# Determinants of Teachers' Technology Adoption in Yogyakarta Classrooms: Exploring the Role of Skills, Infrastructure, and Leadership Policies

**Martina Sunartiningsih[1], Udik Budi Wibowo[2], Muh. Saidil Ikhwan[3]**

[1,2,3] Universitas Negeri Yogyakarta, Yogyakarta, Indonesia; martinasunartiningsih.2022@student.uny.ac.id

| ARTICLE INFO | ABSTRACT |
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| *Keywords:*<br><br>technology integration; Teacher Professional Development; educational leadership; school infrastructure<br><br><br>*Article history:*<br><br>Received 2024-12-29<br>Revised 2025-01-26<br>Accepted 2025-06-25 | This study explores the factors influencing teachers' ability to integrate technology in classroom instruction, specifically within schools in Yogyakarta. As digital tools become integral to education, understanding these factors is essential to supporting effective technology adoption in teaching practices. A qualitative case study approach was employed, involving six teachers from three schools in Yogyakarta selected through purposive sampling. Data were gathered using semi-structured interviews and document analysis. The research process included participant selection, instrument validation, and thematic data analysis to identify patterns related to technology integration challenges and strategies. The findings reveal three primary factors affecting technology use among teachers: (1) teachers' knowledge and digital skills, (2) availability of infrastructure and technical support, and (3) school principals' policies and leadership. These elements significantly influenced teachers' confidence and motivation to utilize technology effectively in their teaching. The results underscore the need for continuous professional development, equitable access to technological infrastructure, and strong, supportive leadership to promote a tech-enabled educational environment. These factors collectively shape teachers' readiness and willingness to adopt digital tools. To foster more effective technology integration in classrooms, stakeholders must prioritize teacher training, improve infrastructure, and encourage proactive leadership. Future research could expand on this study by comparing urban and rural school settings to examine contextual differences in teachers' perceptions and experiences with educational technology. |

**Corresponding Author:**
Martina Sunartiningsih
Universitas Negeri Yogyakarta, Yogyakarta, Indonesia; martinasunartiningsih.2022@student.uny.ac.id

## 1. INTRODUCTION

The use of technology in classroom learning has become an increasingly urgent need in today's digital era (Cornelius & Wilson, 2021). However, many teachers face obstacles in integrating technology into the teaching process. These challenges include the lack of technology skills among teachers, limited infrastructure in some schools, and resistance to changes in traditional learning methods (Glasel, 2018).

These problems are especially evident in areas with uneven educational resources, such as Yogyakarta, which reflects the variation in the level of technology adoption between urban and rural schools. This condition indicates the need for a deeper understanding of the factors that influence teachers' ability to use technology in the classroom.

Technology in education brings great benefits in supporting classroom teaching (Li et al., 2019). Technology not only allows teaching to be more interactive, but also provides wide access to various digital learning resources, such as videos, simulations, and learning applications. Previous studies, such as those conducted by Mishra and Koehler with the TPACK (Technological Pedagogical Content Knowledge) model (Rahmadi, 2019), show that the use of appropriate technology can improve students' understanding of difficult concepts. In addition, research by Carstens et al. (2021) also strengthens the idea that technology expands the scope of learning, enabling teachers to create collaborative and personal learning environments.

The Indonesian government has demonstrated its commitment to supporting the use of technology in education through various policies. Programs such as School Digitalization, technology-based teacher training, and infrastructure assistance for remote schools are some of the strategic steps that have been taken. In Yogyakarta, the implementation of this program can be seen through digital competency training for teachers organized by the local Education Office. However, obstacles remain, such as imbalances in access to technology between regions and challenges in integrating national policies with local school needs.

Research on the use of technology in education has shown a significant increase, especially in recent years, as shown by the distribution that researchers have conducted by filtering data on relevant articles on the use of technology in schools based on related articles from 2015 to 2024.

