Journal of ICSAR
ISSN (print): 2548-8619; ISSN (online): 2548-8600
Volume 10, Number 2; DOI: http://dx.doi.org/10.17977/um005v10i22026p337-351

Teachers' Resistance and Adaptation in Facing the Digitalization of Education at Vocational High School in Indonesia

Hilma Zuroida*, Agus Tinus, Kuncahyono Kuncahyono

Department of Pedagogy, Universitas Muhammadiyah Malang, Malang, Indonesia
Email: *hilmazuroida92@gmail.com

Abstract: This study explores vocational high school teachers' resistance and adaptation in responding to educational digitalization and examines the factors shaping this process. A qualitative phenomenological approach was employed to investigate teachers' lived experiences at SMK Muhammadiyah 1 Kepanjen, Indonesia. Data were collected through in-depth interviews, observations, and documentation, and analyzed using thematic analysis. The findings indicate that teacher resistance is not a rejection of technology but a transitional phase characterized by hesitation, uncertainty, and adjustment. Internal factors such as digital literacy, technological self-efficacy, and generational differences influence teachers' responses, while external factors, including leadership, infrastructure, and professional communities, support adaptation. Teachers gradually develop adaptive strategies by integrating digital tools with conventional teaching practices. These findings highlight the reconstruction of teachers' professional identities. Although this study did not directly examine students with disabilities, the processes of teacher adaptation identified here include flexibility, differentiated support, and pedagogical adjustment. These elements are foundational to creating inclusive digital learning environments in vocational education. The study concludes that resistance and adaptation are interconnected phases in teachers' professional development during educational digitalization.

Keywords: Teacher Resistance; Teacher Adaptation; Educational Digitalization; Inclusion.

INTRODUCTION

The contemporary landscape of education is undergoing rapid transformation driven by the accelerating development of digital technology. Digitalization has significantly reshaped how teaching and learning processes are organized, communicated, and experienced in modern classrooms (Akram et al., 2022; Cattaneo et al., 2022; Winter et al., 2021). Across global education systems, the integration of digital technologies is increasingly viewed as a fundamental requirement for effective teaching practices and for preparing learners for participation in knowledge-based societies (Cabero-almenara et al., 2025; Redecker, 2017; Vanegas et al., 2025). The widespread adoption of information and communication technology (ICT) has altered traditional instructional models and introduced new forms of interaction between teachers, students, and digital resources (Aleksic et al., 2025; Farjon et al., 2018).

While digitalization offers significant potential for enhancing learning, it also raises critical questions about accessibility and equity in education. In the field of special education, researchers have examined how assistive technologies can support students with disabilities (Osman, 2024), how curriculum adaptation models can accommodate diverse learner characteristics (Andini et al., 2025), and how different Asian countries have progressed toward inclusive higher education following the CRPD ratification (Naeemy & Yoneda, 2025). These developments provide an important backdrop for understanding teacher adaptation to digitalization in vocational schools.

In classroom environments, teachers are increasingly required to integrate technological tools while simultaneously maintaining meaningful pedagogical interactions with students (Cattaneo et al., 2022; Hu et al., 2025; Lin et al., 2024). This situation places teachers at the intersection of two dimensions: the pedagogical dimension that emphasizes interpersonal engagement and the digital dimension that demands technological competence

and efficiency (Köstler & Wolff, 2025; Redecker, 2017; Winter et al., 2021). According to Ertner and Ottenbreit-Leftwich (2010), teachers' beliefs about teaching and learning play a crucial role in determining whether digital technologies are meaningfully integrated into instructional practices (Cheng et al., 2020; Veyis & Cigerci, 2025). Similarly, Petko (2012) explains that teachers' pedagogical orientations strongly influence their attitudes toward the use of educational technologies (Antonietti et al., 2022; Susilowati et al., 2025).

Within this intersection, teachers demonstrate diverse responses to digital transformation. Some educators perceive digitalization as an opportunity for professional growth, pedagogical innovation, and improved student engagement (AL-Takhayneh et al., 2022; Liˇcen & Prosen, 2024; Méndez et al., 2023). Others experience uncertainty, hesitation, and even resistance toward technological change due to limited technological confidence or institutional support (Howard et al., 2014; Sabariah et al., 2024; Tondeur et al., 2016). Such responses suggest that the transition toward digitally integrated education is neither linear nor effortless but involves complex emotional, cognitive, and professional adjustments (Martínez-Domingo et al., 2025; Sriwahyuni, 2025). Research examining teachers' motivational beliefs further demonstrates that educators' perceived competence, perceived usefulness of technology, and professional values significantly influence their willingness to integrate digital tools in the classroom (Cheng et al., 2020; Demissie et al., 2022; Redecker, 2017).

Globally, educational systems increasingly emphasize digital transformation as a strategic priority to improve educational quality and prepare students for the demands of the digital era (Cabero-almenara et al., 2025; Redecker, 2017; Vieira et al., 2023). In Indonesia, educational digitalization has become a central governmental priority implemented through several major initiatives, including the Merdeka Belajar policy, school digitalization programs, and the SMK Center of Excellence initiative (Rahmawati et al., 2025; Santi & Kustiawan, 2023). These initiatives aim to promote the integration of digital technologies across teaching and learning environments while fostering innovation in instructional practices (Taufiq et al., 2024; Winter et al., 2021). However, digitalization is not merely the introduction of technological tools into classrooms; it also represents a fundamental shift in pedagogical paradigms, learning processes, and educational relationships (Aleksic et al., 2025; Selwyn, 2022; Winter et al., 2021).

