



Exploration of Elementary School Teachers' Competencies in the Integration of Technology in Classroom Learning Practices: Gioia Method-Based Qualitative Study

Frinko Yulens Wurung, Mita Rahayu, Reginaldus Patrio, Edilinda Clauni, Siti Ni'matul Fitriyah

Correspondence:

snimatul.fitriyah@unitri.ac.id

Affiliation:

Elementary School Teacher
Education, University of Tribhuwana
Tunggadewi, Malang, Indonesia

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Abstract

Technology integration in primary education has become an essential aspect of improving learning quality and preparing students for the demands of the digital era. However, successful technology integration depends not only on the availability of digital resources but also on teachers' competencies and the contextual factors that influence their implementation practices. This study aimed to explore primary school teachers' competencies in integrating technology into classroom practice and to identify the factors influencing technology integration in primary education. A qualitative exploratory approach was employed, involving 15 participants consisting of primary school teachers from different generations, school principals, and school supervisors selected through purposive sampling. Data were collected through semi-structured interviews and analyzed using the Gioia methodology, which involved developing first-order concepts, second-order themes, and aggregate dimensions. The findings revealed four dimensions of teacher competencies in technology integration: pedagogical competence, social competence, professional competence, and attitudes toward technology. These dimensions illustrate that technology integration extends beyond technical skills to encompass the ability to use technology for teaching, communication, professional development, and continuous adaptation to technological change. The study also identified three contextual factors influencing technology integration, namely institutional support, implementation barriers, and strategies for professional development. Institutional support, such as technological facilities and continuous training, facilitated technology integration, whereas limited resources, varying levels of teacher readiness, and resistance to change emerged as major challenges. In conclusion, effective technology integration in primary education requires not only multidimensional teacher competencies but also supportive educational ecosystems characterized by adequate technological infrastructure, sustained professional development opportunities, institutional support, and collaboration among schools, educational authorities, and higher education institutions to foster continuous professional learning and digital transformation.

Keywords:

Technology integration, teacher competence, primary education, digital competence, Gioia methodology

INTRODUCTION

The rapid development of information and communication technology requires schools to prepare students with 21st-century competencies, including digital literacy, critical thinking, creativity, communication, and collaboration, needed to face the challenges of a knowledge-based society (Iskandar et al., 2025). Technology is no longer positioned as a learning tool, but rather as an integral part of the learning process that is able to expand access to learning resources, increase interactivity, and support more personalized and student-centered learning (Chafshah et al., 2024). Effective technology integration can increase student engagement and learning outcomes if it is aligned with the pedagogical goals to be achieved (Tondeur et al., 2020). However, its implementation in elementary schools still faces various

challenges, ranging from limited infrastructure, gaps in access to technology, to low readiness and competence of teachers in utilizing technology to support learning (Kusumawati et al., 2025).

The role of teachers is not only as users of technology, but also as pedagogical decision-makers who ensure that technology is used in accordance with learning goals and the needs of students (Nurhidayani et al., 2025). At the elementary school level, this role is very important because students are still at the stage of cognitive development that requires intensive guidance in utilizing technology productively and responsibly. As learning facilitators, teachers play a role in connecting technology with meaningful learning experiences and supporting the development of student competencies (Izmala et al., 2025; Reni et al., 2025).

Teacher competence in technology integration is a multidimensional construct that includes pedagogical, professional, social, and personality aspects (Fitriyah et al., 2025). These competencies include the ability to choose and adapt technology to support learning, build communication and collaboration, develop professionalism, and demonstrate readiness to face technological changes (Ambarwati et al., 2023). Good digital literacy and pedagogic competence allow teachers to create more interactive and contextual learning, while limitations in digital competence can hinder the effectiveness of technology use (Scherer et al., 2021; Suri et al., 2025).

