

ORIGINAL

Narrative Inquiry into Teachers' Technology Readiness for Effective Classroom Management

Investigación narrativa sobre la preparación tecnológica de los maestros para una gestión eficaz del aula

Ratna Widya Irmayanti¹  , Sri Marmoah¹ , Mohamed Nor Azhari Azman² , Karsono¹ 

¹Universitas Sebelas Maret, Elementary School Teacher Education. Surakarta, Indonesia.

²Universiti Pendidikan Sultan Idris, Engineering Technology. Tanjong Malim, Malaysia.

Cite as: Irmayanti RW, Marmoah S, Azhari Azman MN, Karsono. Narrative Inquiry into Teachers' Technology Readiness for Effective Classroom Management. Salud, Ciencia y Tecnología. 2025; 5:2422. <https://doi.org/10.56294/saludcyt20252422>

Submitted: 27-03-2025

Revised: 18-07-2025

Accepted: 24-10-2025

Published: 25-10-2025

Editor: Prof. Dr. William Castillo-González 

Corresponding author: Ratna Widya Irmayanti 

ABSTRACT

Technology readiness of teachers is considered important in the current learning process, as it plays a vital role in improving the quality of education. This study aims to explore teachers' experiences in classroom management, including planning, implementation, and evaluation with the support of digital technology. A qualitative approach using a narrative inquiry design was employed. Data were collected through in-depth interviews and classroom observations involving seven teachers from urban primary schools in Surakarta City, Indonesia, selected through purposive and snowball sampling. Data were analyzed with narrative analysis. The findings reveal that teachers' technological readiness in the planning stage is demonstrated by their ability to integrate digital tools, utilize educational videos, and prepare interactive learning media in their lesson plans. During implementation, teachers' technology readiness was demonstrated by their ability to operate devices such as laptops, LCD projectors, and Chromebooks independently, while also employing applications like Canva, Quizizz, and Liveworksheet to promote active and creative student participation in the classroom. In the evaluation stage, teachers applied both process- and product-based assessments using digital tools such as Google Forms and performance rubrics to measure students' creativity and digital competencies. This research makes a significant contribution to the field of education by providing empirical data on teachers' technological readiness and underscores the importance of continuous professional development and adequate infrastructure to support the effectiveness of technology-enhanced learning environments.

Keywords: Classroom Management; Narrative Inquiry Study; Teacher; Technology Readiness.

RESUMEN

La preparación tecnológica de los docentes se considera importante en el proceso de aprendizaje actual, ya que desempeña un papel fundamental en la mejora de la calidad de la educación. Este estudio tiene como objetivo explorar las experiencias de los docentes en la gestión del aula, incluida la planificación, implementación y evaluación con el apoyo de la tecnología digital. Se empleó un enfoque cualitativo utilizando un diseño de investigación narrativa. Los datos se recopilaron a través de entrevistas en profundidad y observaciones en el aula en las que participaron siete maestros de escuelas primarias urbanas en la ciudad de Surakarta, Indonesia, seleccionados a través de un muestreo intencional y de bola de nieve. Los datos se analizaron con análisis narrativo. Los hallazgos revelan que la preparación tecnológica de los maestros en la etapa de planificación se demuestra por su capacidad para integrar herramientas digitales, utilizar videos educativos y preparar medios de aprendizaje interactivos en sus planes de lecciones. Durante la

implementación, la preparación tecnológica de los maestros se demostró por su capacidad para operar dispositivos como computadoras portátiles, proyectores LCD y Chromebooks de forma independiente, al mismo tiempo que emplean aplicaciones como Canva, Quizizz y Liveworksheet para promover la participación activa y creativa de los estudiantes en el aula. En la etapa de evaluación, los maestros aplicaron evaluaciones basadas en procesos y productos utilizando herramientas digitales como Google Forms y rúbricas de desempeño para medir la creatividad y las competencias digitales de los estudiantes. Esta investigación hace una contribución significativa al campo de la educación al proporcionar datos empíricos sobre la preparación tecnológica de los maestros y subraya la importancia del desarrollo profesional continuo y la infraestructura adecuada para respaldar la efectividad de los entornos de aprendizaje mejorados por la tecnología.

Palabras clave: Gestión del Aula; Estudio de Investigación Narrativa; Maestro; Preparación Tecnológica.

INTRODUCCIÓN

Teachers play a central role in the educational process as the bridge between knowledge and students.⁽¹⁾ Teachers are the key to quality education to achieve SDG 4 on inclusive, equitable, and quality education.^(2,3,4) In a United Nations report, it was highlighted that despite significant improvements in access to education and digital transformation, globally only about 17 % of the SDG targets are currently on track for adequate achievement, while 48 % of the targets show insufficient progress and 18 % are even regressing.⁽⁵⁾ This confirms the urgency of strengthening teacher capacity in technological readiness as part of efforts to achieve quality education for all.

Facing of the dynamics of 21st-century education, teachers are required to possess adequate competencies to meet the increasingly complex and diverse learning challenges.⁽⁶⁾ Based on the Regulation of Indonesian Director General of Teachers and Education Personnel of the Ministry of Education and Culture Research and Technology, teacher competence encompasses pedagogical, personality, social, and professional aspects.⁽⁷⁾ Pedagogical competence is the skills and knowledge possessed by teachers to effectively deliver learning content, communicate with students, and assess learning outcomes.^(8,9) Personality competence refers to the personal qualities of teachers, such as honesty, adaptability, and emotional stability.⁽¹⁰⁾ Social competence is an individual's ability to interact and communicate effectively in social situations.^(11,12) Meanwhile, professional competence is a teacher's ability to master their field of expertise and plan appropriate tasks to support meaningful learning.⁽¹³⁾ Each of these aspects contributes to the overall effectiveness of student learning and development.

In the digital age, technological innovations have also changed the educational landscape. Teachers' readiness to adopt and utilize technology significantly impacts their ability to manage classrooms effectively.⁽¹⁴⁾ The use of technology in educational settings is not only a necessity but also an expectation to meet the needs of 21st-century learners.⁽¹⁵⁾ The integration of technology in education is an important factor in improving the quality of learning and classroom management.⁽¹⁶⁾ Research shows that integrating technology in the classroom can enhance the quality of class interactions, especially student-teacher interactions.⁽¹⁷⁾ Teachers' readiness to use digital technology effectively not only improves student learning outcomes and classroom management efficiency but also supports teachers' professional development, thus creating a more meaningful learning experience for students.⁽¹⁸⁾ Digital technology can significantly enhance teaching effectiveness, improve students' thinking abilities, learning attitudes, and academic outcomes.⁽¹⁹⁾

Although technology has advanced rapidly and is widely available in educational institutions, there is still a gap in teachers' readiness to use it optimally.⁽²⁰⁾ Teachers often struggle to translate their technology training into effective pedagogical practices.^(21,22) Teachers' anxiety about using technology and their self-perceptions of effectiveness can negatively impact their willingness to integrate technology.⁽²³⁾ This is supported by the results of initial interviews conducted by the researcher with teachers, which revealed that teachers' technological competence is still not optimally honed, even though teachers are skilled in using technology. In the interviews, teachers explained that the use of digital technology in the classroom is still limited. Teachers generally master the theory, but in practice, it is still very poorly applied. Much of the knowledge gained by teachers has not been maximized in the classroom. Similar research reveals that some teachers face constraints in adapting technology into the learning process, whether due to limited training,⁽²⁴⁾ infrastructure,⁽²⁵⁾ or a lack of confidence in its use.⁽²⁶⁾