The digital transformation of education requires teachers to redesign instructional strategies, assessment practices, and learning environments to align technology use with pedagogical objectives (Cattaneo et al., 2022; Koehler & Mishra, 2009; Tondeur et al., 2016). Research on educational technology integration further highlights that meaningful technology use in education depends on the alignment between technological tools, pedagogical methods, and subject content knowledge (Koehler & Mishra, 2009; Vanegas et al., 2025). This framework is commonly conceptualized as Technological Pedagogical Content Knowledge (TPACK), which explains how teachers integrate technology with pedagogy and subject expertise (Farjon et al., 2018; Koehler & Mishra, 2009; Veyis & Cigerci, 2025). Teachers who possess strong TPACK competencies tend to demonstrate more effective technology integration and improved instructional outcomes (Demissie et al., 2022; Köstler & Wolff, 2025; Redecker, 2017; Voogt et al., 2012).

This transformation is particularly significant within vocational education and training (VET), where learning activities emphasize psychomotor competence, practical skills, and contextual workplace experience (Cattaneo et al., 2022; Hu et al., 2025; Pratiwi et al., 2025; Sari & Djari, 2023). According to Billett (2011), vocational learning must remain closely connected to workplace practices and real-world industrial environments (Rahmawati et al., 2025). Therefore, the integration of digital technology in vocational education requires a

pedagogically appropriate redesign of practical learning environments rather than simply introducing digital devices into workshops or classrooms (Antonietti et al., 2022; Cattaneo et al., 2022). Studies examining vocational digitalization similarly indicate that the successful implementation of digital learning environments depends on teachers' ability to combine digital tools with authentic, practice-based learning activities (Cabero-almenara et al., 2025; Liˇcen & Prosen, 2024; Redecker, 2017; Santi & Kustiawan, 2023).

Inclusive education principles emphasize that teachers should be able to accommodate diverse learners, including those with disabilities, through differentiated instruction and flexible pedagogical approaches (Andini et al., 2025; Osman, 2024). However, implementing such accommodations becomes more complex when teachers are navigating digital transformation simultaneously. The present study does not directly examine students with disabilities. Rather, it focuses on understanding how vocational teachers adapt to digitalization. The processes of teacher adaptation identified in this study include flexibility, differentiated support, and pedagogical adjustment, which are foundational elements that can inform efforts to create more inclusive digital learning environments in vocational education.

Despite progressive policy initiatives supporting digital transformation in education, a significant gap remains between digitalization policies and teachers' readiness to implement digital learning practices (Akram et al., 2022; Vanegas et al., 2025). Many vocational teachers continue to face challenges, including limited infrastructure, insufficient technological training, and difficulties integrating digital tools into practice-based learning activities (Anwar et al., 2024; Demissie et al., 2022; Sabariah et al., 2024).

Previous studies indicate that both external barriers, such as inadequate technological resources, and internal barriers, such as teachers' beliefs and attitudes toward technology, significantly influence technology adoption in educational contexts (Aleksic et al., 2025; Ertmer & Ottenbreit-Leftwich, 2010; Hew & Brush, 2007; Martínez-Domingo et al., 2025).

For some teachers, digital technology has not yet become an integral component of everyday teaching practice but is instead perceived as an external demand that generates pressure and anxiety about professional competence (Sriwahyuni, 2025; Winter et al., 2021). Howard et al. (2014) explain that teachers often experience technological anxiety when they feel inadequately prepared to integrate digital tools into classroom instruction (Sellami et al., 2024). Similarly, Tondeur et al. (2016) highlight that insufficient professional development opportunities frequently hinder teachers' ability to adopt innovative teaching approaches involving digital technology (Latifah et al., 2025; Taufiq et al., 2024). Consequently, the process of digital transformation in schools often unfolds alongside uncertainty, adaptation, and negotiation of professional roles (Cheng et al., 2020; Selwyn, 2022).

Teacher resistance and adaptation toward educational digitalization should therefore not be interpreted simply as a binary opposition between acceptance and rejection. Resistance does not necessarily represent opposition to innovation, and adaptation does not automatically signify successful transformation (Sriwahyuni, 2025; Suwarni & Natsir, 2024). In vocational education contexts, resistance may emerge from professional concerns regarding the effectiveness of digital technology in supporting hands-on skill development and workshop-based learning environments (Anwar et al., 2024; Pratiwi et al., 2025). From a theoretical perspective, resistance to change is understood as a multidimensional response involving cognitive, affective, and behavioral reactions to perceived threats to established professional stability and identity (Cabero-almenara et al., 2025; Oreg, 2006).

Empirical studies indicate that teacher resistance toward digital transformation may also arise from limited digital competence, lack of institutional support, and concerns about increased workload or pedagogical uncertainty (Aleksic et al., 2025; Howard et al., 2014; Tondeur et al., 2016). Other research further shows that teachers' beliefs regarding the pedagogical value of technology strongly influence their willingness to adopt digital tools in the classroom (Ertmer & Ottenbreit-Leftwich, 2010; Köstler & Wolff, 2025; Petko, 2012). In vocational education settings, resistance may also emerge when teachers perceive digital technologies as incompatible with practical learning environments or industry-oriented training contexts (Cattaneo et al., 2022; Rahmawati et al., 2025; Wahidmurni et al., 2024).

Conversely, adaptation to digital transformation involves more than simply acquiring technical skills. Adaptation requires teachers to reconstruct pedagogical practices, professional attitudes, and learning strategies in response to technological change (Cattaneo et al., 2022; Vanegas et al., 2025). Educational change literature conceptualizes adaptation as a dynamic process through which teachers adjust their instructional strategies, professional beliefs, and classroom practices in response to evolving educational environments (Akram et al., 2022; Frederickson, 2000; Fullan, 2007).

In vocational education settings, some teachers demonstrate adaptive creativity by implementing project-based learning approaches, digital simulations, and online collaboration with industry partners (Pratiwi et al., 2025; Rama et al., 2024; Taufiq et al., 2024). Collaborative professional learning environments also play a significant role in supporting teacher adaptation (Lin et al., 2024). König et al. (2020) argue that collaboration between teachers with different levels of technological competence can facilitate knowledge exchange and strengthen digital teaching capacity (Latifah et al., 2025; Sellami et al., 2024). Similarly, Deschênes et al. (2024) emphasize that professional learning communities contribute significantly to the development of teachers' digital competence and pedagogical innovation (Hu et al., 2025; Vieira et al., 2023).