Although it has been extensively researched, our understanding of how teacher competencies are formed and realized in technology integration practice remains limited. Most studies use a quantitative approach that focuses on measuring competency levels, technological readiness, or their relationship with other variables such as teacher performance and learning outcomes (Fitriyah et al., 2025; Silvester et al., 2024; Wijayanti et al., 2024). This approach has not been able to explain in depth how teachers interpret their experiences, develop strategies, and face challenges in integrating technology. In fact, the teacher's perspective can reveal dimensions of competence that are not always captured by survey instruments. Based on these conditions, this study aims to: (1) explore the competence of elementary school teachers in integrating technology into learning practices; and (2) identify factors influencing the integration of technology in elementary schools.

METHOD

This study uses qualitative methods to gain a deep understanding of the competence of elementary school teachers in integrating technology into classroom learning practices. This approach was chosen because the research focuses on teachers' experiences, meanings, and interpretations of the competencies they use in technology integration, including the support, challenges, and obstacles they face in real-world learning contexts. Qualitative research allows researchers to explore social phenomena in depth through the perspective of participants, so as to uncover how individuals understand and give meaning to their experiences (Gay et al., 2012; Moleong, 2010).

The study participants were selected using purposive sampling, based on informants' ability to provide relevant, in-depth information aligned with the research objectives (Campbell et al., 2020). This study involved 15 participants, consisting of elementary school teachers, principals, and school supervisors, as the main data sources. Teachers were chosen as the primary informants because they are directly involved in the planning, implementation, and evaluation of technology-based learning in the classroom. To gain a wider variety of experiences and perspectives, the teachers involved come from different generations, age ranges, and levels of teaching experience. These considerations are based on research findings showing that professional experience, age, and exposure to technology can influence how teachers adapt and integrate technology into learning (Hinojo-Lucena et al., 2019). In addition to teachers, school principals were involved because they play a strategic role in policymaking, providing facilities, and developing a school culture that supports the use of technology in learning. Meanwhile, school supervisors were selected to provide a broader

perspective related to policy implementation, teacher professional development, and the dynamics of technology integration at the education unit level. The data analysis in this study used the Gioia method (Gioia, 2021). This method was chosen because it provides a systematic procedure for analyzing and developing concepts and building theoretical understanding based on participants' experiences and perspectives. The analysis was carried out inductively while maintaining closeness between the research findings and the informants' narratives, so that the concepts produced reflect the reality experienced by participants in technology integration practices in elementary schools.

The research data were collected through semi-structured interviews arranged based on the research objectives (Sugiyono, 2012). The interview guide is designed to explore teachers' experiences integrating technology into learning practices, the competencies used, and the factors that affect technology implementation in schools. Interview questions include experience using technology for learning, strategies for developing digital competence, forms of support received from schools and education offices, obstacles encountered in technology integration, and expectations and strategies considered important for improving teacher professionalism in the digital era.