This research is important because teachers' technological readiness is directly related to teaching effectiveness and students' learning experiences. Understanding the challenges and opportunities faced by teachers in integrating technology allows for the design of more effective training strategies and policies to improve teachers' skills in utilizing technology in the classroom.⁽²⁷⁾ Low technological readiness can lead to less effective classroom management, which can impact low student participation and obstacles in the

learning process.⁽²⁸⁾ Therefore, a deep understanding of how teachers experience and interpret technology integration in their classroom practice is an essential foundation for designing responsive and needs-based educational training and policies.⁽²⁹⁾ Research by Badri et al. investigated teachers' technological readiness to manage classrooms using the Technology Readiness Index (TRI), with the results showing that most teachers were classified as laggards and explorers, and their readiness was influenced by factors such as gender, age, school location, and the number of students taught.⁽³⁰⁾ Research conducted by Alghamdi et al.⁽³¹⁾ explore the readiness of kindergarten teacher students to integrate technology into the classroom.⁽³¹⁾ This study shows that teachers are ready to apply technology with a positive attitude and can transfer technical skills into professional practice, but few are ready to apply pedagogy practically with three main factors influencing this: technology resources, school infrastructure, and the number of students in the classroom. Another study showed that teachers' beliefs about the effectiveness of technology in teaching play a crucial role in classroom management.⁽³²⁾ Therefore, this study aims to explore teachers' experiences in managing classes including planning, implementation, and evaluation with the support of digital technology.

METHOD

Research Design

This research employed a qualitative approach with a narrative inquiry design, which captures the experiences of an individual or a small group. It focuses on presenting lived experiences or specific perspectives, typically gathered through interviews that are recorded and structured in chronological order.⁽³³⁾ In this study, narrative inquiry was used to explore teachers' experiences and perceptions regarding their technological readiness in classroom management. This research was conducted in two elementary schools in Surakarta City, Indonesia, from February to April 2025.

Sampling and Participant

The participants were selected using purposive and snowball sampling methods, where initial respondents recommended additional participants. The teachers were selected from Solo City, specifically in primary schools located in urban areas, and most of the teachers had minimum 6 years of teaching experience. The details of the respondents are presented in the following table:

Responden Code	Teaching Periods	Age	Gender	Duty Location
Responden 1 (R1)	6 year	29 year	Female	State Elementary School
Responden 2 (R2)	15 year	49 year	Female	State Elementary School
Responden 3 (R3)	28 year	58 year	Male	State Elementary School
Responden 4 (R4)	10 year	37 year	Male	Private Elementary School
Responden 5 (R5)	12 year	37 year	Female	Private Elementary School
Responden 6 (R6)	6 year	30 year	Female	Private Elementary School
Responden 7 (R7)	8 year	38 year	Female	Private Elementary School

Data Collection

Data were collected through in-depth, face-to-face interviews and observations involving seven primary school teachers. The interview questions focused on teachers' technological readiness in managing classrooms. Each interview was conducted individually in a face-to-face setting and lasted approximately 30 minutes per respondent. A total of 14 questions were asked in each session.

Data Analysis

The data was examined through narrative analysis, which assesses narrative elements such as plot, motifs, and characters to understand individual experiences.⁽³⁴⁾ Narrative analysis is a qualitative research analysis used to understand individual or collective experiences.⁽³⁵⁾ Narrative analysis interprets interview stories to understand how individuals construct meaning within specific contexts.⁽³⁶⁾

Ethical Clearance

This research followed ethical guidelines for research with human subjects. Participants were informed about the nature and objectives of the study, and their informed consent was obtained. Participation was voluntary, and confidentiality of all responses was maintained. This study did not involve any procedures that posed risk or harm to the participants.

RESULTS

Teachers' Technological Readiness in Planning a Lesson

The results of interviews and observations indicate that most teachers have demonstrated technological readiness in planning their lessons. This is demonstrated by the teachers' motivation in designing learning by incorporating technology into their lesson plans. For example, some interview results with teachers stated the following:

"I utilize technology according to learning needs. In the Merdeka Curriculum, I use prompts like videos or songs to capture students' attention." (R5)

"I carefully plan the use of technology in learning through lesson plans, including selecting prompt videos and student worksheets." (R2)

Additionally, an interview with one of the teachers stated:

"I plan my lessons using technology, considering learning objectives, student abilities, and the availability of technological devices." (R6)

From the interview results, it is known that teachers have utilized technology in lesson planning. Furthermore, in the practice of lesson planning, some teachers design lessons conventionally first, then incorporate technological elements in parts where they believe it can strengthen material delivery or increase student participation. This strategy reflects teachers' selective approach to utilizing technology. This aligns with R4's opinion as follows:

"I usually design the learning traditionally first, without directly involving technology. After that, I reviewed which parts were less effective or could be improved, and then I incorporated technology into those areas.

So, technology is used functionally to strengthen the learning process, not just as a supplement."

Other teachers consistently incorporate technology into their teaching modules as part of an initial spark or exploration medium, such as educational videos, interactive images, online quiz applications, and digital projects.

The learning plan portfolio of one teacher, where the teacher integrates technology into their lesson plans, is shown in figure 1.

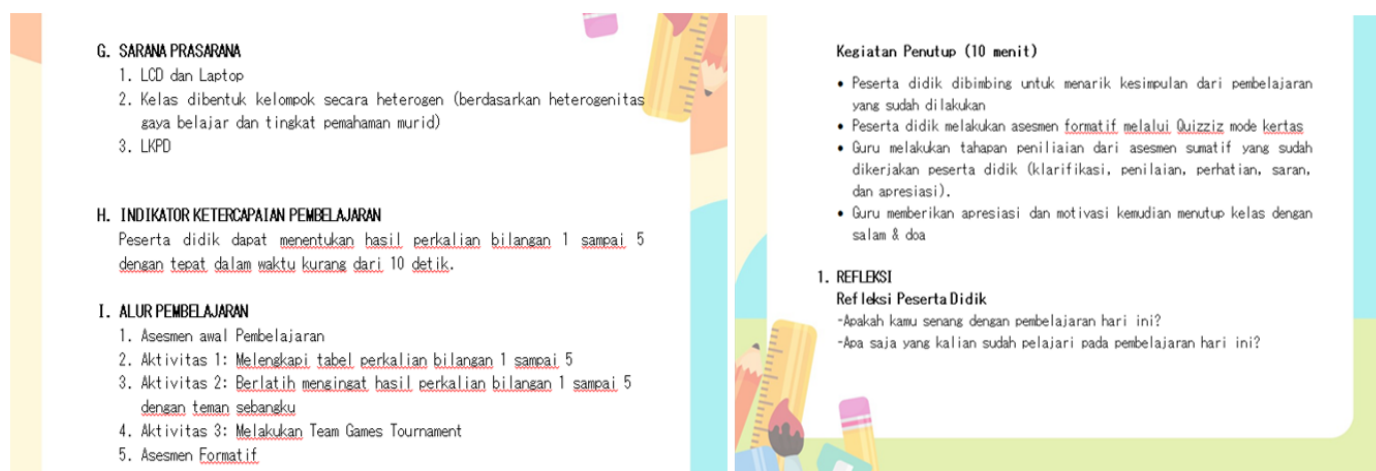


Figure 1. The use of technology in teachers' lesson plans
Source: Teacher documentation.