The use of technology in learning refers to the use of digital tools and applications to support the teaching and learning process (Winter et al., 2021). This technology includes hardware such as computers, tablets, and projectors, as well as software in the form of online learning platforms, interactive applications, and learning management systems (LMS). In the classroom context, technology is used to enrich the delivery of material, encourage student engagement, and facilitate the assessment process. This approach reflects a paradigm shift from traditional teaching methods to more student-focused learning (Mahdum et al., 2019).

The benefits of using technology in learning have been widely recognized in various studies and supported by several educational theories. The Diffusion of Innovation Theory by Rogers, explains that the adoption of technology in education is influenced by five factors: relative advantage, compatibility, complexity, testability, and observability (Zaineldeen et al., 2020). Teachers who see clear benefits of technology will be more likely to use it in their teaching. The Constructivism Theory developed by Piaget and Vygotsky is also relevant, where technology is considered a tool that supports learning based on the construction of knowledge by students, through interaction and collaboration (Mattar, 2018). In addition, the TPACK (Technological Pedagogical Content Knowledge) Model by Mishra and Koehler, emphasizes the importance of harmonious integration between technological knowledge, pedagogy, and content so that technology-based learning can run effectively (Alemán-Saravia & Deroncele-Acosta, 2021). Empirical studies by Puspitarini & Hanif, (2019) confirm that technology helps increase students' learning motivation, while Bond & Bedenlier, (2019) show that technology can facilitate the delivery of complex materials in an interesting and easy-to-understand way. Referring to these theories, it can be concluded that the benefits of technology in learning do not only cover technical aspects, but also support significant pedagogical transformation.

Previous research on technology use in education has provided many valuable insights. For example, research by Aljohani (2022) highlighted the importance of teachers' beliefs about the benefits of technology in driving technology adoption in the classroom. Meanwhile, research by Lopez & Younge, (2021) discussed the role of ongoing training to ensure effective technology use. These studies showed that factors such as training, leadership support, and teachers' intrinsic motivation greatly influenced the success of technology integration.

This research is very important in the context of education, especially in Yogyakarta, which has unique characteristics as an education city. By understanding the factors that determine teachers' use of technology, this study can help identify effective strategies to improve technology integration in schools. This is important to ensure that students get the most out of technology-based learning, especially in facing the challenges of education in the 21st century.

This study focuses on factors that influence teachers' use of technology in the classroom, such as self-efficacy, motivation, and school leadership support (Saidil & Andriani, 2024). This focus is different from the research by Sharma & Srivastava, (2020), which emphasizes more on external and internal barriers to technology adoption. This study aims to fill the gap by specifically exploring the local context in Yogyakarta and providing relevant recommendations for stakeholders.

In conclusion, this study aims to identify factors that determine the use of technology by teachers in the classroom, especially in Yogyakarta. The benefits of this study are that it provides strategic insights to improve teacher competence in using technology and empirical data that can support education policies. The formulation of the problem raised is: what factors influence teachers' ability to integrate technology into classroom learning?