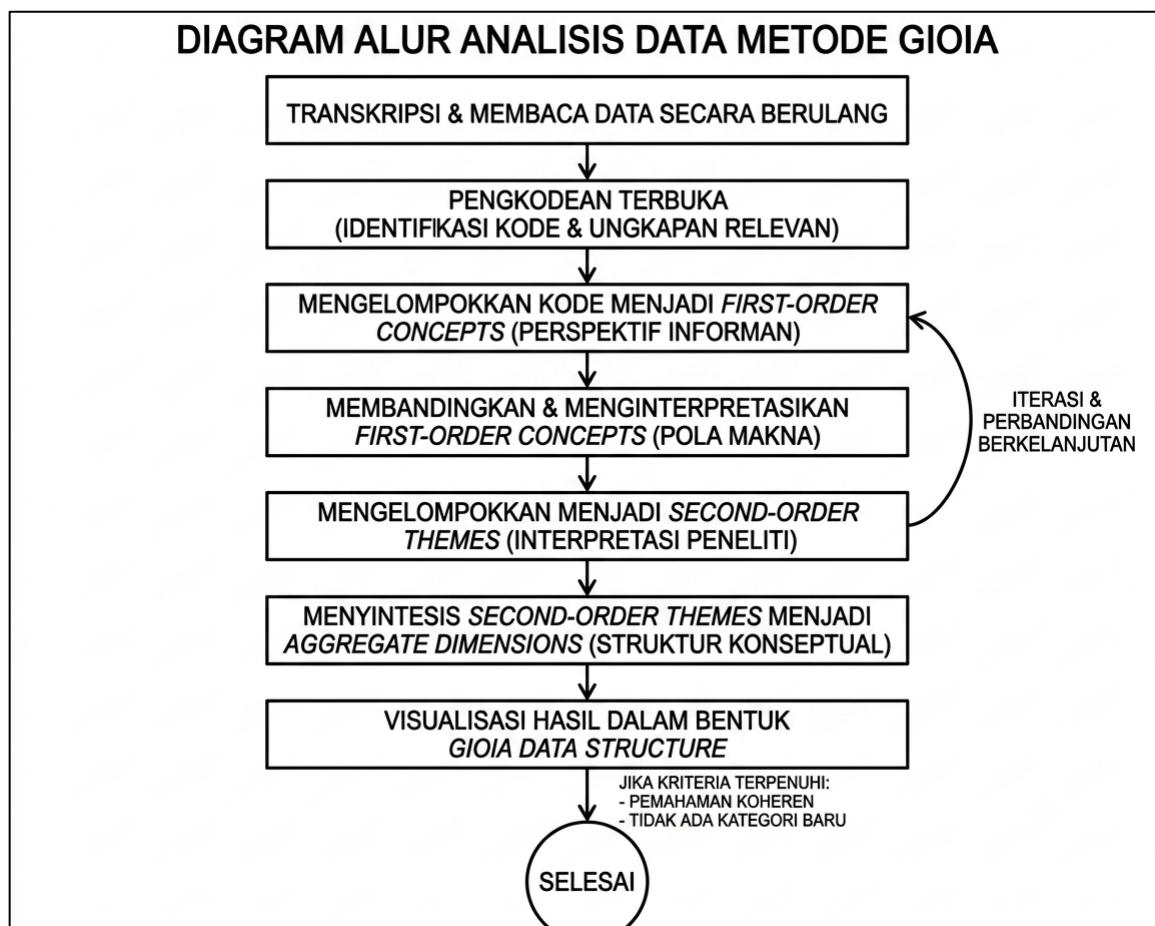


Figure 1. Gioia Method Analysis Flow Chart (Gioia, 2021)

The analysis process begins with transcribing all interview results verbatim and repeatedly reading the data to gain a comprehensive understanding of the participants' experiences. In the first stage, the researcher conducts open coding to identify statements, terms, and expressions relevant to teacher competencies, forms of support, and challenges and obstacles in technology integration. Codes that arise directly from the informants' language and perspective are then grouped into first-order concepts. The next stage involves comparing and interpreting various first-order concepts to identify more abstract patterns of

meaning. Concepts with substantial relevance are then grouped into second-order themes that represent the researcher's interpretation of the phenomenon under study. At this stage, the researcher continuously compares data, concepts, and themes to ensure the consistency and suitability of the interpretation with the context presented by the participants. Furthermore, various second-order themes that have conceptual relationships are synthesized into aggregate dimensions that describe the conceptual structure of teachers' competencies in technology integration, along with the factors that support and hinder its implementation. The results of the analysis are then visualized as a Gioia Data Structure to show the relationships among empirical data, themes, and systematically formed dimensions. The analysis is conducted iteratively until a coherent conceptual understanding is achieved and no significant new categories are identified in the data.