Figure 1 shows that teachers plan their lessons using learning facilities and infrastructure, including technological devices such as LCDs and laptops. Additionally, in the closing activity plan, teachers use the Quiz application with paper mode as the final assessment for the lesson. This certainly proves that in planning lessons, teachers are able to integrate and utilize technology as a form of technological readiness. The teacher's technological readiness will certainly be more optimal if supported by various trainings, whether provided by the school or if the teacher personally continues to learn to explore new technologies. The teacher stated that:

"Our school regularly holds training sessions. In a year, we are required to attend at least two training sessions related to learning technology. For example, a while ago there was a workshop on using gamification in the classroom. That really helps us make learning more engaging. But it is not just from school, we teachers also take the initiative to keep learning on our own. Nowadays, many people are starting to explore the latest technologies, including AI. I myself have started trying out some AI tools to help create learning materials and evaluations. In my opinion, teachers need to keep up with the times. Because our children's world is also changing. If we do not participate in learning, we will fall behind," (R1).

Based on these results, the teacher stated that the school regularly facilitates training to equip them with technological readiness. Within one year, teachers are required to attend a minimum of 2 training sessions related to technology-assisted classroom learning. For example, the school holds training or workshops on using gamification in learning.

Teachers' Technological Readiness in Learning Implementation

In the implementation of learning, teachers show a wide range of variation in their use of technology. Some teachers have been able to utilize technological devices such as laptops, projectors, speakers, Wi-Fi, and even the chromebooks provided by the school. This indicates that the teacher's technological readiness indicator from the aspect of equipment capability is met. Based on the interview results, the teacher stated:

"The equipment in my classroom is quite complete, so I can show videos directly, use online quizzes, and students can also access Canva and Google Docs from their Chromebooks" (R5).

The interview results with the teacher show that the teacher is technologically prepared, as evidenced by their ability to use the technological equipment available in the classroom. Additionally, teachers also have the ability to operate, troubleshoot, and demonstrate their technological readiness in the classroom. This is consistent with the following teacher statements:

"If there are obstacles like the projector not turning on or network problems, I am used to solving them myself." (R6)

"Usually, if the Wi-Fi connection in the class is slow or the projector suddenly turns off, I immediately look for a solution myself. Sometimes I switch to a personal hotspot." (R7)



Figure 2. Teachers' use of technology in teaching and learning

Figure 2 shows how technology is used by teachers in the implementation of teaching and learning. The teacher uses a laptop and LCD projector to deliver learning materials to students in the classroom. It can also be seen in the image that one of the teachers has utilized devices such as speakers and microphones in the classroom, which can accommodate the students. In the observation, the teachers also demonstrated that they have good skills in operating technology.

Next, as an example of technology use in learning, it has been realized through various forms, such as creating assignments using Canva for students, utilizing online quiz applications (Quiziz, Liveworksheet), creating digital content by students (educational videos, learning vlogs), and independent exploration sessions using school chromebooks. The utilization of teacher technology is realized through project-based and exploratory learning. Teachers are not only using technology for presentations, but also as a medium to encourage students' creative thinking abilities. This aligns with the following teacher statements:

"In the digital science class, students not only learn through material presentations but also actively create learning materials in engaging formats such as mindmaps, posters, and creative presentations using Canva. Additionally, they also learn coding and other digital skills to express ideas more exploratively and creatively." R4

Another teacher stated that:

"I utilize devices such as computers, projectors, and online learning applications. This technology is very helpful for students to explore their ideas interactively and develop creative thinking skills, for example, through group project assignments." R1

These teacher statements indicate that technology not only serves as a presentation aid but also as a medium to encourage collaborative and project-based learning. One of the teachers observed had also taught the students about coding. Utilizing coding with technology, as

represented in the coding sheet shown in the following image:

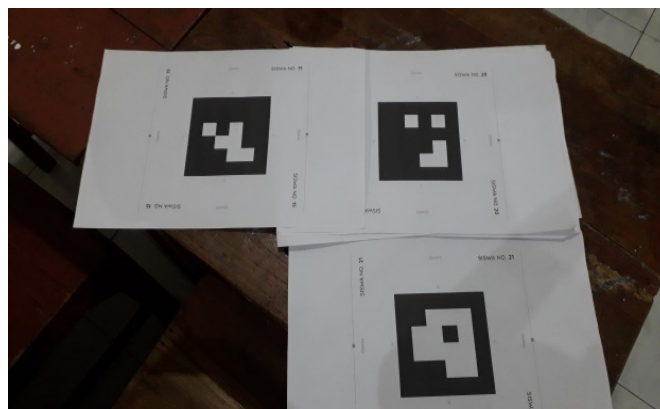


Figure 3. Coding Sheet Used by Students



Figure 4. Teacher scanning student codes to answer Quiziz

Figures 3 and 4 show that the use of technology in elementary schools is already integrated with the use of coding, which is important in the current era. In this study, good teacher technology readiness was proven capable of directing student creativity. Student products include creating video tutorials, conducting field interviews, or designing digital posters based on specific topics. This can be proven by the following student work:

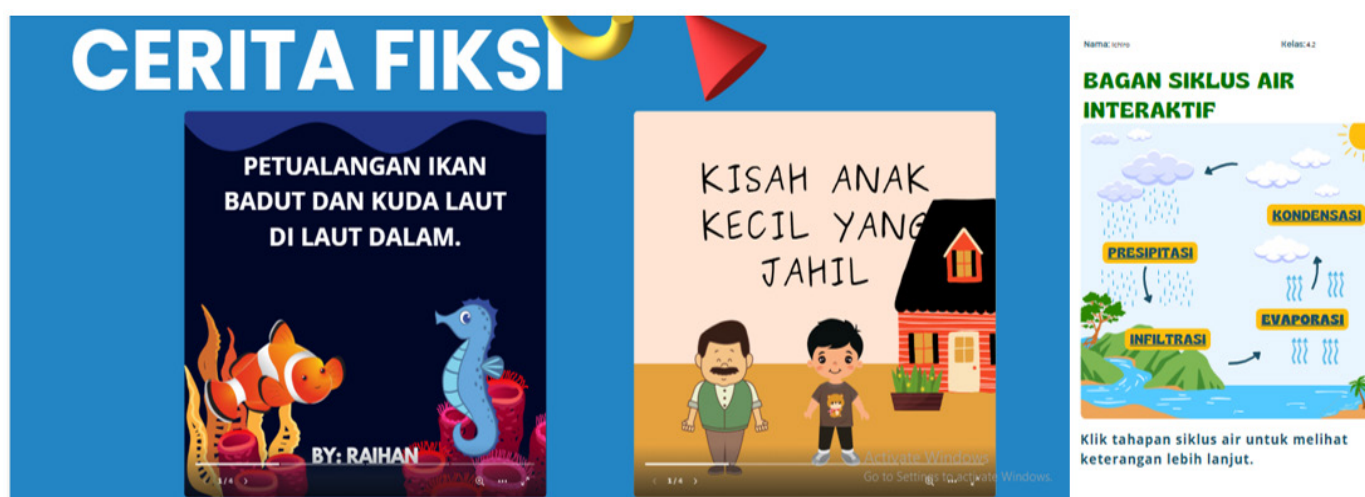


Figure 5. Student Work
Source: Teacher documentation.

