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The pedagogical competence of teachers in enhancing student creativity based on information technology

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Abstract

This research aimed to understand how teachers' teaching skills can help students improve their creativity by utilizing information technology at one elementary school. The method applied was qualitative, with a case study approach that emphasized teachers in the classroom as the primary focus. Data were collected through interviews, observations, and documentation, then analyzed using qualitative descriptive methods. This research indicates that teachers with practical teaching skills can utilize various digital applications and media in the classroom to encourage students' creativity. Students' creativity increases, as seen by their ability to express ideas, create digital works, and complete school assignments differently. These findings prove that using information technology in learning by pedagogically skilled teachers positively influences the development of students' creativity. This research recommends that teachers improve their pedagogical skills, especially in technological literacy, to improve the quality of the learning process and students' creativity.

Keywords
Pedagogic competence, student creativity, technology information, elementary school

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Introduction

Advances in information and communication technology have brought about significant changes in the world of education. Today's digital age concentrates on enhancing creativity and technological efficiency through teaching aids (Collins & Halverson, 2018; Friedman & Deek, 2004; Starkey, 2012). Teachers are crucial in incorporating technology into the learning process to help develop children's creativity early on. A teacher's quality is one of the most important things they must have to do their job. This aspect involves the teacher's ability to design, implement, and assess the learning process based on students' abilities. Information technology finds its application in various fields, including education, in Indonesia. Sugandi and Kurniawan (2018) showed that information technology significantly influences the quality and effectiveness of Indonesia's teaching and learning process. Learning technology can support better communication between teachers and students, improve learning aids, and promote access to high-quality learning materials. In addition, lecturers can utilize information technology to improve and expand their teaching in this area. In addition, Ongus and Nyamboga (2019) discussed how information technology can help improve the efficiency and effectiveness of data collection and provide more sophisticated research alternatives. The modern teaching process combines digital technology to improve the quality and services of education. Thus, achieving learning objectives becomes easier. Learning objectives are designed to be advantageous, engaging, and not boring for students (Lin et al., 2017; Moss & Brookhart, 2012; Senjahari et al., 2018).

Pedagogical competence is one of the most important talents for an educator to carry out his/her duties effectively. This ability is crucial for maximizing students' skills and potential to suit the needs and changes of the times. This view is rooted in the understanding that every learning process must involve a close relationship between students and the role of educators. As the center of the world of education, an educator must be ready to carry out the mission to create an intelligent and quality generation by mastering various skills needed in a changing world. In an era of education based on technology, a teacher needs to understand digital technology and to use it efficiently to provide innovative and engaging learning experiences for students.

Along with technological advances, the internet can become a learning center (Elvi, 2025). At the research site, efforts to explore students' creativity through learning that utilizes information technology highly depend on teachers' readiness and teaching ability. Therefore, this research investigates how teachers' teaching skills can enhance students' creativity by using technology-based methods.

Literature Review

Pedagogical competence of teachers

Pedagogical competence is one of the core elements of teacher professionalism. According to Law No. 14 of 2005 on Teachers and Lecturers, pedagogical competence includes understanding learners, designing and implementing learning, evaluating learning

outcomes, and developing students' potential (Syoviana et al., 2025). This competence equips teachers to facilitate meaningful learning experiences that address students' needs and developmental levels. Pedagogical competence is one of the fundamental pillars of teacher professionalism and plays a decisive role in shaping compelling learning experiences.

In the context of 21st century education, the role of pedagogical competence is not merely procedural but transformative. A pedagogically competent teacher should master content and instructional strategies and be capable of adapting them to meet the diverse needs of students and the demands of the digital age. Kravarusić (2021) stated that this competence enables educators to organize engaging, responsive, and developmentally appropriate teacher learning activities. Moreover, pedagogical competence encompasses the teacher's ability to manage learning environments, communicate effectively, and implement inclusive practices that support all students.

Aligning with Habibullah (2012), pedagogical competence involves critical elements such as knowledge of student characteristics, curriculum, educational theory, learning design, and integrating assessment strategies. These elements interact in a dynamic process whereby teachers must continually reflect and adapt their practice to maintain relevance and effectiveness. Teachers' capacity to perform formative assessments and use feedback as part of instruction further underscores the role of pedagogy as a continuous cycle of improvement.