However, existing studies on the digitalization of vocational education largely focus on technical aspects such as infrastructure readiness, digital competence, and technological self-efficacy (Akram et al., 2022; Vanegas et al., 2025). For instance, Anwar et al. (2024) emphasize the role of technological self-efficacy in shaping vocational teachers' digital teaching practices (Cattaneo et al., 2022). Similarly, Widaningsih et al. (2024) highlight the lack of clear digital competency frameworks for vocational educators in Indonesia (Rahmawati et al., 2025; Santi & Kustiawan, 2023). Although these studies contribute valuable insights into teachers' readiness for digital integration, they offer a limited understanding of teachers' lived experiences navigating processes of resistance and adaptation during digital transformation (Aleksic et al., 2025; Sriwahyuni, 2025; Suwarni & Natsir, 2024).

Therefore, there remains a need for research exploring how teachers interpret and experience digitalization in their professional and pedagogical contexts (Cheng et al., 2020; Liˇcen & Prosen, 2024; Martínez-Domingo et al., 2025). Understanding teachers' subjective experiences is essential for explaining how resistance emerges, how adaptation develops, and how teachers reconstruct their professional identities in response to digital transformation (Hu et al., 2025; Vanegas et al., 2025; Veyis & Cigerci, 2025).

Based on this research gap, the present study investigates teachers' resistance and adaptation in responding to the digitalization of vocational education at SMK Muhammadiyah 1 Kepanjen. In this study, resistance and adaptation are conceptualized not as opposing conditions but as interconnected processes through which teachers negotiate professional meaning and reconstruct their pedagogical identity in a changing educational environment (Akram et al., 2022; Sriwahyuni, 2025; Winter et al., 2021).

Accordingly, this study seeks to answer the following research questions: (1) How do teachers at SMK Muhammadiyah 1 Kepanjen interpret their experiences of resistance and adaptation toward the digitalization of vocational learning? (2) What internal and external factors influence the emergence of resistance and encourage adaptation among teachers in the use of digital technology? (3) What forms of adaptation strategies are developed by teachers in responding to the challenges of digitalization in vocational education?

METHOD

This study employed a qualitative, phenomenological design. The research explored teachers' lived experiences of interpreting and responding to the digitalization of education. A phenomenological approach was chosen to capture the complexity of resistance and adaptation as subjective experiences shaped by internal factors such as perceptions and beliefs, as well as external factors including workplace support and institutional context.

The research was conducted at SMK Muhammadiyah 1 Kepanjen, Malang Regency, East Java, Indonesia. The site was selected purposively because it represents a vocational institution actively integrating digital technology into its educational practices, thereby reflecting the real challenges faced by vocational schools in Indonesia. The study was conducted in November 2025 and included preliminary preparation, field data collection, and data analysis and validation.

Participants and School Context

This study involved five teachers and educational staff directly involved in the school's digitalization process. Participants were selected using purposive sampling based on their experience with digital teaching practices. The number of participants was determined by data saturation, whereby data collection continued until no new significant themes emerged.

The participants included the school principal, the vice principal for curriculum, the head of IT, a Computer Network Engineering teacher, and a Chemistry teacher. Their teaching experience ranged from 10 to over 20 years, with ages from 28 to 50. This generational variation provided diverse perspectives on digital technology adoption.

Regarding the school context, SMK Muhammadiyah 1 Kepanjen does not have formally designated inclusive classes or a specific program for students with disabilities. However, the school provides basic accessibility features, including accessible toilets, accessible pathways, and wheelchair access. Although there is no dedicated special needs class, a small number of students with disabilities (approximately one or two students) are enrolled in regular classes. These students include individuals with limb differences and hearing difficulties. Consequently, the participating teachers have limited direct experience teaching students with disabilities, as the number of such students is very small and the school does not operate a formal inclusive education program. This study did not specifically examine inclusive education practices; rather, it focused on teachers' general experiences of digitalization.

Data Collection

Data were collected through in-depth interviews, observation, and documentation. In line with phenomenological inquiry (Creswell, 2009), interviews were the primary data source, enabling participants to articulate their experiences of resistance and adaptation. Observations were conducted to capture contextual teaching practices and interactions, while relevant documents were examined to support data triangulation. In qualitative research, the researcher acts as the primary instrument. An interview guide was developed based on the

framework adapted from Rahmawati et al. (2025), with a focus on perceptions of technology, ease of use, and attitudes toward digital integration in vocational education.

Data Analysis

Data were analyzed using thematic analysis following the procedures outlined by Braun & Clarke (2008) and Greening (2019). The analysis involved several stages: (1) familiarization with the data through repeated reading of interview transcripts; (2) generating initial codes to identify significant statements related to resistance and adaptation; (3) categorizing codes into broader themes such as internal resistance, external support, and adaptive strategies; (4) reviewing and refining themes to ensure coherence and consistency; and (5) interpreting the phenomenological essence of teachers' experiences. The findings were presented through thematic narratives supported by direct quotations to preserve participants' voices.

To ensure trustworthiness, four criteria were applied: credibility, transferability, dependability, and confirmability. Credibility was maintained through source triangulation (teachers, school leaders, IT staff), method triangulation (interviews and observations), and member checking. The provision of rich, contextualized descriptions supported Transferability. Dependability was ensured through an audit trail documenting the research process. Confirmability was addressed through reflexive journaling to minimize researcher bias and maintain analytical rigor.

FINDING AND DISCUSSION

Finding(s)

Digitalization in the Context of Vocational Education

The findings indicate that digitalization at SMK Muhammadiyah 1 Kepanjen is understood not merely as the adoption of technological tools but as an institutional response to broader educational and industrial transformation. School leadership described digitalization as a strategic effort to align vocational education with rapid technological development and industry expectations.

