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Barriers to Educational Digitalization in Non-Urban Secondary Schools: A Case Study of SMA Negeri 4 Kaur

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Abstract: The digitalization of education in Indonesia has advanced rapidly, yet its implementation in secondary schools remains constrained by various challenges. This study aims to analyze the main barriers to integrating learning technology in non-urban educational settings using a qualitative descriptive approach with data obtained through interviews, observations, and document analysis. The findings reveal three primary obstacles: limited infrastructure such as unstable internet and insufficient devices, uneven teacher competence that causes technology to be used more for administrative tasks than innovative instruction, and the absence of a systematic school-level implementation plan that weakens the realization of national digital initiatives. The study concludes that successful digital transformation requires comprehensive educational ecosystem readiness, including strengthened infrastructure, continuous teacher professional development, and adaptive governance capable of sustaining technology integration in the long term.

Keywords: Educational digitalization, Learning technology, Teacher competence, Digital infrastructure, Policy implementation

Introduction

The rapid development of digital technology in the past five years has brought significant transformations to the global education landscape, including in Indonesia (Hikmat, 2022). The integration of technology is believed to enhance student engagement, enrich learning resources, and enable more flexible learning experiences. However, the implementation of digital transformation in Indonesian schools has not yet been optimal, mainly due to uneven infrastructure readiness between urban and rural institutions. These challenges include limited internet connectivity, insufficient technological devices, and the lack of technical support within schools. This condition indicates that digital education initiatives cannot be fully realized without strong and equitable technological infrastructure across regions, despite the increased urgency to digitalize education after the COVID-19 pandemic (Albert et al., 2025; Masngud & Hanif, 2025).

In addition to infrastructure issues, teacher competency is also a crucial factor determining the success of technology integration in the learning process. Although many teachers understand the importance of digital technology, formal training in digital literacy and technological pedagogy remains inconsistent and limited. Research shows that teachers often rely on self-directed learning rather than structured institutional training to improve their digital competence (Bećirović, 2023). As a result, technology tends to be used primarily for administrative tasks rather than transforming classroom instruction into innovative, student-centered learning experiences (Karasavvidis & Kollias,

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2017). This situation highlights the urgent need to improve teachers' professional capacity to ensure that digital transformation leads to meaningful improvements in learning quality.

From a policy perspective, the Indonesian government has launched various digital school programs as part of national education modernization. However, the implementation of these policies still faces challenges related to governance, bureaucracy, budget distribution, and variations in regional administrative capacity (Fitri et al., 2025). Disparities in infrastructure availability and digital readiness between regions have further widened the gap in educational quality, especially between urban and rural schools. This demonstrates that despite progressive policy frameworks, practical implementation requires alignment between national directives and school-level needs to ensure that digitalization efforts focus not only on providing devices but also on continuous instructional support (Yulianto, 2025).

The research problem in this context is that the integration of educational technology in Indonesia has not yet been effective, as reflected in: (1) unequal distribution of digital infrastructure, (2) suboptimal digital pedagogical competence among teachers, and (3) policy implementation that is not yet synchronized between national and institutional levels. These issues contribute to learning inequalities and uneven digital proficiency across schools and regions, preventing digital transformation from fully supporting the demands of 21st-century education. Therefore, a comprehensive study is necessary to examine the root challenges in order to propose more strategic solutions for implementation.

Previous studies have discussed aspects of these issues but are mostly isolated in focus. Fahruddin (2024), for example, highlight infrastructure challenges, while Nuryatin et al. (2023) focus on teacher competence. Other studies examine regional digital inequality Aukmasari et al. (2022), and the implementation of government policies (Imaduddin & Firdaus, 2025). However, studies that analyze the three elements technological infrastructure, teacher professional competence, and policy effectiveness simultaneously are still limited (Al Munziroh et al., 2025; Alamin et al., 2023; Hanifah et al., 2025). In fact, these three dimensions are interrelated and jointly determine the success of Indonesia's educational digitalization (Hamilaturroyya & Adibah, 2025; Irvani et al., 2025; Sholihin & Irvani, 2025). This reflects the need for more holistic research to describe the digital education ecosystem in a comprehensive manner.

The urgency of this study lies in the need to systematically analyze the challenges of integrating digital learning, especially after the COVID-19 pandemic, which accelerated technology adoption in schools. The novelty of this study lies in its comprehensive analytical framework that evaluates three core pillars of digital transformation: technological infrastructure, teacher professional competence, and the implementation effectiveness of digital education policies. This research not only contributes theoretically to strengthening the literature on educational digitalization but also provides practical recommendations for government institutions, schools, and stakeholders to accelerate equitable and sustainable digital transformation in the future.