Creativity as a learning outcome

Creativity is increasingly recognized as a core learning outcome and essential skill in the 21st century. According to Munandar (2009), creativity generates new ideas, discovers unique solutions, and expresses thoughts innovatively. Teachers are critical in creating learning environments that stimulate curiosity, encourage exploration, and value originality. Therefore, creativity development is closely tied to how teachers design and deliver their learning processes.

Educational institutions, particularly at the elementary level, are responsible for cultivating creativity from an early age. According to Muqodas (2015), fostering creativity requires learning environments that are open, flexible, and non-judgmental. In such environments, students are encouraged to experiment, take intellectual risks, and engage in exploratory learning.

Teachers are the primary facilitators in this process. Their beliefs, behaviors, and instructional choices greatly influence how students perceive and exercise their creative potential. Wola and Charoen-In (2025) emphasized that project-based, inquiry-based, and problem-solving approaches nurture creativity. These methods allow students to work collaboratively, develop autonomy, and produce authentic outcomes that reflect their understanding.

The measurement of creativity in education often includes indicators such as fluency (number of ideas), flexibility (variety of ideas), originality (uniqueness), and elaboration (detail and development). Teachers must be equipped to recognize and assess these dimensions and provide students with constructive feedback that reinforces their creative growth.

The role of pedagogical competence in fostering creativity

Teachers with strong pedagogical competence can better apply varied teaching strategies that enhance student creativity. Mulyasa (2013) asserted that creative learning requires methods that allow students to explore, express, and create without fearing being wrong. Pedagogically competent teachers can differentiate instruction, manage flexible classrooms, and provide constructive feedback, encouraging students to take intellectual risks and develop original ideas.

A teacher with strong pedagogical skills is sensitive to students' developmental stages, learning styles, and socio-emotional needs. This enables the teacher to select appropriate instructional methods that resonate with students' experiences and interests. For example, open-ended questions, collaborative tasks, and reflective journals can stimulate students to think deeply and creatively.

Moreover, constructivist theories such as those by Piaget and Vygotsky provide the theoretical foundation for understanding how pedagogical practices influence creativity. Constructivism posits that learners build knowledge through interactions with their environment. In this framework, the role of the teacher is to scaffold learning experiences that challenge students to explore, discover, and construct new meanings. Hoidn and Reusser (2021) noted that creativity is multifaceted and context-dependent, requiring a pedagogical approach that is flexible and student-centered. A rigid or authoritarian teaching style stifles creativity, whereas a facilitative and empathetic teacher fosters a safe space for creative exploration.

Information technology integration in education

In the digital era, integrating information technology into learning has become essential. Information and Communication Technology (ICT) provides access to vast knowledge and offers tools that support creative expression, such as multimedia, digital storytelling, coding platforms, and collaborative online projects. Hamalik (2012) stated that technology can enrich learning when used appropriately to enhance interaction, visualization, and student engagement.

The use of IT in education aligns with the demands of a digital society, preparing students to become competent in a technology-rich world. Tools such as learning management systems (LMS), multimedia applications, virtual simulations, and digital collaboration platforms have become common in classrooms across the globe. In primary education, particularly at schools like SDN 09 Koto Baru, tools such as Canva, PowerPoint, video editing apps, and online quizzes (e.g., Kahoot!) are increasingly used to stimulate students' creativity and participation. These tools allow students to express their understanding multimodally—through images, animations, sounds, and narratives.

Elvi (2021) found that gamification and digital evaluation tools increase student motivation and create enjoyable learning experiences. Moreover, digital portfolios and blogs provide students with platforms to showcase their work and receive feedback from peers and teachers. Despite the opportunities, successful technology integration depends on the

teacher's digital competence. Teachers must navigate, evaluate, and integrate digital resources effectively. In this context, technological pedagogical content knowledge (TPACK) is an essential framework that highlights the intersection between pedagogy, content, and technology. Teachers must develop competencies in all three domains to design effective tech-enhanced learning.

Pedagogical and technological synergy

The effectiveness of technology integration depends on the teacher's ability to combine pedagogical knowledge with digital tools. Niess and Gillow-Wiles (2017) explained that the teacher's pedagogical approach must guide the use of technology, not the other way around. A teacher with high pedagogical competence can align learning objectives with appropriate technological resources, fostering creativity while meeting instructional goals.