As the school principal explained:

> *"At least there are three reasons why we implement digitalization in learning: the rapid development of information technology, the demand for vocational schools to follow industrial technological development, and the need to equip students with relevant 21st-century competencies."* (KS-01, 28/01/2026)

The same principal also described the school's context regarding students with disabilities:

> *"The school provides basic accessibility facilities, including toilets for persons with disabilities, walking pathways, and wheelchairs. Although there is no dedicated special needs class, a small number of students with disabilities, approximately one or two students, are enrolled in regular classes. These students include individuals with limb differences and hearing difficulties."* (KS-01, 28/01/2026)

These findings indicate that digitalization is perceived as a strategic initiative aimed at maintaining educational relevance and preparing students for technologically evolving industries. At the same time, the school has taken initial steps toward physical accessibility by providing basic facilities for persons with disabilities, and a small number of students with disabilities are already enrolled in regular classes. However, the absence of a formal inclusive education program or dedicated special needs classes suggests that disability accommodation remains informal and unsystematized. For this study, this context is significant because teachers' digital adaptation occurs in an environment where inclusive practices are still emerging. The flexibility, differentiated support, and pedagogical adjustment that teachers develop through digital transformation may therefore serve as unintentional but valuable resources for accommodating the diverse learning needs of the few students with disabilities in regular classes, even though inclusive education was not the primary focus of teachers' digital training.

The Meaning of Teacher Resistance Toward Digitalization

The findings demonstrate that teacher resistance toward digitalization does not appear as explicit rejection of technological innovation. Instead, resistance emerges as a transitional experience during the early stages of adjustment when teachers encounter unfamiliar technological systems that challenge established pedagogical routines.

Figure 1. In-depth interview with a vocational teacher during data collection at SMK Muhammadiyah 1 Kepanjen

Teachers described their early experiences of digital implementation using expressions such as "awkward," "uncertain," and "afraid of making mistakes."

> *"At the very beginning, it felt rather awkward."* (GP-01, 28/01/2026)

Similarly, school leadership acknowledged the existence of uncertainty among teachers who were not accustomed to digital learning systems:

> *"Those who were not used to it felt a kind of worry, because it required time, especially the need to change their habitual teaching patterns."* (KS-01, 28/01/2026)

Technological anxiety was particularly evident among senior teachers who feared making mistakes when operating digital platforms.

> *"Usually they are afraid of making mistakes, afraid to operate it because there are many menus. But with continuous assistance, eventually they can do it."* (IT-01, 28/01/2026)

Teachers also reported challenges in managing student behavior during digital learning activities.

> *"Many students use their phones in class, but not all of them open the learning material. Sometimes they open other applications, so it needs to be controlled."* (WK-01, 28/01/2026)

These findings indicate that resistance is closely associated with uncertainty, technological anxiety, and classroom management challenges during the early stages of digital transformation.

Internal and External Factors Influencing Resistance and Adaptation

Internal Factors

The findings reveal that internal factors such as digital literacy, technological self-efficacy, and generational differences significantly influence teachers' responses to digital transformation.

Teachers with lower levels of technological confidence experienced greater hesitation during digital integration.

> "*At the beginning, we really needed habituation. Whether we liked it or not, we had to learn first and become familiar with it.*" (WK-01, 28/01/2026)

Generational differences also influenced the adaptation process. Younger teachers demonstrated stronger digital skills, while senior teachers contributed pedagogical experience.

> *"Senior teachers are stronger in conventional methods, but their experience is greater than ours as younger teachers. We help each other."* (WK-01, 28/01/2026)

These findings indicate that collaboration between teachers of different generations contributed to the adaptation process.

External Factors

Institutional factors, including leadership, infrastructure, and professional learning communities, also influenced the adaptation process.

School leadership adopted a supportive and humanistic approach:

> "*We use a humanistic and persuasive approach, not forcing teachers, but supporting them through communication, mentoring, training, and workshops."* (KS-01, 28/01/2026)

Infrastructure availability also influenced digital learning implementation:

"The infrastructure is quite adequate; it only needs upgrading. Not all classrooms have Smart TVs yet." (IT-01, 28/01/2026)

Professional learning communities such as MGMP also supported adaptation:

"Once a month, we have MGMP meetings where we share platforms and software that can support learning." (GP-01, 28/01/2026)

Pedagogical Dimensions of Digitalization in Vocational Education

Another important finding relates to the practice-oriented nature of vocational education.

"Theory might only be around 30 percent, while 70 percent is practice." (GP-01, 28/01/2026)

Teachers integrated digital tools to support practical learning:

"After every practical session, students are required to create reports using Canva." (WK-01, 28/01/2026)

These findings suggest that digitalization supports rather than replaces practical learning activities.