Figure 5 shows some of the students' work, where the teacher provided technology-assisted learning that stimulated the students to create creatively. This indicates that teachers already possess basic competencies

in facilitating technology-based classrooms with creative and collaborative approaches. The teacher stated:

“I used to only ask students to make videos of themselves reading poetry, but it turned out they edited the videos using apps like Capcut and Kinemaster. Children can be creative in their own way, and the results are even more interesting because they are developed independently.” (R2)

Overall, student creativity can flourish because teachers provide space for exploration, supported by the teachers’ technological readiness. Therefore, technological readiness is important so that it can facilitate students’ creative thinking abilities, which are increasingly needed in the current era. Students with creative thinking abilities will be able to generate new ideas and find solutions relevant to real life effectively and efficiently.

Teachers’ Technological Readiness in Learning Evaluation

Teachers’ technological readiness in learning evaluation is reflected in their ability to select, operate, and adapt various digital platforms as tools to measure learning achievement. Highly prepared teachers not only understand the basic functions of technology but are also able to integrate it into the assessment process, which includes cognitive, affective, and skills aspects. Some teachers utilize digital media such as Google Forms, Canva, and online rubrics to collect data on students’ learning processes and outcomes. The use of these tools demonstrates that the teacher not only understands the technology but is also able to use it strategically to evaluate students’ creativity, participation, and development of digital skills. This aligns with the following teacher interview results:

“One form of evaluation I see is from their artwork. For example, when the children explore Canva, I can assess how well they can creatively use its features to produce something good and useful. Additionally, I also conducted direct observations of both the process and the results. Sometimes I also ask them what obstacles they face when using technology.” (R4)

This quote indicates that the teacher has mastered the use of digital applications as part of performance-based assessment, and also possesses pedagogical awareness to assess students’ technology usage processes and obstacles. In addition to product-based assessment, teachers also utilize digital data to continuously record and analyze student progress. Evaluation is conducted by monitoring participation in the digital space, online assignment submission, and student feedback on technology use. This is evidenced by the following interview:

“I evaluate the use of technology by monitoring student progress, analyzing assessment results, and seeking feedback from them. The methods I use include project assessment, group assignments, and performance.” (R3)

This indicates that teachers’ technological readiness is not only technical but also encompasses reflective and analytical abilities in using digital data for learning improvement.

On the other hand, teacher readiness is also evident in how they differentiate task results based on the method of completion, such as using technology or manual methods, and in creating appropriate assessment rubrics. This is consistent with the following interview results:

“The evaluation is based on the results and the process. There are children who are truly proficient in technology, and there are also those who are less motivated to learn together. That all affects the final result. For example, for the poster-making assignment, I differentiate the grades between those made manually and those using Canva, which are usually more interesting and have more value.” (R1)

Evaluation not only assesses the final product, but also student engagement, creativity, and the development of their digital skills. If technology was used as a tool during the planning and implementation stages, then during evaluation, teachers began to position technology as a means of assessing students’ creative thinking and active participation. The use of digital media such as Google Forms, Canva, and rubrics for assessing student work reflects the teacher’s readiness to measure affective and cognitive aspects holistically.

DISCUSSION

Teachers’ Technological Readiness in Planning a Lesson

Based on the results, teachers demonstrated technological readiness in planning, as evidenced by the integration of digital devices and applications into lesson plans, such as videos, songs, Quiziz, and interactive worksheets. Some teachers designed conventional lessons first and then selectively added technology to enhance the delivery of the material. Developing a planning for learning with technology involves understanding about interaction between strategy, learning, and technology integration.⁽³⁷⁾ Teachers’ technological readiness in lesson planning can be seen from mature planning and the use of digital applications in learning.⁽¹⁸⁾ Teachers’ technological readiness is not merely technical; it reflects a deep understanding of innovative instructional strategies.⁽³⁸⁾

The teacher develops a lesson plan considering the alignment between learning objectives, student characteristics, and the potential of technology that can be used. Every component in lesson planning is interconnected and mutually influential.⁽³⁹⁾ Setting learning objectives that are too high without adjusting to students’ abilities can lead to ineffective learning. Meanwhile, the undirected use of technology can actually

disrupt learning focus.⁽⁴⁰⁾ Therefore, there needs to be a connection between the components of learning planning before technology is incorporated to make learning more engaging.⁽⁴¹⁾ Aligning TPACK with real-world learning experiences and strategies can be used to determine appropriate technologies that can effectively support student learning.⁽⁴²⁾ Teachers need to not just follow trends but genuinely select learning segments that require enhanced interaction or visualization to make the material easier for students to understand.⁽⁴³⁾

Integration with digital technology not only enriches students' learning experiences but also helps build engagement from the beginning of the learning process.⁽⁴⁴⁾ Teachers who are adaptable in adjusting their teaching to digital developments will demonstrate good motivation as an indicator of technological readiness in planning lessons.^(18,45) Teachers' technology readiness such as optimism and innovativeness, can influence their adoption of technology and its perceived usefulness in enhancing teaching quality.^(46,47) Teacher technological readiness is very important for integrating technology into lesson planning.^(15,48) Teachers' technological readiness is evident in their routine use of digital learning applications in the classroom.⁽⁴⁹⁾ The ability to integrate technology shows that teachers not only know technology, but also understand its appropriate context of use in learning scenarios.⁽⁵⁰⁾

Technological readiness is also supported by regular training from schools and teacher initiatives to learn new technologies, including the use of AI. Effective teacher training programs are important for technology to be used well in schools. If planned from the outset, technology can be a tool for exploration and assessment.⁽⁵¹⁾ Training equips teachers with the skills to understand and effectively apply technology, thus supporting their readiness for classroom learning.⁽⁵²⁾ It does not stop there; the teacher also revealed that teachers often explore the latest technologies themselves, such as the use of AI, which can be utilized in learning. This reflects the presence of intrinsic motivation and a willingness to learn independently, which are important indicators of teachers' technological readiness in the digital age.⁽⁵³⁾ Teachers who have received more training tend to be more confident and creative in their teaching practice.^(54,55)

Teachers' Technological Readiness in Learning Implementation

In implementation, teachers' technological readiness is demonstrated by their ability to utilize various devices (laptops, LCDs, Chromebooks, speakers) and digital applications (Canva, Google Docs, Quiziz, Liveworksheet). Technology readiness has four aspects, including equipment capability, technology readiness skill, self-directed learning, and motivation.⁽⁵⁶⁾ Technological capabilities are crucial for the efficient management of resources.⁽⁵⁷⁾ Equipment capability plays a key role in technology use. Newer devices support effective implementation, while outdated ones can limit it.⁽⁵⁸⁾ The process of self-direct learning contributes to the use of internet communication technology in collaborative learning.⁽⁵⁹⁾ Motivation is a process in which activities that are directed to goals and are maintained and reflected in personal investment, cognitive, emotional and behavioral involvement in the learning activities.⁽⁶⁰⁾