A teacher who understands this synergy can select digital tools that align with learners' cognitive and affective needs. For example, using interactive mind-mapping software to brainstorm ideas enhances visual learning and encourages creativity. Video creation tools allow students to synthesize knowledge and present it creatively. In this way, technology becomes a medium through which creativity can be expressed and evaluated.

The Substitution-Augmentation-Modification-Redefinition (SAMR) Model, developed by Ruben Puentedura, helps analyze how deeply technology transforms learning. Teachers operating at the modification and redefinition levels are likelier to foster innovative learning experiences. Students consume digital content at these levels and become creators and co-constructors of knowledge.

Furthermore, Elvi (2025) emphasized that the internet can serve as a powerful learning center when guided by teachers with the competence to use it meaningfully. Such environments empower students to explore beyond textbooks, collaborate with peers globally, and create digital artifacts that reflect critical thinking. This synergy is essential in contexts where infrastructure may be limited. Teachers must creatively adapt and integrate available technologies into the curriculum to ensure that all students benefit from digital innovation. Therefore, continuous professional development is vital to equip teachers with pedagogical and digital skills.

Application at the research site

In the context of SDN 09 Koto Baru, enhancing student creativity through ICT-based learning requires teachers to demonstrate pedagogical competence in designing interactive, student-centered lessons. Teachers can create meaningful learning experiences that inspire students to think critically and creatively by leveraging technology as a medium for exploration and innovation. This synergy of pedagogy and technology reflects the evolving role of teachers as facilitators of learning in a digital age.

Teachers used Canva and Google Slides to facilitate project-based learning during the research process. Students were tasked with creating digital posters, infographics, and multimedia presentations related to environmental themes. These tasks required students to

research, synthesize information, and present their understanding in visually compelling formats.

Applying such pedagogical strategies led to observable improvements in student creativity, as shown in the data collected. Students became more confident in sharing ideas, more autonomous in completing assignments, and more collaborative in group tasks. Teachers also reported increased student motivation and engagement, attributed to the novelty and interactivity of the digital tools.

This experience at SDN 09 Koto Baru reflects broader trends in educational transformation where schools become hubs of innovation in urban and rural settings. Teachers can lead the shift towards creative, technology-enabled learning with adequate support, training, and leadership. The findings of this research support the assertion that teacher quality remains the single most important school-based factor influencing student achievement. By strengthening teachers' pedagogical and digital competence, educational stakeholders can foster an environment where creativity thrives.

Methodology

This research employed a qualitative approach with a case study design to investigate how teachers' pedagogical competence can enhance students' creativity by integrating information technology. The qualitative method is suitable for naturally exploring complex human behaviors and educational phenomena (Sandu et al., 2010). Through this approach, the researchers aimed to understand the subjective experiences of teachers and students at SDN 09 Koto Baru in implementing technology-based learning practices.

The case study design focused on one specific elementary school (SDN 09 Koto Baru) as a bounded system to provide an in-depth analysis of the pedagogical practices and their impact on students' creativity. The decision to use a single case was based on the school's unique characteristics, such as its recent efforts in integrating digital technology into learning and its proactive teaching staff, who are innovative in using educational media.

Participants and research site

The primary participants of this research were five classroom teachers who teach fifth-grade students at SDN 09 Koto Baru and have been actively incorporating information technology in their teaching. Additionally, 25 fifth-grade students were involved as subjects in the observation and documentation phases. The school is a semi-urban area in West Sumatra, Indonesia, and has basic facilities for digital learning, such as computers, projectors, and an internet connection.

Data collection techniques

Data were collected over four weeks using three main techniques: in-depth interviews, classroom observations, and document analysis.

1. In-depth interviews were conducted with teachers using a semi-structured interview guide. This allowed the researchers to explore teachers' understandings of pedagogical

competence, attitudes toward technology in education, and strategies for fostering creativity. Interviews were recorded with consent and transcribed verbatim for analysis.
2. Classroom observations were conducted to see firsthand how teachers implement information technology during learning. The observation focused on aspects such as teacher-student interactions, the use of digital media, student engagement, and creativity indicators. Field notes and observation checklists document relevant behaviors and teaching practices.
3. Document analysis included reviewing students' digital projects (e.g., Canva designs, posters, and short videos), lesson plans, teaching media, and assessment rubrics. These documents helped triangulate findings from interviews and observations.

Data analysis

The collected data were analyzed using thematic analysis, which involves identifying, analyzing, and reporting patterns or themes within the data. The process began with data reduction, eliminating irrelevant information, followed by data display through matrices and the coding of emerging themes.