## 2. METHODS

This study employed a qualitative research approach. According to Creswell (2020), qualitative research is designed to describe, explore, and understand the varied perspectives individuals or groups hold about specific social or educational phenomena. In this approach, the researcher acts as the primary instrument for data collection and interpretation, deriving insights through qualitative analysis (Groenland & Dana, 2020). A case study methodology was selected to examine the factors that influence teachers' ability to integrate technology in classrooms in Yogyakarta. This approach was considered appropriate because it enables an in-depth investigation of the complex, context-specific elements affecting technology use in education. The steps involved in the research process are illustrated in Figure 1 below.
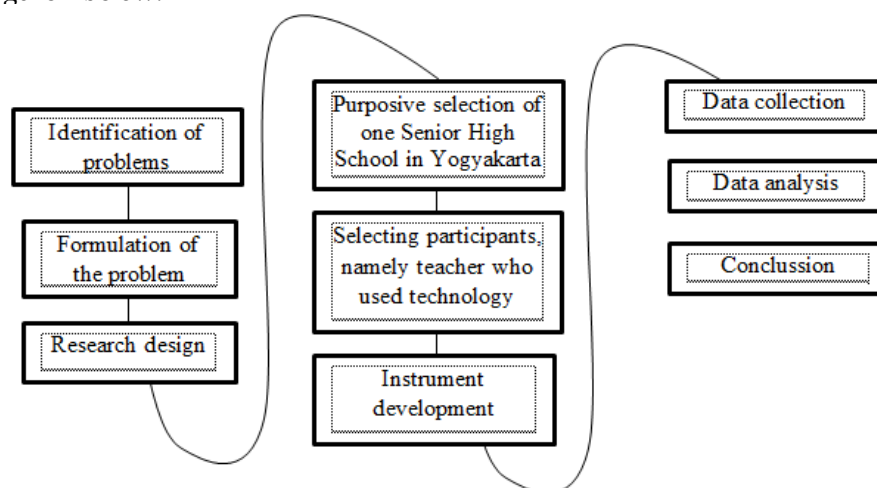


**Figure 1.** Research Steps

The research participants were selected using a purposive sampling approach (Lichtman, 2023). Purposeful sampling enables the selection of participants based on the specific objectives of the study (Llewellyn et al., 2004). The participants included six teachers from three schools in Yogyakarta. The teachers selected for this study had at least three years of teaching experience and were actively involved in integrating technology into their teaching practices. Demographic details about the participants, such as age, gender, educational background, and teaching experience, were recorded to provide a comprehensive understanding of their perspectives. Participants' ages ranged from twenty-five to fifty-five years, and their teaching experience varied between three and fifteen years.

The dataset consists of 100 articles, with 92 articles meeting the selection criteria based on the theme of "use of technology in education, especially in Yogyakarta." A distribution analysis of the publication year was conducted to identify research trends.

Data collection methods included semi-structured interviews and document analysis. According to (Groenland & Dana, 2020), data collection involves systematic procedures to gather information required to answer research questions. The interviews were conducted with all six participants to gain insights into their experiences, challenges, and strategies in using technology for classroom instruction. Each interview lasted approximately twenty to thirty minutes and was recorded using a digital device to ensure accuracy. An interview guide was developed based on existing literature on technology adoption in education to maintain consistency across interviews. In addition to interviews, documents such as lesson plans, school policies, and training records related to technology use were analyzed to supplement the findings from the interviews.

The collected data were analyzed using thematic analysis, a method that involves identifying, analyzing, and interpreting patterns within qualitative data. The Huberman (2014) model was employed for data analysis, consisting of the following stages: data reduction, data display, and conclusion drawing. Data reduction involved condensing the raw data by coding and categorizing key themes related to teachers' use of technology. Data display included organizing the themes into tables and visual formats to facilitate interpretation. Finally, conclusions were drawn by identifying patterns and relationships among the themes, providing insights aligned with the research objectives.

This study was conducted over a period of six weeks. The interviews and documentation analysis aimed to uncover the factors that influence teachers' ability to integrate technology in classroom settings effectively. The findings from this research are expected to contribute to understanding how teachers can be better supported in leveraging technology to enhance educational outcomes.

## 3.    FINDINGS AND DISCUSSION

Based on the results of a search for relevant data on Google search regarding the use of technology in the classroom and teachers adopting technology to assist learning, it can be seen in Figure 1 below, which was searched from 2015 to 2024.
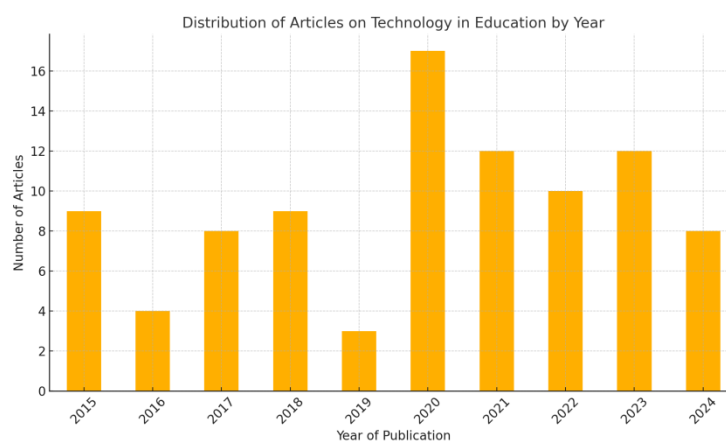