The validity of the data is maintained by referring to trustworthiness criteria, which include credibility, transferability, dependability, and confirmability (Nowell et al., 2017). Credibility is established through member checking and repeated reading of transcripts to ensure the suitability of interpretation with the participants' experience. Transferability is maintained through clear descriptions of the participants and the research context. Dependability is achieved by systematically documenting the entire research process, from data collection to theme and dimension formation. Meanwhile, confirmability is maintained by storing audit trails in the form of interview transcripts, field notes, and analysis results, so that findings can be traced back to the empirical data obtained.

RESULTS AND DISCUSSION

Data analysis using the Gioia method produced several main dimensions that represent the competence of elementary school teachers in technology integration, along with the supporting factors and obstacles that affect it. The structure of the research findings is presented in Table 1.

Table 1. Results of Analysis with the Gioia Method

First-Order Concepts	Second-Order Themes	Aggregate Dimensions
"I often use Quizizz and Wordwall to make the kids more excited when learning because they are like games." (GK03, GK05) "Canva and PowerPoint helped me create material that was more engaging and easy for students to understand." (GK02, GK07)	Utilization of technology in learning	Integration of technology in pedagogic competencies
"The number of students in the classroom is quite large, so technology helps me keep students' attention focused during learning." (GK01, GK02) "Google Forms make it easier for me to do evaluations because the results can be immediately recapped and analyzed." (GK04)	Use of technology for classroom management Technology in learning assessment	
"Communication with parents is faster through WhatsApp Groups, especially to convey information on assignments and student learning progress." (GK04, GK06) "We often share teaching tools through Google Drive so we don't have to create materials from scratch." (GK07)	Technology as a communication tool Technology-based collaboration	Teachers' social competence with technology
"I participated in webinars and KKG activities to increase insight into the use of technology in learning." (GK08, GK10) "ChatGPT helps me find learning ideas, while YouTube gives me many examples of teaching practices." (GK09)	Development of technology-based professionalism Utilization of technology in material mastery	Technology-based teacher professional competence
"If there's a new app that can help with learning, I usually try to learn it first." (GK08)	Positive attitude towards technology	
		Teachers' attitudes towards technology

First-Order Concepts	Second-Order Themes	Aggregate Dimensions
"I don't have much of a grasp of technology but I always want to learn from my fellow teachers who are already proficient." (GK03, GK02)	An open attitude towards technology even though not fully mastered	Institutional support for teacher professionalism
"I try to keep learning because technology is developing so fast and teachers have to be able to adapt." (GK03)	Motivation to keep learning	
"If we don't want to learn technology, it will be difficult to keep up with the current learning needs." (GK02, GK06)		
"My motivation for learning technology is to make learning more interesting and in accordance with the needs of today's students." (GK03)		
"Schools are working to provide laptops and Chromebooks so that teachers have adequate facilities to prepare for technology-based learning." (KS01)	Provision of technological facilities for teachers	Institutional support for teacher professionalism
"We continue to add the devices that teachers need because technology has become an important part of the learning process." (KS03)		
"Teachers routinely participate in workshops and trainings organized by schools and agencies to improve the ability to use technology." (KS02)	Teacher Professionalism Development Program	
"The agency always encourages schools to include teachers in various learning technology training programs." (PS01)		
"Every month there is guidance from supervisors who not only discuss administration but also strengthen teachers' competence in the use of technology." (KS04)	Continuous assistance from the service	Obstacles in implementation
"We provide regular assistance so that teachers remain motivated to keep up with the development of educational technology." (PS01)		
"There are teachers who are very enthusiastic about learning technology, but there are also those who still need encouragement to start trying new things." (KS01)	Differences in individual readiness in technology integration	
"Differences in motivation are one of the challenges because not all teachers have the same readiness to adapt to technology." (PS01)		
"The technology facilities are not fully adequate so several devices still have to be used interchangeably." (KS02)	Limited facilities in learning	Obstacles in implementation
"Limited facilities are an obstacle in expanding the use of technology in all classes." (KS03)		
"There are still teachers who feel comfortable with the methods that have been used so far that they are less encouraged to use technology." (KS04)	Internal challenges in technology adoption	
"The biggest challenge is actually not just the facilities, but the readiness of some teachers to get out of their comfort zone and learn new technologies." (PS01)		
"We are very open to cooperation with universities because it can help improve teachers' competence through training and mentoring." (KS03)	Synergy between educational institutions	Strategies to improve teacher professionalism
"Collaboration with universities can be a means of knowledge transfer and innovation that is beneficial to schools." (PS01)		
"Going forward, we hope that every student will have better access to computers so that their digital skills can develop optimally." (KS01)	Innovation in technology integration	