Method

The study employed a qualitative descriptive research approach to analyze in depth the challenges of integrating technology into the learning process in schools. This approach was chosen because it enables a comprehensive understanding of naturally occurring phenomena without manipulating variables, while uncovering the meaning behind the experiences and perceptions of participants involved in technology implementation. Qualitative inquiry is considered appropriate for examining complex educational issues such as infrastructure readiness, teachers' digital pedagogical competence, and policy implementation, which cannot be adequately explained using quantitative measurements alone. The research was conducted at SMA Negeri 4 Kaur in Bengkulu Province, a school selected based on its ongoing efforts to incorporate digital learning while facing notable challenges in internet access and technological facilities. Its geographical conditions and limitations in digital accessibility make it representative of non-urban educational settings where digitalization efforts often develop at a slower pace compared to schools in metropolitan regions. Participants included the principal, teachers, and administrative staff directly involved in the use of digital learning

technologies, selected using purposive sampling on the basis of their roles, experiences, and knowledge of school digitalization practices (Rahman et al., 2022; Subroto et al., 2023).

Data were collected through in-depth interviews, field observation, and document analysis. Interviews were conducted to explore participants' perceptions, experiences, challenges, and institutional responses related to the integration of digital technology into learning. Direct observation was carried out to examine the actual conditions of technological infrastructure such as internet connectivity, device availability, and supporting facilities within the school environment. Document analysis involved the examination of institutional policies, digital usage logs, and reports on teacher development programs to strengthen and validate interpretations obtained from interviews and observations (Agustini & Irvani, 2023; Felesia & Irvani, 2025; Maimun & Hakim, 2021). The primary instrument of data collection was the researcher, supported by interview guides, observation sheets, and documentation checklists to ensure that the data gathering process proceeded systematically and aligned with the research objectives.

Data were analyzed using Miles and Huberman's interactive analytical model, consisting of three interconnected stages: data reduction, data display, and conclusion drawing. During data reduction, interview transcripts, observational notes, and documentary materials were filtered and coded to identify information relevant to the research focus. The reduced data were then organized into descriptive narratives, matrices, or thematic categories to clarify emerging relationships and patterns. Conclusions were drawn through a continuous interpretive process that allowed the development of a comprehensive understanding of the barriers to effective integration of digital learning at SMA Negeri 4 Kaur (Ismail et al., 2023). To ensure the credibility and trustworthiness of the findings, the study employed source and method triangulation by comparing data obtained through interviews, observations, and documentation. Member checking was also conducted by presenting preliminary interpretations to participants to confirm the accuracy of the researcher's conclusions. These validation procedures ensured that the findings accurately reflected the real conditions of digital technology implementation within the school environment.

Result and Discussion

The findings indicate that the digitalization of learning at SMA Negeri 4 Kaur remains at an early stage and is significantly affected by infrastructural limitations (Mulyana et al., 2023). Unstable internet connectivity frequently interrupts classroom activities involving online applications, making it difficult for teachers to sustain digital-based instruction. Field observations reveal that most classrooms lack essential technological equipment such as projectors, computers, or reliable Wifi coverage. These conditions restrict the use of digital learning media, despite teachers' readiness to adopt technology. Interview data further show that teachers primarily utilize digital tools for administrative tasks, while instructional technology integration remains minimal. Documentation also indicates that the school has not yet developed a comprehensive digitalization plan, resulting in inconsistent and unstandardized practices. To illustrate the empirical findings, the following table summarizes the main barriers identified during the study (Pahrijal & Novitasari, 2023; Sausan et al., 2025).

Tabel 1. Summary of Barriers to Digital Learning Implementation

(Author's field data, 2025)

Category	Observed Condition	Impact on Learning
Infrastructure	Unstable internet; limited devices; absence of digital classrooms	Technology cannot be used consistently during lessons
Teacher Competence	Unequal digital skills; reliance on self-learning	Minimal use of digital pedagogy; return to traditional methods
Policy Implementation	No internal digital roadmap; limited supervision	National digital policies not translated into school practice

Technical Support	Lack of ICT personnel or troubleshooting assistance	Teachers avoid using tools due to fear of technical failure
Learning Culture	Students not accustomed to digital platforms	Low engagement with online learning tools

Another substantial finding concerns the variation in teachers' digital pedagogical competence, which directly affects instructional quality (Runge et al., 2023). Although several teachers engage in self-directed digital training through online tutorials, proficiency levels vary widely. Teachers with stronger digital skills experiment with interactive applications, while others struggle to integrate technology into lesson design due to limited confidence and mastery. Observations reveal that teachers who feel uncertain about their digital capabilities prefer conventional teaching methods to avoid disruptions. Factors such as limited technical assistance, age differences, and varying professional development exposure further widen the digital skills gap. The study also indicates that the principal's digital supervision is constrained by limited resources and competing administrative priorities. These findings confirm that human resource readiness remains a critical determinant of the success of school digitalization (Ofita et al., 2024; Rustandi et al., 2024).