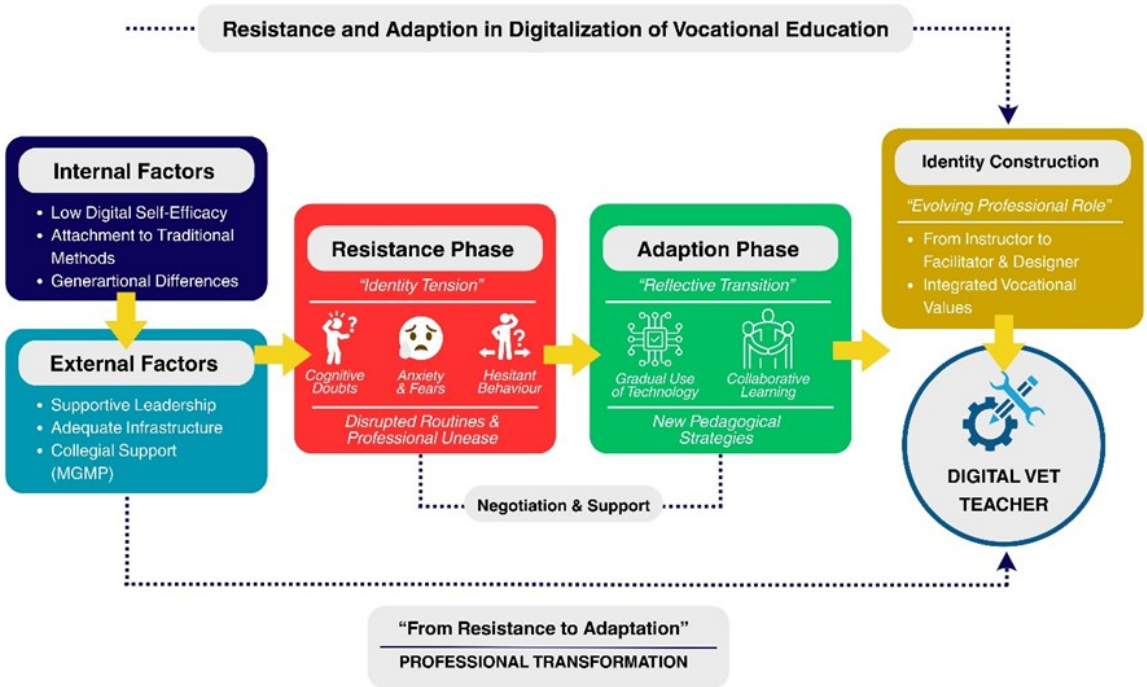

Figure 2. Conceptual Model of Teacher Resistance and Adaptation in the Digitalization of Vocational Education

Discussion

The findings indicate that digitalization in vocational education represents a broader institutional transformation rather than merely the adoption of technological tools. This finding aligns with studies emphasizing that educational digitalization entails systemic change that affects pedagogical practices and institutional structures (Akram et al., 2022; Aleksic et al., 2025; McCarthy et al., 2023; Vanegas et al., 2025; Veyis & Cigerci, 2025). Digital transformation requires teachers to adapt instructional strategies and integrate digital competencies into learning environments (Cabero-almenara et al., 2025; Instefjord & Munthe, 2015; Redecker, 2017).

In vocational education contexts, digitalization must be aligned with practical learning environments. Previous studies emphasize the need for integration between digital tools and hands-on experience (Billett, 2011; Cattaneo et al., 2022; Hu et al., 2025; Pratiwi et al., 2025). These findings confirm that digital transformation in vocational education is characterized by pedagogical adaptation rather than technological replacement.

Teacher resistance observed in this study reflects transitional experiences during technological change. This finding is consistent with research indicating that resistance often arises from uncertainty, technological anxiety, and disruptions to established routines (Cheng et al., 2020; Howard et al., 2014; Sriwahyuni, 2025). Resistance can also function as a meaning-making process through which teachers negotiate professional identity during educational transformation (Hew & Brush, 2007; Vanegas et al., 2025).

However, resistance in this study did not appear as outright rejection of digital tools. Instead, teachers expressed concerns about how digitalization might affect the hands-on, practice-based nature of vocational learning. This finding suggests that resistance in vocational contexts is closely related to teachers' professional identity as facilitators of practical skill development, rather than merely technological anxiety. When teachers perceived that digital tools might replace hands-on practice rather than support it, resistance emerged as a cautious response aimed at maintaining the integrity of vocational pedagogy.

Internal factors such as digital literacy and technological self-efficacy influenced teachers' adaptation processes. These findings align with studies demonstrating that teachers' confidence and competence significantly influence technology adoption (Anwar et al., 2024; Ertmer & Ottenbreit-Leftwich, 2010; Farjon et al., 2018). Generational collaboration also supported adaptation, consistent with research highlighting the importance of collaborative professional learning (Deschênes et al., 2024; König et al., 2020; Latifah et al., 2025).

Importantly, collaboration between younger and senior teachers also contributed to improved classroom practices. As teachers adapted to digital tools together, they reported better student engagement during lessons. Students appeared more focused when digital platforms were integrated with familiar teaching methods. Although this study did not directly measure student outcomes, these findings suggest that teacher adaptation may indirectly support more effective learning experiences.

External factors such as leadership and infrastructure also shaped adaptation. Supportive leadership has been widely recognized as a critical factor in educational change (Fullan, 2007; Uzorka & Kalabuki, 2025). Similarly, infrastructure availability influences the effectiveness of digital integration (Cattaneo et al., 2022; Hew & Brush, 2007).

The findings also demonstrate that vocational digitalization requires pedagogical alignment with practice-based learning. This result supports previous research emphasizing that digital tools should complement practical learning activities (Hu et al., 2025; Martínez-Domingo et al., 2025; Vieira et al., 2023).

A recurring tension in teachers' narratives involved integrating digital tools into practice-based learning. Teachers explained that vocational subjects requiring hands-on activities, such as experiments or hardware assembly, could not be fully replaced by digital simulations. Instead, they adopted blended approaches, using digital tools for documentation and theoretical explanation while maintaining hands-on practice as central. This finding suggests that adaptation in vocational contexts involves not only learning to use digital tools but also deciding when they are most appropriate to use.

Although this study did not specifically examine students with disabilities, teachers' adaptive strategies may be relevant to inclusive education. The flexibility and differentiated support developed during digital adaptation helped accommodate students with varying ability levels. This finding aligns with research on inclusive education that emphasizes flexible and differentiated instruction (Andini et al., 2025; Osman, 2024). However, future research should examine how teacher digital adaptation directly supports students with diverse learning needs.

The school context included basic accessibility facilities and a small number of students with disabilities, but no formal inclusive education program. Teachers developed flexible strategies primarily to manage general classroom diversity, which also benefited students with disabilities. This suggests that teacher digital adaptation may support inclusive practices, although the absence of formal policies indicates a need for more structured inclusive support.

Overall, resistance and adaptation represent interconnected phases within teachers' professional transformation. Resistance emerges as an initial response to change, while adaptation develops through collaboration, leadership support, and pedagogical adjustment (Aleksic et al., 2025; Tondeur et al., 2016; Winter et al., 2021). From a phenomenological perspective, digitalization represents a process of professional reorientation rather than purely technological implementation (Cattaneo et al., 2022; Sriwahyuni, 2025; Vanegas et al., 2025).