**Figure 2.** Distribution of Articles on technology use in education by year

The graph above shows the distribution of the number of relevant articles about the use of technology in education, especially in Yogyakarta, based on the year of publication. This is evidence of how often technology is used as a tool to utilize technology in the classroom. Based on a survey conducted by researchers. Researchers can display data on how technology is used by teachers, especially in Yogyakarta, focusing on the school that is the research location. The image below is the result of the interpretation.
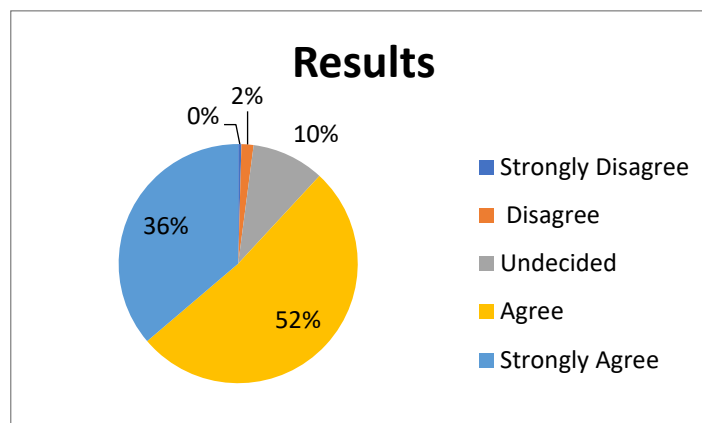
**Figure 3.** Survey result

Based on the graph above, it can be concluded that most teachers in Yogyakarta show a good understanding of the use of technology-based applications in classroom learning, as seen from the distribution of responses in the survey. Based on the data displayed, 52% of respondents stated "strongly agree" (value 4) that they understand the use of applications such as Zoom, Whatsapp, and Google Classroom. In addition, 36% of respondents gave a value of 5, which also reflects a high level of understanding. Meanwhile, only 2% of respondents gave a value of 2, indicating low understanding, and 10% gave a neutral value (value 3). These results indicate that the majority of teachers, around 88%, have a fairly good to very good understanding of utilizing technology in learning. However, there is still a minority who need further training to increase their confidence and understanding of technology.

### 3.1 Knowledge and Skills

Technological knowledge and skills are the foundation for teachers to be able to integrate technology into the learning process (Akram et al., 2021). The results of this study indicate that teachers who have good technological knowledge tend to be more confident in using digital tools in the classroom (Drossel et al., 2017). Teachers said that:

> *"..one of the challenges I have in how technology is utilized in class is that I have to learn and understand that the tools help me in facilitating learning in class, this is how the selection of technological tools must be appropriate.."* (NI/21/24)

They are able to take advantage of hardware such as laptops or projectors, as well as interactive learning software designed to increase student engagement. In contrast, teachers who are less trained or who do not have adequate technological knowledge are hesitant and reluctant to try innovations in teaching methods.
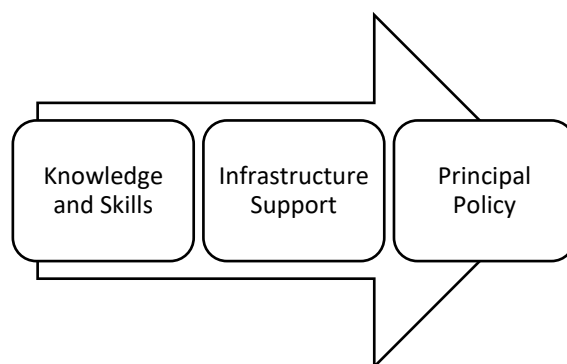
**Figure 4.** Factoring teacher technology use in the classroom