First-Order Concepts	Second-Order Themes	Aggregate Dimensions
"Teachers need to have the will to continue learning because technological developments are happening very quickly." (KS04) "Our hope is that teachers will be more open to innovation and make technology a part of their daily learning practices." (PS01)	Awareness of the importance of continuous learning	

1. Competence of Elementary School Teachers in the Integration of Technology in Learning Practices

The competence of elementary school teachers in integrating technology into learning practices is realized through four main dimensions: the integration of technology into pedagogic competence, the social competence of teachers with technology, the professional competence of technology-based teachers, and teachers' attitudes towards technology. These four dimensions illustrate that technology integration is a process involving a combination of teachers' knowledge, skills, and attitudes in utilizing technology to support learning. This perspective is in line with various studies that view teachers' digital competencies as a multidimensional construct that includes pedagogical, professional, communication, and self-development aspects in a sustainable manner (Chafshah et al., 2024; Fitriyah et al., 2025; Izmala et al., 2025).

In pedagogical competence, the use of applications such as Quizizz, Wordwall, YouTube, Canva, PowerPoint, Google Form, and digital worksheets shows that technology has been integrated into learning, classroom management, and assessment. This practice reflects teachers' ability to select and adapt technology according to learning objectives and student needs. This condition is consistent with the research by Erviana et al. (2025), which affirms the importance of pedagogic and professional competencies in supporting technology implementation, as well as Scherer et al. (2021), which states that effective technology integration depends on teachers' ability to combine technology with learning strategies suited to students' characteristics.

Social competence shows that technology expands the space for communication and collaboration among teachers, parents, and peers through WhatsApp Groups, social media, Google Drive, and Google Docs. This practice emphasizes that teachers' social competence in the digital era is developing towards technology-based communication and collaboration. These findings are in line with the DigCompEdu framework, which places professional communication and collaboration as important domains of educators' digital competencies (Redecker, 2017). In addition, the ability to build effective digital communication also contributes to teachers' readiness to implement technology in learning (Abtokhi & Admoko, 2025; Siregar & Siregar, 2024).

Professional competence is reflected in teachers' involvement in seminars, workshops, online training, Teacher Working Group (KKG) activities, as well as the use of digital learning resources and artificial intelligence-based technologies such as ChatGPT and Gamma AI. This condition shows that technology not only functions as a medium of learning, but also as a means of professional development that allows teachers to update their knowledge and skills on an ongoing basis (Muthmainnah et al., 2025). These findings are in line with research that confirms that the development of teachers' digital competencies is influenced by continuous training, professional learning communities, and access to digital learning resources (Meyvita et al., 2025; Reni et al., 2025; Satman, 2023).

Personality competencies reflected in teachers' attitudes towards technology are the foundation for the development of other competencies. Openness to technological developments, willingness to learn, and motivation to improve digital skills indicate a growth mindset in facing change. This indicates that the success of technology integration is determined not only by technical skills but also by the individual's confidence and readiness to adapt to innovation. These findings are in line with Lase (2016) and Zola and Mudjiran

(2020), who affirm that a positive attitude towards technology contributes to teachers' readiness to adopt and utilize technology in learning.