This study shows that teacher resistance and adaptation in vocational digitalization are not only technical but also pedagogical and identity-related. The findings also suggest that teacher digital adaptation can unintentionally support diverse learners, particularly in classrooms with emerging inclusive practices. However, without systematic policies and training, the potential of digital tools to better support students with disabilities may remain underutilized.

CONCLUSION

This study explored teachers' resistance and adaptation in responding to the digitalization of vocational education at SMK Muhammadiyah 1 Kepanjen. The findings demonstrate that digitalization in vocational schools is not merely a technological transition but a broader institutional response to rapid technological development and the evolving demands of industry and twenty-first-century competencies.

The study reveals that teacher resistance toward digitalization does not manifest as explicit rejection of technology. Instead, resistance appears as a transitional experience characterized by hesitation, uncertainty, and technological anxiety when established pedagogical routines encounter unfamiliar digital systems. From a phenomenological perspective, this resistance reflects a process of professional negotiation in which teachers reinterpret their roles and teaching practices within changing educational environments.

Several internal and external factors shape this process. Internal factors include digital literacy, technological self-efficacy, and generational differences among teachers. External factors include institutional leadership, infrastructure availability, and professional learning communities such as MGMP, which facilitate knowledge sharing and collaborative learning. These factors interact dynamically to shape teachers' capacity to move from resistance to adaptation.

The findings further indicate that adaptation occurs through multiple strategies. Teachers adopt blended instructional approaches that combine digital tools with conventional teaching methods, ensuring that technological integration remains aligned with the practice-oriented nature of vocational learning. Digitalization also extends beyond classroom instruction to administrative and assessment processes, including the use of digital platforms for document management and learning evaluation. In addition, collaborative professional networks among teachers play a crucial role in supporting continuous learning and the development of technological competence.

Overall, this study highlights that resistance and adaptation should not be understood as opposing conditions but as interconnected stages in teachers' professional transformation during educational digitalization. The findings emphasize the importance of supportive leadership, collaborative learning cultures, and pedagogically grounded technological integration in facilitating sustainable digital transformation in vocational education.

From an inclusive education perspective, the adaptive strategies identified in this study, such as flexibility, differentiated support, and pedagogical adjustment, can inform teacher training in inclusive digital pedagogy. Future research should further explore how teacher digital adaptation influences learning outcomes for students with disabilities in vocational education. In addition, policymakers are encouraged to integrate inclusive education principles into digital transformation initiatives to ensure that technological advances benefit all students, including those with diverse learning needs.

REFERENCES

Akram, H., Abdelrady, A. H., & Al-adwan, A. S. (2022). Teachers' Perceptions of Technology Integration in Teaching-Learning Practices: A Systematic Review. *Frontiers in Psychology,* 13, 1–9. https://doi.org/10.3389/fpsyg.2022.920317

Aleksic, V., Mandic, M., & Ivanovic, M. (2025). Aligning the Operationalization of Digital Competences with Perceived AI Literacy: The Case of HE Students in IT Engineering and Teacher Education. *Education Sciences, 15*(12), 1–15. https://doi.org/10.3390/educsci15121582

AL-Takhayneh, S. K., Karaki, W., Hasan, R. A., Chang, B. L., Shaikh, J. M., & Kanwal, W. (2022). Teachers' psychological resistance to digital innovation in Jordanian entrepreneurship and business schools: Moderation by teachers' psychology and attitudes toward educational technologies. *Frontiers in Psychology,* 13. https://doi.org/10.3389/fpsyg.2022.1004078

Andini, D. W., Hufad, A., Rochyadi, E., Aprilia, I. D., & Trisniawati, T. (2025). Design of Curriculum Adaptation Model Based on Decision Support System. *Journal of ICSAR, 9*(1), 152–162. https://doi.org/10.17977/um005v9i12025p152-162

Antonietti, C., Cattaneo, A., & Amenduni, F. (2022). Can teachers' digital competence influence technology acceptance in vocational education? *Computers in Human Behavior, 132*(2), 1–9. https://doi.org/10.1016/j.chb.2022.107266

Anwar, C., Sofyan, H., Ratnaningsih, N., & Muh. Asriadi, A. M. (2024). Digital technology practices for vocational teachers in the industrial revolution 4.0: Mediating technology self-efficacy. *Journal of Pedagogical Research, 8*(1), 172–190. https://doi.org/10.33902/JPR.202424585

Billett, S. (2011). *Vocational Education: Purposes, Traditions, and Prospects*. Springer Dordrecht. https://doi.org/10.1007/978-94-007-1954-5

Braun, V., & Clarke, V. (2008). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(January 2013), 77–101. https://doi.org/10.1191/1478088706qp063oa

Cabero-almenara, J., Palacios-rodríguez, A., Loaiza-aguirre, M. I., & Pugla-quirola, D. R. (2025). A Structural Model of Distance Education Teachers' Digital Competencies for Artificial Intelligence. *Education Sciences, 15*(10), 1–17. https://doi.org/10.3390/educsci15101271

Cattaneo, A. A. P., Antonietti, C., & Rauseo, M. (2022). How digitalized are vocational teachers? Assessing digital competence in vocational education and looking at its underlying factors. *Computers and Education, 176*(6). https://doi.org/10.1016/j.compedu.2021.104358

Cheng, S., Lu, L., Xie, K., & Vongkulluksn, V. W. (2020). Understanding teacher technology integration from expectancy-value perspectives. *Teaching and Teacher Education, 91,* 1–14. https://doi.org/10.1016/j.tate.2020.103062

Creswell, J. W. (2009). *Research Design Qualitative, Quantitative and Mixed Method Approach.* In SAGE (3rd ed., Number January 2010). SAGE.