Teachers use technology not only as a presentation medium but also as a means of exploration, collaboration, and project-based learning. The availability of adequate technological devices can create more interactive learning.^(61,62) Additionally, the completeness of digital infrastructure in learning serves as the main foundation for creating meaningful learning.⁽⁶³⁾ Technological readiness is an important foundation for creating an effective digital learning ecosystem,⁽⁶⁴⁾ because without mastering technology, the potential of digital tools cannot be optimized in the learning process.⁽⁶⁵⁾ Teacher technological readiness significantly influences the success of technology integration in schools.⁽⁶⁶⁾

Teachers' technology readiness can foster student creativity, such as creating videos, digital posters, learning vlogs, and coding. The use of technology as a tool of production indicates a shift in the learning paradigm from teacher-centered to student-centered, where students become active subjects in constructing knowledge.⁽⁶⁷⁾ Technology is not just a visual aid, but a medium for student exploration and creativity.⁽⁶⁸⁾ Coding education not only improves students' digital literacy but also encourages critical thinking and creative problem-solving.⁽⁶⁹⁾ Project-based learning with a technological approach also allows students to actively engage in the learning process.⁽⁷⁰⁾

Students' creativity can be enhanced when teachers facilitate technology-assisted learning.⁽⁶⁸⁾ Reflective practices in digital teaching involve evaluating the effectiveness of digital tools and methodologies.⁽⁷¹⁾ Teachers who are accustomed to evaluating digital products such as online posters, presentation videos, and platform-based quizzes show a higher level of readiness compared to teachers who only transfer traditional evaluation formats to digital form. Additionally, Bećirović⁽⁷²⁾ found that teachers with high digital competence are able to utilize technology for real-time formative assessment through platforms such as Google Forms, Padlet, and similar tools.⁽⁷²⁾ This reinforces that teachers' technological readiness in learning evaluation is not only technical but also encompasses pedagogical, reflective, and integrative aspects, enabling teachers to assess the learning process more comprehensively and meaningfully.

Teachers' Technology Readiness in Learning Evaluation

Teachers' technological readiness in learning evaluation is demonstrated by their ability to use digital

platforms (Google Forms, Canva, online rubrics) to assess students' cognitive, affective, and skill aspects. Teachers' technological readiness not only affects instructional effectiveness but also improves the quality of feedback and student engagement.⁽⁷³⁾ Teachers who are technologically prepared can lead more effective instructional practices.⁽⁷⁴⁾ Participation in professional development courses focused on technology, pedagogy, and instructional design significantly improves course design and instructional effectiveness.⁽⁷⁵⁾

Furthermore, flexible and creative evaluations like this reflect the teacher's competence in adapting assessments to the needs and characteristics of the students.⁽⁷⁶⁾ Evaluations focus not only on the final outcome but also on the process, creativity, participation, and challenges students face in using technology. Evaluations often consider the entire learning process.⁽⁷⁷⁾ Evaluations in creative technologies education, for instance, assess both the process and the final product, using methods like portfolios and adaptive comparative judgment.^(78,79)

Teachers also differentiate assessments based on task completion methods (manual or digital), reflecting analytical and reflective readiness to utilize digital data to improve learning. Study showed that digital technologies such as game-based environments, ePortfolios, and automated marking systems diversify assessment modes, allowing teachers to collect varied evidence of learning and improve assessment efficiency.⁽⁸⁰⁾ Teachers not only assess what students achieve, but also pay attention to how the learning process supports the development of independence, collaboration, and learning responsibility. Technology not only facilitates understanding of the material but also encourages students to express ideas, elaborate on concepts, and create more complex and original products.⁽⁸¹⁾ Effective use of digital media in teaching requires teachers to have strong digital competencies, which can be developed through targeted training and support.^(82,83)

Limitation of Study

The study is significant for enhancing teaching effectiveness and student learning experiences by strengthening teachers' readiness in using technology, particularly in the context of elementary education. This research provides an important contribution to understanding teachers' technological readiness in lesson planning, implementation, and evaluation. However, several limitations should be acknowledged. First, the study involved a limited number of teachers from selected elementary schools, which may restrict the generalizability of the findings to broader educational contexts. Furthermore, the study focused on qualitative exploration without incorporating quantitative measures of teachers' technological readiness. The integration of standardized instruments or large-scale surveys in future studies could strengthen data triangulation and improve the reliability of the findings. Despite these limitations, this study offers valuable empirical contributions to the discourse on technology integration in elementary education. The findings also provide practical implications for the development of teacher training programs and educational policies aimed at enhancing teachers' technological readiness in the digital era.

CONCLUSIONS

This study reveals that teachers have demonstrated a high level of technological readiness across the three main aspects of classroom management: planning, implementation, and evaluation. In the planning phase, teachers do not merely include technology as a supplementary tool but design instructional strategies by considering the alignment between learning objectives, student characteristics, and the potential of technology. During implementation, teachers have utilized various devices and applications to create interactive learning experiences and foster student creativity, as seen in the use of media such as Canva, Quizizz, and basic coding activities. In the evaluation phase, teachers effectively integrate technology for project-based assessments, digital observation, and reflective analysis of student learning processes. This readiness is supported by regular training as well as teachers' intrinsic motivation and initiative to explore emerging technologies like AI, indicating that technological readiness goes beyond technical skills and reflects strong digital pedagogical literacy. Teachers' technological readiness significantly contributes to enhancing the quality of creative, collaborative, and 21st century relevant learning. However, this study does not delve deeply into the specific challenges faced by teachers in areas with limited technological infrastructure. Expanding access to practical and contextual technology training, along with providing equitable infrastructure, is recommended to support teachers' technological readiness in delivering digital-based learning across all educational levels and regions.

REFERENCES

1. La Velle L. Translational research and knowledge mobilisation in teacher education: towards a 'clinical', evidence-based profession? *J Educ Teach*. 2015;41(5):460-3. Available from: <http://www.tandfonline.com/doi/full/10.1080/02607476.2015.1105534>
2. Sunthonkanokpong W, Murphy E. Quality, equity, inclusion and lifelong learning in pre-service teacher education. *J Teach Educ Sustain*. 2019;21(2):91-104. Available from: <https://www.sciendo.com/article/10.2478/jtes-2019-0019>