Overall, the four competencies show that teachers' technology integration competencies are interrelated and inseparable. Pedagogic competence determines how technology is used to support learning; social competence strengthens professional communication and collaboration; professional competence encourages sustainable capacity development; and attitudes towards technology are the foundation that affects teachers' readiness to face change. The interconnectedness among these dimensions shows that the success of technology integration depends not only on the ability to operate digital devices but also on teachers' capacity to interpret, manage, and develop the use of technology sustainably in the context of learning. These findings enrich the study of teachers' competence in technology integration by showing that digital transformation in elementary schools requires a balanced approach across pedagogical, social, professional, and personal aspects.

2. Factors Affecting the Integration of Technology in Elementary School Learning

The integration of technology in learning is determined not only by teachers' competencies but also by various contextual factors that support or hinder its implementation. Data analysis shows that technology integration practices occur within an ecosystem comprising institutional support, individual readiness, resource availability, and professional development opportunities. The success of technology integration cannot be understood as the teacher's responsibility alone, but rather as the result of the interaction between individual capacity and the environment in which the teacher carries out their professional practice.

Institutional support is an important factor in strengthening the integration of technology in elementary schools. The provision of tools, training, workshops, and mentoring demonstrates the commitment of schools and education offices to encouraging the transformation of technology-based learning. This support not only expands access to resources but also increases teachers' confidence in utilizing technology. These findings are in line with those of Howard et al. (2021) and Siregar and Siregar (2024), who affirm that organizational support, school leadership, and access to professional development contribute to the success of technology integration. From a professional development perspective, institutional support also serves as a catalyst, accelerating teachers' adaptation to technological changes and the demands of digital learning.

On the other hand, technology integration still faces various obstacles, such as differences in teacher motivation and readiness, the tendency to maintain established learning practices, and limited facilities. This condition shows that the barriers to technological integration are not only technical but also psychological and cultural. This view is in line with Scherer et al. (2021), which states that individual readiness, belief in technology, and environmental support interact to determine the success of technology integration.

In addition to the support and obstacles, collaboration among schools, education offices, and universities is seen as important for strengthening teacher professionalism. Expectations for increased access to technology for students and teachers' openness to technological developments suggest that digital competencies need to be developed sustainably as part of a culture of lifelong learning. This perspective is in line with Hargreaves and Fullan (2012), who emphasize the importance of collaboration and sustainable professional development in supporting educational transformation.

Overall, institutional support, implementation constraints, and professional development strategies constitute interrelated factors influencing technology integration in primary schools. Adequate support can strengthen teachers' competence and confidence, while various obstacles can slow the process of technology adoption if not handled systematically. Therefore, efforts to increase technological integration are not enough to improve individual teachers' abilities; they also need to be accompanied by strengthening the education ecosystem, which can provide resources, mentoring, and sustainable learning opportunities.

Limitation and Future Work

This study was limited to participants from primary school contexts in a specific region and relied on interview data as the primary source. Therefore, further research is recommended to include more diverse contexts and combine interviews with observations to gain a more comprehensive understanding of technology integration practices in learning.

CONCLUSION

This research shows that the competence of elementary school teachers in technology integration is a multidimensional construct comprising pedagogic, social, professional, and attitudinal competencies towards technology. These competencies are reflected in teachers' ability to use technology for learning, communication and collaboration, professional development, and adaptation to technological developments. These four dimensions complement each other in supporting the implementation of meaningful technology in the classroom.

Technology integration is also influenced by institutional and individual factors. Support in the form of facilities, training, workshops, and ongoing mentoring helps strengthen teacher competence, while differences in readiness and motivation, limited facilities, and resistance to change remain obstacles. Therefore, continuous professional development is needed through collaboration between schools, education offices, and colleges.

The findings of this study underscore the importance of developing teacher competency improvement programs that focus not only on technical skills in using technology but also on strengthening pedagogic competence, professional collaboration, and adaptive attitudes toward technological change. Therefore, schools, education offices, and colleges need to build sustainable partnerships to support digital transformation in elementary schools.

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