Demissie, E. B., Labiso, T. O., & Thuo, M. W. (2022). Social Sciences & Humanities Open Teachers' digital competencies and technology integration in education: Insights from secondary schools in Wolaita Zone, Ethiopia. *Social Sciences & Humanities Open, 6*(1). https://doi.org/10.1016/j.ssaho.2022.100355

Deschênes, M., Dionne, L., & Parent, S. (2024). Supporting digital competency development for vocational education student teachers in distance education. *Frontiers in Education, 9,* 1–12. https://doi.org/10.3389/feduc.2024.1452445

Ertmer, P. A., & Ottenbreit-Leftwich, A. (2010). Teacher Technology Change: How Knowledge, Beliefs, and Culture Intersect. *Journal of Research on Technology in Education, 3*(42), 255–284. https://doi.org/10.1080/15391523.2010.10782551

Farjon, D., Smits, A., & Voogt, J. (2018). Technology integration of pre-service teachers explained by attitudes and beliefs, competency, access, and experience. *Computers & Education,* 130, 81–93. https://doi.org/10.1016/j.compedu.2018.11.010

Frederickson, K. (2000). Research-Based Evaluation of Conceptual Models of Nursing Nursing Knowledge Development Through Research: Using the Roy Adaptation Model. *Nursing Science Quarterly, 13*(1), 12–17. https://doi.org/10.1177/089431840001300105

Fullan, M. (2007). *The New Meaning of Educational Change (4th ed.).* Teachers College Press.

Greening, N. (2019). Phenomenological research methodology. *Scientific Research Journal*, *7*(5), 88-92. https://doi.org/10.31364/scirj/v7.i5.2019.p0519656

Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: current knowledge gaps and recommendations for future research. *Education Technology Research Development, 55*(3), 223–252. https://doi.org/10.1007/s11423-006-9022-5

Howard, S. K., Chan, A., & Caputi, P. (2014). More than beliefs: Subject areas and teachers' integration of laptops in secondary teaching. *British Journal of Educational Technology, 46*(2), 1–10. https://doi.org/10.1111/bjet.12139

Hu, H., Wang, Y., & Jacquet, W. (2025). Cross-Regional Students' Engagement and Teacher Relationships Across Online and In-School Learning. *Education Sciences, 15*(8), 1–14. https://doi.org/10.3390/educsci15080993

Instefjord, E., & Munthe, E. (2015). Preparing pre-service teachers to integrate technology: an analysis of the emphasis on digital competence in teacher education curricula. *European Journal of Teacher Education, 39*(1), 77–93. https://doi.org/10.1080/02619768.2015.1100602

Koehler, M. J., & Mishra, P. (2009). What Is Technological Pedagogical Content Knowledge? *Journal of Education, 9*(1), 60–70. https://doi.org/10.1177/002205741319300303

König, J., Jäger-biela, D. J., Glutsch, N., & Jäger-biela, D. J. (2020). Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany early career teachers in Germany. *European Journal of Teacher Education, 43*(3), 1–16. https://doi.org/10.1080/02619768.2020.1809650

Köstler, V., & Wolff, M. (2025). Promoting Digital Competencies in Pre-Service Teachers: The Impact of Integrative Learning Opportunities. *Education Sciences, 15*(3), 1–14. https://doi.org/10.3390/educsci15030337

Latifah, A., Hudallah, N., Sutopo, Y., & Anis, S. (2025). Enhancing Digital Competence of Vocational School Teachers Through Website-Based Learning Management System (LMS). *Journal of Vocational and Career Education*, *10*(2), 82-89.

Ličen, S., & Prosen, M. (2024). Strengthening sustainable higher education with digital technologies: development and validation of a digital competence scale for university teachers (DCS-UT). *Sustainability*, *16*(22), 9937. https://doi.org/https://doi.org/10.3390/su16229937

Lin, X., Chiu, T. K. F., Luo, S., Yue, S., Hwang, H., Hwang, S., Li, W., Liang, Z., Peng, S., & Lin, W. (2024). Teacher learning community for AR-integrated STEM education. *Teaching and Teacher Education, 141*, 1–15. https://doi.org/10.1016/j.tate.2024.104490

Martínez-Domingo, J. A. M.-D., Aznar-Díaz, I., Romero-Rodríguez, J. M., & Victoria-Maldonado, J. J. (2025). Use of Instagram as an Educational Tool with Pre-Service Teachers and the Impact on Digital Competence in Communication and Collaboration. *Education Sciences, 15*(2). https://doi.org/10.3390/educsci15020149

McCarthy, A. M., Maor, D., McConney, A., & Cavanaugh, C. (2023). Digital transformation in education: Critical components for leaders of system change. *Social Sciences and Humanities Open, 8*(1), 100479. https://doi.org/10.1016/j.ssaho.2023.100479

Méndez, V. G., Marín-Suelves, D., Vidal-Esteve, M. I., & Ramón-Llin, J. (2023). Digital competence of training teachers: Results of a teaching innovation project. *Education Sciences*, *13*(2), 162. https://doi.org/https://doi.org/10.3390/educsci13020162

Naeemy, M. I., & Yoneda, H. (2025). Toward Inclusive Higher Education: Challenges and Opportunities in Ten Asian Countries Following CRPD Ratification. *Journal of ICSAR, 9*(2), 337–366. https://doi.org/10.17977/um005v9i22025p337-366

Oreg, S. (2006). Personality, context, and resistance to organizational change. *European Journal of Work and Organizational Psychology, 15*(1), 73–101. https://doi.org/10.1080/13594320500451247

Osman, F. M. (2024). Innovative Teaching: A Proposed Immersive Reader Training Program for Special Needs Teachers. *Journal of ICSAR, 8*(1), 1. https://doi.org/10.17977/um005v8i1p1

Petko, D. (2012). Computers & Education Teachers' pedagogical beliefs and their use of digital media in classrooms: Sharpening the focus of the 'will, skill, tool' model and integrating teachers' constructivist orientations. *Computers & Education, 58*(4), 1351–1359. https://doi.org/10.1016/j.compedu.2011.12.013

Pratiwi, D., Ismara, K. I., Sudira, P., & Maryadi, T. H. T. (2025). Implementation of digital portfolio for vocational teachers' digital skills: A systematic literature review. *International Journal of Research and Innovation in Social Science, IX (IIIS)*, 4143-4159. https://doi.org/10.47772/IJRISS

Rahmawati, S., Prestridge, S., Abdullah, A. G., & Widiaty, I. (2025). Unpacking the digital competence challenge in vocational education: A case from Indonesia. *Social Sciences and Humanities Open, 12*(January), 101803. https://doi.org/10.1016/j.ssaho.2025.101803

Rama, A., Ambiyar, A., Lapisa, R., & Verawardina, U. (2024). Vocational Technology Education Innovation: Building a Generation of Experts in the Digital Age. *Jurnal EDUCATIO: Jurnal Pendidikan Indonesia, 9*(2), 1079. https://doi.org/10.29210/1202323361

Redecker, C., & Punie, Y. (2017). Digital competence of educators. *Edited by Yves Punie*.