3. Islam ME, Hasan Polas MR, Jahanshahi AA, Falahat M. Valuing teachers' voices in educational reform. In: Institutes of Higher Education (IHE) and Workforce Collaboration for Digital Literacy. Hershey (PA): IGI Global; 2025. p.153-80. Available from: <https://services.igi-global.com/resolvedoi/resolve.aspx?doi=10.4018/979-8-3373-0004-7.ch006>
4. Tatto MT. Comparative research on teachers and teacher education: global perspectives to inform UNESCO's SDG 4 agenda. *Oxford Rev Educ.* 2021;47(1):25-44. Available from: <https://www.tandfonline.com/doi/full/10.1080/03054985.2020.1842183>
5. United Nations. The Sustainable Development Goals Report. New York: United Nations; 2024. Available from: <https://unstats.un.org/sdgs/report/2021/#>
6. Othman LB, Robinson R, Molfenter NF. Emerging issues with consequential use of the edTPA: overall and through a special education lens. *Teach Educ Spec Educ.* 2017;40(4):269-77. Available from: <https://journals.sagepub.com/doi/10.1177/0888406417718251>
7. Ditjen GTK. Tentang Model Kompetensi Guru. Jakarta: Ditjen GTK; 2023. 14 p.
8. Kaynardağ AY. Pedagogy in HE: does it matter? *Stud High Educ.* 2019;44(1):111-9. Available from: <https://www.tandfonline.com/doi/full/10.1080/03075079.2017.1340444>
9. Kali Y, Sagy O, Benichou M, Atias O, Levin-Peled R. Teaching expertise reconsidered: the Technology, Pedagogy, Content and Space (TPeCS) knowledge framework. *Br J Educ Technol.* 2019;50(5):2162-77. Available from: <https://bera-journals.onlinelibrary.wiley.com/doi/10.1111/bjet.12847>
10. Liu D, Chaemchoy S, Siribanpitak P. Unlocking teacherpreneur potential in higher education: validating a competency measurement scale. *Educ Sci.* 2024;14(9):1005. doi:10.3390/educsci14091005
11. Angers K, Gu P, Lasagna CA, McLaughlin MM, Taylor SF, Tso IF, et al. The relationship of neurocognitive and social cognitive performance to social competence and appropriateness on a performance-based social skills assessment in individuals with psychosis and unaffected controls. *J Psychiatr Res.* 2024;179:15-20. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0022395624005077>
12. Carstensen B, Klusmann U. Assertiveness and adaptation: prospective teachers' social competence development and its significance for occupational well-being. *Br J Educ Psychol.* 2021;91(1):500-26. Available from: <https://bpspsychub.onlinelibrary.wiley.com/doi/10.1111/bjep.12377>
13. Hammer S, Ufer S. Professional competence of mathematics teachers in dealing with tasks in lesson planning. *Teach Teach Educ.* 2023;132:104246. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0742051X23002342>
14. Alieto E, Abequibel-Encarnacion B, Estigoy E, Balasa K, Eijansantos A, Torres-Toukoumidis A. Teaching inside a digital classroom: a quantitative analysis of attitude, technological competence and access among teachers across subject disciplines. *Heliyon.* 2024;10(2):e24282. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S240584402400313X>
15. Howorth SK, Marino MT, Flanagan S, Cuba MJ, Lemke C. Integrating emerging technologies to enhance special education teacher preparation. *J Res Innov Teach Learn.* 2024. Available from: <https://www.emerald.com/insight/content/doi/10.1108/JRIT-08-2024-0208/full/html>
16. Consoli T, Schmitz M-L, Antonietti C, Gonon P, Cattaneo A, Petko D. Quality of technology integration matters: positive associations with students' behavioral engagement and digital competencies for learning. *Educ Inf Technol.* 2024. Available from: <https://link.springer.com/10.1007/s10639-024-13118-8>
17. Mao Q, Fang X, Jiang L, Zhu L. Enhancement or impediment? How university teachers' use of smart classrooms might impact interaction quality. *Sustainability.* 2023;15(22):15826. Available from: <https://www.mdpi.com/2071-1050/15/22/15826>

18. Kamahina RS, Yakovenko TV, Daibova EV. Teacher's readiness to work under the conditions of educational space digitalization. *Int J High Educ.* 2019;8(7):79-86. Available from: <http://www.sciedu.ca/journal/index.php/ijhe/article/view/16547>
19. Jiang L. Digital technology boosts the construction of English smart classroom in colleges and universities. *Appl Math Nonlinear Sci.* 2024;9(1). Available from: <https://www.sciendo.com/article/10.2478/amns-2024-0658>
20. Rawal DM. Mapping of school teachers' digital competency in the context of digital infrastructure: a systematic review and empirical study of India. *J Prof Cap Community.* 2024;9(3):173-95. Available from: <https://www.emerald.com/insight/content/doi/10.1108/JPCC-01-2024-0016/full/html>
21. Villa G. The InterTICES-type activity (ITA) and its impact on pre-service teacher trainers' e-learning culture. In: *Advances in Intelligent Systems and Computing.* 2018. p.629-37. Available from: http://link.springer.com/10.1007/978-3-319-73210-7_73
22. Saxena A. Issues and impediments faced by Canadian teachers while integrating ICT in pedagogical practice. *Turkish Online J Educ Technol.* 2017;16(2):58-70. Available from: <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85017021912>
23. Mercader C. Explanatory model of barriers to integration of digital technologies in higher education institutions. *Educ Inf Technol.* 2020;25(6):5133-47. Available from: <https://link.springer.com/10.1007/s10639-020-10222-3>
24. Stockwell G, Wang Y. Exploring the challenges of technology in language teaching in the aftermath of the pandemic. *RELC J.* 2023;54(2):474-82. Available from: <https://journals.sagepub.com/doi/10.1177/00336882231168438>
25. Dinçer S. Bridging the gap in technology integration in education: an examination of science teachers' competencies and needs. *J Turkish Sci Educ.* 2024;21(4):620-34. Available from: <https://www.tused.org/index.php/tused/article/view/2312>
26. El-Sayary A. An investigation of teachers' perceptions of using ChatGPT as a supporting tool for teaching and learning in the digital era. *J Comput Assist Learn.* 2024;40(3):931-45. Available from: <https://onlinelibrary.wiley.com/doi/10.1111/jcal.12926>
27. Razukhan N, Zhiyenbayeva A, Konieczna I, Erdenebaatar B, Gursed V. Challenges in teachers' knowledge and use of accessible digital technologies for inclusive learning in Mongolia. *Educ Process Int J.* 2025;15(1). Available from: <https://edupij.com/index/arsiv/76/498/challenges-in-teachers-knowledge-and-use-of-accessible-digital-technologies-for-inclusive-learning-in-mongolia>
28. Özgün Z, Saritepeci M. Determination of the factors affecting teachers' perceptions of classroom management competence in technology-assisted courses. *Technol Pedagog Educ.* 2021;30(5):673-91. Available from: <https://www.tandfonline.com/doi/full/10.1080/1475939X.2021.1956579>
29. Akram H, Abdelrady AH, Al-Adwan AS, Ramzan M. Teachers' perceptions of technology integration in teaching-learning practices: a systematic review. *Front Psychol.* 2022;13:920317. Available from: <https://www.frontiersin.org/articles/10.3389/fpsyg.2022.920317/full>
30. Badri M, Al Rashedi A, Yang G, Mohaidat J, Al Hammadi A, Al Hammad A. Technology readiness of school teachers: an empirical study of measurement and segmentation. *J Inf Technol Educ Res.* 2014;13:257-75. Available from: <https://www.omicsgroup.org/journals/technology-readiness-of-school-teachers-an-empirical-study-of-measurement-and-segmentation-2169-0316.1000117.php>
31. Alghamdi J, Mostafa F, Abubshait A. Exploring technology readiness and practices of kindergarten student-teachers in Saudi Arabia: a mixed-methods study. *Educ Inf Technol.* 2022;27:7851-68.
32. Lazarides R, Watt HMG, Richardson PW. Teachers' classroom management self-efficacy, perceived classroom management and teaching contexts from beginning until mid-career. *Learn Instr.* 2020;69:101346.

Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0959475219302245>

33. Lyons D, Scull J. Critiquing narrative inquiry's epistemological pillars within a large-scale study into the teaching of phonics. *Int J Res Method Educ.* 2024;47(2):114-25.
34. Sevilla-Liu A. The theoretical basis of a functional-descriptive approach to qualitative research in CBS: with a focus on narrative analysis and practice. *J Context Behav Sci.* 2023;30:210-6. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S2212144723001230>
35. Cowger T, Tritz J. Narrative analysis research: a tool for extension educators. *J Ext.* 2019;57(6).
36. Wiles JL, Rosenberg MW, Kearns RA. Narrative analysis as a strategy for understanding interview talk in geographic research. *Area.* 2005;37(1):89-99. Available from: <https://rgs-ibg.onlinelibrary.wiley.com/doi/10.1111/j.1475-4762.2005.00608.x>
37. Hugo J, Callaghan R, Cronje J. A strategy development framework for educational technology: an integrated Design Science Research and Modified Delphi approach. *Electron J e-Learning.* 2024;22(5):60-75. Available from: <https://academic-publishing.org/index.php/ejel/article/view/3568>
38. Prestridge S. Examining the shaping of teachers' pedagogical orientation for the use of technology. *Technol Pedagog Educ.* 2017;26(4):367-81. Available from: <https://www.tandfonline.com/doi/full/10.1080/1475939X.2016.1258369>
39. Garrido A, Onaindia E. Assembling learning objects for personalized learning: an AI planning perspective. *IEEE Intell Syst.* 2013;28(2):64-73. Available from: <http://ieeexplore.ieee.org/document/5749995/>
40. Müller FA, Wulf T. Technology-supported management education: a systematic review of antecedents of learning effectiveness. *Int J Educ Technol High Educ.* 2020;17:47. Available from: <https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-020-00226-x>
41. Boateng SL, Penu OKA, Boateng R, Budu J, Marfo JS, Asamoah P. Educational technologies and elementary level education - a bibliometric review of Scopus indexed journal articles. *Heliyon.* 2024;10(7):e28101. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S240584402404132X>
42. Lee C-J, Kim C. A technological pedagogical content knowledge-based instructional design model: a third version implementation study in a technology integration course. *Educ Technol Res Dev.* 2017;65(6):1627-54. Available from: <http://link.springer.com/10.1007/s11423-017-9544-z>
43. McKenney S, Visscher AJ. Technology for teacher learning and performance. *Technol Pedagog Educ.* 2019;28(2):129-32. Available from: <https://www.tandfonline.com/doi/full/10.1080/1475939X.2019.1600859>
44. Lin H-CK, Lu L-W, Lu R-S. Integrating digital technologies and alternate reality games for sustainable education: enhancing cultural heritage awareness and learning engagement. *Sustainability.* 2024;16(21):9451. Available from: <https://www.mdpi.com/2071-1050/16/21/9451>
45. Reeves TD, Li Z. Teachers' technological readiness for online professional development: evidence from the US e-Learning for Educators initiative. *J Educ Teach.* 2012;38(4):389-406. Available from: <https://www.tandfonline.com/doi/full/10.1080/02607476.2012.707921>
46. Ayyash MM, Alkhateeb MAA, Abdalla RAM. Smartphone-based learning and academic performance in higher education institutions: extending task-technology-fit with technology readiness constructs. *Int J Innov Learn.* 2024;36(2):131-55. Available from: <http://www.inderscience.com/link.php?id=140260>
47. Setati PP, Paledi VN. Conceptualised framework for assessing teachers' e-learning readiness in South African rural schools. In: 2019 Open Innovations (OI). IEEE; 2019. p.320-30. Available from: <https://ieeexplore.ieee.org/document/8908204/>
48. Vatanartiran S, Karadeniz S. A needs analysis for technology integration plan: challenges and needs of teachers. *Contemp Educ Technol.* 2015;6(3). Available from: <https://www.cedtech.net/article/a-needs->

analysis-for-technology-integration-plan-challenges-and-needs-of-teachers-6150

49. Marmoah S, Supianto, Sukmawati F, Poerwanti JIS, Yantoro. The elementary school teachers adoption of learning management system: a UTAUT model analysis. *Ing des Syst d'Information*. 2024;29(2):715-22.

50. Ifinedo E, Kankaanranta M. Understanding the influence of context in technology integration from teacher educators' perspective. *Technol Pedagog Educ*. 2021;30(2):201-15. Available from: <https://www.tandfonline.com/doi/full/10.1080/1475939X.2020.1867231>

51. Ley T, Tammets K, Sarmiento-Márquez EM, Leoste J, Hallik M, Poom-Valickis K. Adopting technology in schools: modelling, measuring and supporting knowledge appropriation. *Eur J Teach Educ*. 2022;45(4):548-71. Available from: <https://www.tandfonline.com/doi/full/10.1080/02619768.2021.1937113>

52. Love ML, Simpson LA, Golloher A, Gadus B, Dorwin J. Professional development to increase teacher capacity for the use of new technologies. *Interv Sch Clin*. 2020;56(2):115-8. Available from: <https://journals.sagepub.com/doi/10.1177/1053451220914886>

53. Salikhova NR, Lynch MF, Salikhova AB. Psychological aspects of digital learning: a self-determination theory perspective. *Contemp Educ Technol*. 2020;12(2):ep280. Available from: <https://www.cedtech.net/article/psychological-aspects-of-digital-learning-a-self-determination-theory-perspective-8584>

54. Hepp K-P, Prats Fernández MÀ, Holgado García J. Teacher training: technology helping to develop an innovative and reflective professional profile. *RUSC Univ Knowl Soc J*. 2015;12(2):30-43. Available from: <http://rusc.uoc.edu/rusc/ca/index.php/rusc/article/view/v12n2-hepp-prats-holgado.html>

55. El-Sayary A. The impact of a professional upskilling training programme on developing teachers' digital competence. *J Comput Assist Learn*. 2023;39(4):1154-66. Available from: <https://onlinelibrary.wiley.com/doi/10.1111/jcal.12788>

56. Gestardi R, Sarwanto S, Chumdari C, Maryani I. Using a technology readiness model to understand perceived usefulness of learning in the COVID-19 era. *Int J Elem Educ*. 2021;5(4):631-8.

57. Molina RIR, Amaris RRA, Palencia DAB, Raby NDL, Barraza LL. Support systems and technological capabilities in digital transformation according to the nature of the company. In: *Communications in Computer and Information Science*. 2023. p.202-14. Available from: https://link.springer.com/10.1007/978-3-031-28180-8_14

58. Herterich MM, Uebernickel F, Brenner W. Empowering technical customer service by cyber-physical industrial equipment: exploring rationales, opportunities, and impediments. In: *Pacific Asia Conference on Information Systems (PACIS) 2015 Proceedings*. 2015. Available from: <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85011031743>

59. Gestardi R. Pengaruh self-efficacy dan collaboration skill terhadap technology readiness mahasiswa pendidikan guru sekolah dasar di Yogyakarta [tesis]. Surakarta: Universitas Sebelas Maret; 2022.