The main stages of analysis included:

- Open coding: Researchers read transcripts and observation notes line by line to identify key concepts.
- Axial coding: Codes were grouped into categories such as "teacher readiness," "technology integration strategies," and "creativity indicators."
- Selective coding: Core themes were refined, especially regarding the role of pedagogical competence in encouraging creative thinking.

NVivo 12 software was utilized to assist with organizing and coding qualitative data. The use of software helped improve the accuracy and consistency of the coding process.

Trustworthiness

To ensure the credibility and trustworthiness of the data, several validation techniques were applied:

- Triangulation of data sources (interviews, observations, and documents) and methods helped corroborate findings.
- Member checking was conducted by presenting initial findings to the participating teachers for feedback and confirmation.
- Peer debriefing was employed by involving a team of researchers to review the data coding and interpretations.
- Audit trail documentation was maintained to track the research process and decisions made during the research.

By implementing these strategies, the researchers aimed to minimize bias and enhance the dependability and confirmability of the research findings.

Ethical considerations

This research adhered to ethical standards in educational research. Informed consent was obtained from all participants, including parents or guardians of the student participants. Participants were told the research purpose, data confidentiality, their right to withdraw, and how the results would be used. The researchers also ensured anonymity by using pseudonyms in all transcripts and reports. Approval was secured from the school principal and relevant authorities before conducting the research.

Findings and Discussion

The results of interviews, observations, and documentation with teachers at SDN 09 Koto Baru show that the quality of teaching greatly influences student creativity using information technology. Teachers demonstrate skills in designing digital learning sessions, for example, by using educational software such as Canva to design learning activities that encourage students to think critically, conduct investigations, and participate actively. Observations conducted for a week showed progress in student creativity as measured by various indicators, including the ability to convey ideas, create small digital works, complete projects with new approaches, and actively participate in discussions. This improvement can be analyzed by comparing the results of student creativity assessments before and after teachers' implementation of information technology-based strategies. The following data were obtained from 25 of the fifth-grade students:

Table 1. *Increase in student creativity before and after technology-based learning*

No	Creativity indicator	Average value before	Average value after	Improvement
1	Expressing ideas	68	83	+15
2	Creating simple digital	65	80	+15
3	Innovation in completing task	70	85	+15
4	Active participation	72	87	+15
	Overall Average	68.75	83.75	+15

The increase in scores on all variables indicates that if teachers have adequate pedagogical skills, especially in designing learning responsive to technological developments, students will be more involved and creative in their learning process. This research supports the constructivist theory, which states that meaningful learning occurs when students actively construct knowledge through direct experience and appropriate technology. In other words, teachers' ability to use information technology pedagogically can be a major driver of innovation and the development of student creativity at the elementary education level.

Furthermore, the enhancement of student creativity observed in this research cannot be separated from the alignment between technological tools and the teachers' understanding of students' learning needs. When technological literacy supports pedagogical competence, teachers are more likely to create adaptive learning environments that stimulate student engagement. For example, the use of visual aids such as Canva not only makes lessons more

attractive but also provides students with tools for self-expression that go beyond traditional methods like drawing or writing on paper. This aligns with Muqodas (2015), who emphasized that creativity in students is more likely to develop when learners are given opportunities to express ideas using varied media.

Teachers at SDN 09 Koto Baru were observed to provide open-ended assignments that allowed multiple solutions, such as designing posters for environmental awareness or creating multimedia presentations. This flexibility allows students to explore their imagination and develop critical thinking, an essential aspect of creativity. The creative outcomes produced by the students during the learning process serve as tangible evidence of how well the pedagogical approaches aligned with students' interests and learning styles. According to Mulyasa (2013), differentiated instruction that responds to diverse learning needs is a hallmark of pedagogical competence, and in this case, the use of ICT enabled such differentiation effectively.

Another key factor contributing to the success of this approach is the supportive school culture. Observations revealed that teachers collaborated to share best practices in using digital media. This collaborative spirit encouraged innovation not only among students but also among teachers themselves. The professional learning community fostered within the school catalyzed sustained technology integration in a pedagogically meaningful way. In turn, this learning culture among educators creates a ripple effect on students' motivation and enthusiasm for learning.