Sabariah, S., Rufi'i, R. I., Sitompul, N. C., Elvianti, E., Sulaiman, P. K. A., & Al-Ayyubi, S. (2024). Influence of Teacher Training on Technology Integration in Learning Media Development. *Thawalib: Jurnal Kependidikan Islam*, *5*(2), 473-480. https://doi.org/https://doi.org/10.54150/thawalib.v5i2.485

Santi, K., & Kustiawan, I. (2023). Teacher Vocational Education Competence in Digital Age: A Bibliometric Analysis. *JOVES (Journal of Vocational Education Studies), 6*(1), 181–197. https://doi.org/10.12928/joves.v6i1.6511

Sari, Y. N., & Djari, M. C. Y. (2023). Penerapan Model Transisi Bridges dalam Manajemen Perubahan Di Sekolah Penggerak [Application of the Bridges Transition Model in Change Management in Indonesian Driving Schools Program (Sekolah Penggerak)]. *JAMP: Jurnal Adminitrasi Dan Manajemen Pendidikan, 6*(2), 126–132.

Sellami, A., Santhosh, M. E., Bhadra, J., & Ahmad, Z. (2024). High school teachers' perceptions of technology integration in instruction. *On the Horizon: The International Journal of Learning Futures*, *32*(4), 188-205. https://doi.org/10.1108/OTH-10-2023-0032

Selwyn, N. (2022). *Education and technology: Key issues and debates*. In Bloomsbury Academic (3rd ed.). Springer Netherlands. https://doi.org/10.5040/9781474235952

Sriwahyuni, E. (2025). Teacher Professionalism in Facing the Challenges of Digitization of Learning. *Gateway for Understanding Research in Education*, *1*(1), 20-29. https://doi.org/10.69855/guru

Susilowati, T., Akbarini, N. R., & Prameswara, Y. T. (2025). Investigating the Role of Teacher's Transformative Leadership in Fostering Technology Acceptance among Vocational High School Students. Journal of Education and Teaching (JET), 6(2), 325–344. https://doi.org/10.51454/jet.v6i2.553

Suwarni, A., & Natsir, N. (2025). Technology integration in English language teaching: Analysis of teachers' perceptions. *International Journal of Educational Research, 1*(2), 74–98. DOI: https://doi.org/10.62951/ijer.v1i2.282

Taufiq, M., Kaniawati, I., Liliasari, L., Nugultham, K., & Park, H.-Y. (2024). The Readiness and Constraints of Technological Integration in Implementing the Case Method and Team- Based Projects in The Mechanics Course. *Jurnal Pendidikan IPA Indonesia, 13*(3), 377–390. https://doi.org/10.15294/jpii.v13i3.4118

Tondeur, J., Braak, J. Van, Ertmer, P. A., & Ottenbreit-Leftwich, A. (2016). Erratum to: Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. Educational Technology Research and Development, 65(3), 577. https://doi.org/10.1007/s11423-016-9492-z

Uzorka, A., & Kalabuki, K. (2025). Educational leadership in the digital Age: An exploration of Technology's impact on leadership practices. *Social Sciences & Humanities Open, 11*(21), 1–7. https://doi.org/10.1016/j.ssaho.2025.101581

Vanegas, H. D., Segovia Cifuentes, Y. D. M., & Sobrino Morrás, A. (2025). Educational technology in teacher training: A systematic review of competencies, skills, models, and methods. *Education Sciences*, *15*(8), 1036. https://doi.org/10.3390/educsci15081036

Veyis, F., & Cigerci, F. M. (2025). The Role of Sustainable Education and Digital Competence in the Relationship Between Teachers' TPACK Levels and Performance Self-Assessments. *Sustainability, 17*(14). https://doi.org/https://doi.org/10.3390/su17146585

Vieira, R. M., Tenreiro-vieira, C. C., Bem-Haja, P., & Lucas, M. (2023). STEM Teachers' Digital Competence: Different Subjects, Different Proficiencies. *Education Sciences, 13*(11). https://doi.org/10.3390/educsci13111133

Voogt, J., Fisser, P., Roblin, N. P., Tondeur, J., & Braak, J. Van. (2012). Technological pedagogical content knowledge – a review of the literature. *Journal of Computer Assisted Learning, 29*(2), 109–121. https://doi.org/10.1111/j.1365-2729.2012.00487.x

Wahidmurni, W., Susilawati, S., & Abidin, A. A. (2024). Resistance to Curriculum Changes among Teachers of Madrasah Ibtidaiyah in Indonesia. *Nidhomul Haq: Jurnal Manajemen Pendidikan Islam, 9*(1), 16–27. https://doi.org/10.31538/ndh.v9i1.4300

Widaningsih, L., Sari, A. R., Dwiyanti, V., Maknun, J., & Hayat, J. (2024). Digital competency for Indonesian TVET educators. *Jurnal Pendidikan Teknologi Kejuruan, 30*(2), 209–221. https://doi.org/10.21831/jptk.v30i2.71436

Winter, E., Costello, A., O'Brien, M., & Hickey, G. (2021). Teachers' use of technology and the impact of COVID-19. *Irish Educational Studies, 40*(4), 235–246. https://doi.org/10.1080/03323315.2021.1916559