60. Arvesu HA. Technology readiness on students' behavior and engagement. *Int J Res Publ*. 2023;123(1):539-52.

61. Asad MM, Hussain N, Wadho M, Khand ZH, Churi PP. Integration of e-learning technologies for interactive teaching and learning process: an empirical study on higher education institutes of Pakistan. *J Appl Res High Educ*. 2021;13(3):649-63. Available from: <http://www.emerald.com/jarhe/article/13/3/649-663/193614>

62. El-Sayary A. Using interactive technology to enable interactive e-learning environment. In: *Overcoming Challenges in Online Learning*. London: Routledge; 2023. p.145-50. Available from: <https://www.taylorfrancis.com/books/9781003342335/chapters/10.4324/9781003342335-17>

63. Shadiev R, Reynolds BL, Li R. The use of digital technology for sustainable teaching and learning. *Sustainability*. 2024;16(13):5353. Available from: <https://www.mdpi.com/2071-1050/16/13/5353>

64. Huang Y. The role of digital readiness and innovative teaching methods in music art e-learning students' satisfaction with entrepreneur psychological capital as a mediator: evidence from music entrepreneur training institutes. *Front Psychol.* 2022;13:979628. Available from: <https://www.frontiersin.org/articles/10.3389/fpsyg.2022.979628/full>
65. Kallas K, Pedaste M. How to improve the digital competence for e-learning? *Appl Sci.* 2022;12(13):6582. Available from: <https://www.mdpi.com/2076-3417/12/13/6582>
66. Petko D, Prasse D, Cantieni A. The interplay of school readiness and teacher readiness for educational technology integration: a structural equation model. *Comput Sch.* 2018;35(1):1-18. doi:10.1080/07380569.2018.1428007
67. Mubarak S, Wibowo S, Rahamathulla M, Yang R, Schönert S. Blending emerging technologies for student-centred teaching. In: *Digital Transformation and Disruption of Higher Education*. Cambridge: Cambridge University Press; 2022. p.102-19. Available from: https://www.cambridge.org/core/product/identifier/9781108979146%23CN-bp-9/type/book_part
68. Tang C, Mao S, Naumann SE, Xing Z. Improving student creativity through digital technology products: a literature review. *Think Skills Creat.* 2022;44:101032. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1871187122000359>
69. Videnovik M, Vlahu-Gjorgievska E, Trajkovik V. To code or not to code: introducing coding in primary schools. *Comput Appl Eng Educ.* 2021;29(5):1132-45. Available from: <https://onlinelibrary.wiley.com/doi/10.1002/cae.22369>
70. Al-Qora'n LF, Jawarneh A, Nganji JT. Toward creating software architects using mobile project-based learning model (Mobile-PBL) for teaching software architecture. *Multimodal Technol Interact.* 2023;7(3):31. Available from: <https://www.mdpi.com/2414-4088/7/3/31>
71. Lin R, Yang J, Jiang F, Li J. Does teachers' data literacy and digital teaching competence influence empowering students in the classroom? Evidence from China. *Educ Inf Technol.* 2023;28(3):2845-67. Available from: <https://link.springer.com/10.1007/s10639-022-11274-3>
72. Bećirović S. Digital competence of teachers and students. In: *Digital Pedagogy*. Singapore: Springer; 2023. p.39-50. Available from: https://link.springer.com/10.1007/978-981-99-0444-0_4
73. Joseph GV, Thomas KA, Nero A. Impact of technology readiness and techno-stress on teacher engagement in higher secondary schools. *Digit Educ Rev.* 2021;(40):51-65. Available from: <https://revistes.ub.edu/index.php/der/article/view/32271>
74. Matalaka MA, Ayasrah FTM, Jarrah HY, Jawarneh M, Alkhawaldeh BY, Darawsheh SR, et al. The importance of effective learning technology utilization, teacher leadership, student engagement, and curriculum in the online learning environment. *Int J Data Netw Sci.* 2024;8(3):1727-40. Available from: http://www.growingscience.com/ijds/Vol8/ijdns_2024_38.pdf
75. Slijepcevic N, Huang W. Evaluating the impact of online course development and teaching certificate academy on university faculty teaching practices through student learning experiences and faculty perceptions. *Internet High Educ.* 2025;67:101020. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1096751625000296>
76. Mohamadi Z, Malekshahi N. Designing and validating a potential formative evaluation inventory for teacher competences. *Lang Test Asia.* 2018;8(1):6. Available from: <https://languagetestingasia.springeropen.com/articles/10.1186/s40468-018-0059-2>
77. Panke S. Evaluating blended learning: instructional design case studies. In: *Case Studies on Blended Learning in Higher Education: Policy, Planning and Quality Assurance*. Singapore: Springer Nature Singapore; 2024. p.223-44. Available from: https://link.springer.com/10.1007/978-981-97-9388-4_13
78. Ashcroft E, Gill L, Campbell C. Assessment in creative technologies education. In: *Creative Technologies Education*. London: Routledge; 2025. p.223-38. Available from: <https://www.taylorfrancis.com/>

books/9781003490715/chapters/10.4324/9781003490715-15

79. Aquije-Mansilla ME, Ríos TCDL, Solís-Trujillo BP, Pérez-Ruiz JC. Teaching strategies and development of creativity in education. *Edelweiss Appl Sci Technol*. 2025;9(2):1273-82. Available from: <https://learning-gate.com/index.php/2576-8484/article/view/4749>

80. Blundell CN. Teacher use of digital technologies for school-based assessment: a scoping review. *Assess Educ*. 2021;28(3):279-300. Available from: <https://www.tandfonline.com/doi/full/10.1080/0969594X.2021.1929828>

81. Zaremohzzabieh Z, Ahrari S, Abdullah H, Abdullah R, Moosivand M. Effects of educational technology intervention on creative thinking in educational settings: a meta-analysis. *Interact Technol Smart Educ*. 2024;22(2):235-65. Available from: <https://www.emerald.com/insight/content/doi/10.1108/ITSE-11-2023-0224/full/html>

82. Papak PP, Mezak J. Attitudes of students, future teachers, to the importance of using media in teaching. In: 2021 44th International Convention on Information, Communication and Electronic Technology (MIPRO). IEEE; 2021. p.636-40. Available from: <https://ieeexplore.ieee.org/document/9596854/>

83. Henning-Kahmann J, Hellmann K. Entwicklung und Überprüfung eines Fragebogens zur Erfassung studentischer Bedarfe an medienbezogenen Lehrkompetenzen im Lehramtsstudium. *Z Pädagog Psychol*. 2025;39(1-2):81-94. Available from: <https://econtent.hogrefe.com/doi/10.1024/1010-0652/a000358>

FINANCING

The authors received financial support from The Ministry of Education, Culture, Research, and Technology grant number 1186.1/UN27.22/PT.01.03/2025.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORSHIP CONTRIBUTION

Conceptualization: Ratna Widya Irmayanti, Sri Marmoah.

Data curation: Mohamed Nor Azhari Azman.

Formal analysis: Sri Marmoah, Karsono.

Research: Ratna Widya Irmayanti.

Methodology: Ratna Widya Irmayanti, Sri Marmoah, Mohamed Nor Azhari Azman, Karsono.

Project management: Sri Marmoah.

Resources: Ratna Widya Irmayanti.

Software: Ratna Widya Irmayanti, Mohamed Nor Azhari Azman.

Supervision: Sri Marmoah, Mohamed Nor Azhari Azman.

Validation: Karsono.

Display: Ratna Widya Irmayanti.

Drafting - original draft: Ratna Widya Irmayanti, Sri Marmoah.

Writing - proofreading and editing: Mohamed Nor Azhari Azman.