This variation in technological literacy levels is often influenced by previous experiences with technology. Younger teachers, who are generally more familiar with digital devices in their daily lives, have higher levels of technology adoption compared to older teachers. However, structured training can help address this gap. Research by Mannila et al. (2018) highlights the importance of training that focuses on building teachers' confidence and practical skills in using technology. Teachers said:

> *"..as a form of our commitment in developing our competence as teachers is by participating in training in order to be able to increase knowledge about learning in the context of how technology implementation facilitates learning in the classroom.."* (MZ/22/24).

In this context, the TPACK (Technological Pedagogical Content Knowledge) model provides significant insights. Mishra and Koehler (2006) explain that teachers not only need to understand technology technically, but also must be able to integrate it into pedagogical strategies that are relevant to the learning content. Without this understanding, technology tends to be used superficially, only as an additional tool, rather than as an integral component in the learning process. In addition to technological literacy, teacher motivation also plays an important role. Teachers who have intrinsic motivation to improve the quality of teaching are more likely to adopt technology, as explained in a study by Sharma & Srivastava (2020). This motivation is often driven by their perception of the benefits of technology for students and its ease of use.

The results of this study also show that continuous training is essential. Garzón Artacho et al. (2020) found that training specifically designed for teachers' needs can significantly improve their technological competence. This training not only covers technical aspects but also how technology can be used to achieve specific learning goals. In addition to training, on-the-job mentoring has also been shown to be effective. Scherer et al. (2019) recommend this approach to provide direct support to teachers when they face challenges in adopting technology. This approach allows teachers to learn collaboratively and build their confidence in using digital tools. Furthermore, teachers stated that

> *"..external support is also an important factor in how we can commit to utilizing technology in classroom learning. Because their current curriculum policy also recommends that, so we need to continue upgrading ourselves.."* (MH/21/24)

Support from the principal is also an important factor in improving teacher knowledge and skills. Principals who provide resources and facilitate training create a work environment that supports innovation. Research by Karakose et al. (2021) shows that teachers who are supported by supportive school policies have a greater chance of successfully adopting technology. In conclusion, teachers technology knowledge and skills are elements that cannot be ignored in integrating technology into education. Continuous training, principal support, and mentoring are strategic steps to ensure that all teachers can use technology effectively and consistently.

### 3.2 Infrastructure Support

Technology infrastructure support in Yogyakarta schools plays a key role in the success of technology integration in learning. The results showed that schools in urban areas generally have better facilities, including stable internet access, adequate digital devices, and relevant learning software. However, schools in rural areas often face limitations in this regard, which is a major barrier for teachers to utilize technology optimally.

> *"The main obstacle to how we cannot develop is actually the inadequate facilities that cannot be utilized, however, policy makers have begun to pay attention to this so that in the future, infrastructure that can support learning can be realized"* (FS/23/24).

This disparity reflects the broader challenge of equalizing access to technology. Amelia, (2023) highlights that without adequate infrastructure, even highly motivated and skilled teachers will struggle to integrate technology (Sari et al., 2024). Research by Wati & Nurhasannah (2024) also suggests that the availability of relevant hardware and software is a fundamental factor that enables teachers to use technology in their teaching. In addition to hardware, internet connectivity is also an important element. Research by Hu et al., (2021) found that fast and stable internet access greatly influences the level of technology adoption by teachers. Teachers with limited internet access often feel frustrated because they cannot access the digital resources they need to support their learning.

From a theoretical perspective, Rogers' (2003) Diffusion of Innovations Theory provides a relevant framework for understanding the role of accessibility in technology adoption. According to this theory, technologies that are easily accessible and compatible with user needs are more likely to be adopted. In this context, providing adequate infrastructure is the first step that must be taken to ensure that technology can be used effectively.

