facilities also affect the low use of technology. Teachers in this area rarely get the opportunity to take part in professional training from government agencies or higher education institutions. They also have difficulty accessing learning resources due to signal limitations or unstable power grids in some areas.

Syahir (2024) in his study in West Nusa Tenggara showed that online learning planning in 3T areas is greatly constrained by the geographical and economic conditions of the community. This is in line with the context in Indragiri Hilir, where teachers face structural challenges in developing an IT-based approach. Similarly, Astathi (2023) added that madrasahs in the 3T area are not institutionally ready to face the demands of society 5.0 because there is no equitable regulatory and technological support.

Table 2. Factors Inhibiting the Use of Technology in Madrasah 3T

Factor	Indicators of Findings in the Field
Infrastructure	Limited devices, weak internet, alternating usage
Digital Competence	Lack of formal training, fear of mispressing, unfamiliarity with learning applications
Institutional Culture	No policy to encourage the use of technology, individual initiatives
Socio-Geographic	Remote location, low training access, limited power and signal network

Overall, the low use of technology by Indonesian teachers in 3T madrasahs is not only caused by technical factors, but also concerns psychological, organizational culture, and structural aspects. Without holistic support, it will be difficult to develop technology in a sustainable manner. Therefore, there is a need for collaboration between madrasahs, local governments, and higher education institutions to build a learning ecosystem that encourages comprehensive digital transformation.

Teachers' Efforts in Overcoming the Challenges of Technology Utilization

Despite facing various limitations, teachers at 3T madrasah in Indragiri Hilir Regency showed a number of adaptive initiatives and strategies to continue to provide relevant learning through the use of information technology (IT). Based on the results of observations and interviews, there are three main forms of teacher efforts, namely: independent learning, collaboration among teachers, and simple technology adaptation. This effort shows the potential for bottom-up transformation, while emphasizing the importance of structural support to expand its impact.

a. Independent Learning

Indonesian teachers in the three madrasahs show the spirit of independent learning by looking for learning resources through online platforms such as YouTube, educational blogs, or modules from the Ministry of Education and Culture. Some teachers even access belajar.id accounts even though not all of their features are fully utilized due to connection limitations.

This shows that teachers have the desire to develop, even though the facilities and support from the madrasah are inadequate. Rosita (2022) in her service activity report revealed that the use of digital learning resources is highly dependent on individual teacher initiatives, especially in areas that do not have supportive institutional policies. Kurnia et al. (2024) also show that teachers who independently develop application-based teaching materials such as Focusky can improve the quality of material delivery, although the implementation is still simple.

However, this self-paced learning has not been structured and does not necessarily result in significant changes in teachers' digital competencies. Therefore, it is important to provide a forum that can facilitate this self-directed and productive learning, such as online training with mentoring or *community-based* peer mentoring.

b. Collaboration with fellow teachers

Collaborative efforts are also a fairly prominent practice in the 3T madrasah environment, even though it is informal. Teachers borrow devices from each other, share PowerPoint files or images, and have light discussions about applications or digital learning resources. This collaboration is a form of solidarity between colleagues in overcoming the lack of infrastructure.

Sutarini and Purnamaningsih (2023) emphasized that the success of technology assistance in elementary schools is highly determined by the existence of a collaborative culture between teachers. In the context of 3T, this collaboration can be an important strategy to expand access and build teachers' confidence in using technology. Similarly, Azizah et al. (2025) encourage the establishment of community-based literacy centers in 3T areas to foster a sustainable digital learning ecosystem.

Unfortunately, at the research site, this collaboration has not been accommodated in the form of an official teacher learning community (KLG). The absence of regular forums or institutional structures makes these collaborative practices undocumented and difficult to evaluate. Therefore, support from the head of madrasah and the Ministry of Religion is needed to encourage the formation of a KLG that focuses on developing learning technology competencies.

c. Simple Technology Adaptation

In a situation of limited infrastructure, teachers show creativity in using simple technology. Some teachers download videos or images first so that they can be played offline in class. There are also teachers who make PowerPoint presentations with narrative text and static illustrations instead of interactive videos. At MI Nurul Islam, teachers even display

illustrated poetry texts through projectors, even without audio, as a form of adaptation to limitations.

The use of this simple technology illustrates the adaptive ability of teachers to real conditions in the field. Aini and Wahyuni (2023) revealed that Indonesian learning materials presented in simple visual form can help increase students' understanding and interest in learning, especially at the basic education level. In addition, Ramadanti et al. (2024) added that technology, although simple, is still effective if used contextually according to the characteristics of the student and the learning environment.

However, without sustained capacity building, these adaptations can *be stagnant* and undeveloped. Therefore, it is important to equip teachers with digital pedagogical skills that focus not only on tools, but also on technology integration strategies in learning plans, assessments, and reflections.



Figure 1. Examples of Teachers' Efforts to Use PowerPoint Offline in Learning

In general, these efforts show great potential from within (*internal capacity*) that can be developed if appropriate policy interventions are received. As conveyed by Saiman and Kasman (2025), the success of the Independent Curriculum in the 3T region is highly dependent on the flexibility of the approach adapted to local realities. In other words, education policy interventions should not be uniform, but must be adaptive to the conditions of madrasas in disadvantaged areas.

It is also important to ensure that these teachers' efforts do not stop as a personal response to limitations, but develop into an institutional-based collective movement. Collaboration across actors—teachers, madrasah heads, supervisors, local governments, and higher education institutions—is key in creating a digital ecosystem that empowers teachers and provides access to quality education for students in 3T madrasas.

CONCLUSION

The study found that teachers in 3T madrasahs have a limited ability to use information technology in Indonesian language learning, primarily restricted to basic applications without full integration into teaching strategies. Key barriers include inadequate infrastructure, low teacher digital literacy, and insufficient institutional support. Nevertheless, teachers showed promising efforts through self-directed learning, informal collaboration, and simple technology adaptations, indicating potential for growth. To enhance digital integration, ongoing support is essential, including contextualized training, adequate resource provision, and fostering a school

culture that values technology use. Future research should investigate the effectiveness of tailored professional development programs and policy interventions that promote sustained, inclusive digital transformation across diverse 3T educational settings.

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