A teacher's competence combines various aspects, including personal, scientific, technological, social, and spiritual abilities, which determine the standard of teacher professionalism (Hakim, 2015; Orazbayeva, 2016). This includes mastery of teaching materials, understanding of students, effective learning methods, and self-development and professionalism. One of the important elements of the four criteria for teacher competence, namely pedagogical, professional, personality, and social, is pedagogical competence. The term pedagogy comes from the Greek, where "paedos" means boy and "agogos" means to guide or direct. Therefore, pedagogy is the act of helping boys. Pedagogical competence is the ability to guide the student's learning process (Law Number 14 of 2005 concerning Teachers and Lecturers, Article 1, date 1). A professional teacher must master basic pedagogical competence. Pedagogical competence includes behaviors that influence how teachers teach during the educational process. Behavior is regulated by theories underlying various components of pedagogical competence, which include student characteristics, learning theories, principles of meaningful learning, curriculum development, educational learning activities, and development of student potential. Students can optimize their abilities (Habibullah, 2012).

According to the provisions of the National Education Standards, one of the pedagogical skills that teachers must possess is related to the teaching and learning process. The Draft Government Regulation concerning teachers reaffirms the need for educators to organize an educational and interactive learning process. This means that the implementation of learning must start with dialogic interactions between subjects that encourage critical thinking and communication (Teo, 2019). Such expertise includes understanding student characteristics, mastering learning theories, developing curriculum, and utilising technology in the learning process. Integrating teacher pedagogical skills into the elementary school learning process is vital because teachers play a crucial role in shaping students' learning experiences. Therefore, a teacher's teaching skills directly affect students' academic achievement. Nasrallah

(2014) noted that research shows that teachers influence student learning outcomes with a contribution of 30%. This evidence confirms that teachers have a significant impact on student learning outcomes. Teachers are encouraged to optimise their role as a bridge for students (Rahman & Ermiana, 2025). Researching creativity is intriguing, but it can be challenging due to the many existing perspectives. People interpret creativity in different ways. There is no single explanation that represents all people's views on creativity, and there is no universal definition that all parties accept. There are two reasons for this situation. First, creativity is a complex aspect of psychology.

In this research, SDN 09 Koto Baru teachers demonstrated strong pedagogical competence by using technology to create an innovative and engaging learning environment. The teaching methods teachers apply have a significant impact on the development of student creativity. Isaksen et al. (2010) defined creativity as the ability to think differently, especially to generate various alternative solutions to a problem. When teachers design learning activities that encourage exploration and integration of technology, students are more likely to think creatively and generate new ideas. Field research shows that digital applications such as Canva allow students to express themselves more independently and artistically. This technology-based learning aligns with Vygotsky's constructivist principle, which emphasizes the importance of active learning through interaction with the social and technological environment. Teachers who have excellent pedagogical skills can support this process effectively. At SDN 09 Koto Baru, teachers use digital media to teach materials and assist students in creating ICT-based projects, including digital presentations, short videos, and creative posters. The results of these projects show an increase in students' creative thinking skills. Thus, this research strengthens the argument that combining teachers' pedagogical skills and technological literacy can produce learning responsive to change. This aligns with Thieman (2008), who stated that teachers today must use technology to help students develop critical and creative thinking skills rather than memorizing materials. Therefore, mastery of technology-based teaching methods is crucial to creating a creative, innovative generation ready to face future challenges.

Conclusions and Recommendations

This research affirms that pedagogical competence is pivotal in enhancing student creativity through integrating information technology in elementary education. At SDN 09 Koto Baru, teachers with strong teaching abilities could transform traditional classrooms into dynamic, student-centred learning environments using digital tools, such as Canva and other ICT-based applications. These tools supported the learning process and served as platforms for students to express themselves creatively, develop original ideas, and approach tasks innovatively.

The improvement in student creativity—reflected in four primary indicators: idea expression, creation of digital products, innovation in problem-solving, and active participation—showed a consistent increase of 15 points across all categories. This significant enhancement confirms that educators well-versed in pedagogical principles and technological tools can create impactful and engaging learning experiences. The findings resonate with the

constructivist theory, particularly Vygotsky's view that learning becomes most meaningful when students actively and purposefully interact with their environment, including technology.

In conclusion, integrating pedagogical competence and information technology offers a powerful strategy to foster student creativity. This approach is relevant to current educational demands and essential for cultivating a future generation of innovative, adaptable, and forward-thinking learners.

Disclosure statement

The authors declared no potential conflicts of interest.

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