In addition to physical infrastructure, technical support is also an important need. Hasna, (2024) stated that the availability of a technical support team in schools can help teachers overcome technical problems they face, so they can focus on teaching. This is in line with the findings of Yusuf & Sodik, (2023), who emphasized the importance of technical support in creating a conducive work environment for technology adoption.

> *"Infrastructure is something that must be considered. Internet services, hardware, and other tools that can help us facilitate learning must be a priority. I believe that good infrastructure will provide interesting learning. This is important because I have a commitment to continue to develop our quality if things like complete and well-maintained facilities"* (JK/23/24).

Schools can also leverage collaboration with third parties, such as technology companies, to improve infrastructure quality. These partnerships can include the provision of free or subsidized devices, training, or consulting services to support technology implementation. Teachers further stated that, in the context of students, good infrastructure support allows them to engage in more collaborative and interactive learning. With access to digital tools, students can explore a variety of learning resources, collaborate with peers, and develop digital skills that are important for their future.

In conclusion, infrastructure support is a key element in determining the success of technology adoption in schools. Local governments, schools, and communities must work together to ensure that all teachers and students have equal access to technology, regardless of their geographic location.

### 3.3 Principal Policy

Principals have a strategic role in encouraging technology adoption in schools. The results of this study indicate that principals who are proactive in providing support, such as providing technology training, setting a digital vision, and providing incentives, tend to create a work environment that is conducive to innovation (Sheninger, 2019). In contrast, principals who are less involved often face barriers to teachers' adoption of technology. Teachers said:

> *"..The support of the school principal is key to enabling us to work optimally. It allows us to align with the policies established by the principal. Moral support, technical assistance, and access to facilities are also integral components of these policies. This support is crucial in enabling us to effectively utilize technology in our teaching..."*(WSN/23/24).

Uğur & Koç's (2019) research revealed that principals who support technology adoption can help teachers overcome resistance to change. In addition, Domeny (2017) stated that principals who involve teachers in technology-related decision-making are more successful in creating a sense of ownership and responsibility among teachers.

Successful principal policies often involve ongoing training. Sterrett & Richardson, (2020) found that training supported by principals not only improved teachers' technology skills but also built their confidence in using technology in the classroom. This training should be designed to meet the specific needs of teachers and include hands-on practice. One type of leadership that can support this is by implementing digital leadership.

Digital leadership is leadership that has a great view of the future or visionary, and has the ability to realize the goals of the organization it leads. Digital leaders must be able to articulate a clear vision of the role of technology in learning, encourage the adoption of technology-based pedagogical practices, and ensure adequate technology infrastructure (Sauers & McLeod, 2018). Leaders are also responsible for building staff capacity in the use of technology and facilitating ongoing professional development (Tondeur et al., 2019).

In conclusion, principal policies play a significant role in determining the success of technology integration in schools. Structured support, relevant training, and active involvement are key elements in creating an environment conducive to technology adoption.

## 4.    CONCLUSION

This study identified three key factors that influence teachers' ability to integrate technology into classroom instruction: knowledge and skills, infrastructure support, and principal policies. Teachers with stronger technological proficiency demonstrated greater confidence in using digital tools to enhance learning experiences. The findings highlight the importance of continuous professional development and mentoring, particularly within the TPACK framework, which combines technological, pedagogical, and content knowledge. However, a notable limitation of this study is the disparity in technology literacy between junior and senior teachers, indicating a need for more inclusive and differentiated training approaches. Moreover, infrastructure and leadership were found to play critical roles; access to reliable internet and sufficient hardware, coupled with principals who foster a supportive digital vision, significantly encouraged technology adoption. These leadership strategies—including training, incentives, and policy support—contributed to a more innovation-friendly school environment. Future research is encouraged to explore the specific impacts of different types of technology training on teachers' digital competencies and to conduct comparative studies between urban and rural settings to better understand contextual differences in teachers' perceptions and experiences with educational technology.

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