The significance ofthese findings shows that digital transformation cannot be achieved solely through the provision of technological tools; rather, it requires a systemic approach that integrates infrastructure, human capacity, and policy governance. Insufficient connectivity and device shortages limit teachers' opportunities to adopt innovative learning models, while unreliable technology forces them to revert to traditional methods. This situation widens learning disparities between urban and non-urban schools, particularly in developing regions. The findings suggest that digital inequality is both a technical and pedagogical issue because it restricts students' opportunities to engage in higher-order learning experiences and digital skill development. Therefore, infrastructural constraints not only impact daily instruction but also shape long-term educational outcomes. These insights reinforce the view that digital education should be conceptualized as a holistic ecosystem rather than a hardware-driven intervention (Faloye & Ajayi, 2021; Timotheou et al., 2023).

The study also highlights the importance of policy coherence and effective school governance in sustaining digital innovation (Manggalasari et al., 2025). Although the national government has introduced multiple digital learning initiatives, their implementation at the school level remains hindered by administrative inconsistencies and limited technical guidance. The absence of clear internal policies prevents schools from operationalizing national directives effectively. Teachers also require continuous, structured professional development to use technology pedagogically rather than merely for administrative tasks. However, due to limited formal training opportunities, many teachers rely on self-directed learning that does not always correspond with instructional needs. These findings underscore the need for greater collaboration between policymakers, school leaders, and teachers to create a supportive digital learning environment. The success of digital transformation depends on integrated support for infrastructure, teacher capacity-building, and adaptive governance systems (Marie et al., 2024; Mustafa, 2025).

Further analysis of the field data shows that the school's digital ecosystem is shaped not only by technical constraints but also by organizational culture. Interviews with teachers reveal that the absence of routine digital coordination meetings or structured discussions on technology integration makes the digitalization process less collaborative. Teachers often work independently without shared guidelines or peer support, resulting in inconsistent adoption of digital practices across subjects. The school's reliance on individual initiative rather than collective planning also creates disparities in classroom implementation. Some departments are more adaptive and willing to experiment with digital tools, while others remain cautious due to limited skills or structural barriers. These conditions suggest that digital transformation requires not only resources but also a supportive organizational culture that encourages experimentation, collaboration, and reflection. Such a culture is currently underdeveloped at SMA Negeri 4 Kaur, contributing to uneven progress in digital practices (Setyawan, 2022; Syauta et al., 2024).

Table 2. Variation in Digital Adoption Across Subject Areas

(Author's field data, 2025)

Subject Area	Level of Digital Use	Examples of Practices	Key Limiting Factors
Science	Moderate	Online quizzes, simulations	Unstable internet; lack of devices
Social Studies	Low	Basic PPT presentations	Limited teacher confidence
Mathematics	Very low	Occasional calculator apps	Insufficient training
Languages	Moderate	Digital reading platforms	Limited Wi-Fi coverage
Vocational Areas	High	Editing software, digital tools	Inconsistent technical support

The variation across subject areas highlights the need for differentiated digital capacity building. Subjects that depend on interactive visualizations, such as science and vocational studies, show higher levels of digital experimentation because teachers perceive technology as directly enhancing conceptual understanding. Meanwhile, subjects like mathematics and social studies demonstrate lower digital utilization because teachers are less familiar with pedagogical models that incorporate technology effectively. This contrast reinforces the importance of subject specific digital training rather than generic workshops. The findings also indicate that technology adoption is strongly influenced by teachers' perceptions of relevance and utility, suggesting that professional development must address not only technical skills but also pedagogical value. Therefore, digital transformation requires a more nuanced approach that acknowledges the unique characteristics and needs of different subject domains (Alieto et al., 2024; Althubyani, 2024).

Another significant implication of the study concerns student engagement. Observations show that students respond positively when digital tools are used to support visual or interactive learning; however, low infrastructure reliability often disrupts these activities, leading to frustration and decreased motivation. Students also express difficulty adapting to digital platforms due to inconsistent exposure caused by infrastructural issues and the uneven integration of technology by teachers. These inconsistencies create a fragmented digital learning experience that limits the development of digital literacy among students. The findings suggest that sustained and equitable exposure to digital tools is essential for promoting higher engagement and ensuring that students acquire the competencies needed in contemporary learning environments. Therefore, improving the reliability of technological infrastructure is crucial to creating meaningful and motivating learning experiences (Moustaghfir et al., 2024; Niraula, 2023; Suarniati, 2024).

From a policy perspective, the study underscores the need for improved alignment between national digital education initiatives and school-level implementation. Although the government has provided digital platforms and instructional resources, their effective use depends heavily on school readiness and ongoing support mechanisms. The lack of dedicated ICT coordinators or technical staff at SMA Negeri 4 Kaur limits the school's ability to troubleshoot issues and provide immediate assistance to teachers. This gap increases teachers' reluctance to experiment with new tools and reduces the long-term sustainability of digital initiatives. Strengthening governance structures such as appointing digital champions, establishing digital committees, and developing internal digital roadmaps could foster more cohesive and sustainable implementation. The findings emphasize that policy success requires more than distribution of tools; it demands structured school-level leadership that consistently guides and monitors digital practices.

Conclusion

The study concludes that the digitalization of learning at SMA Negeri 4 Kaur is significantly constrained by three interrelated factors: inadequate infrastructure, uneven teacher digital competence, and weak policy implementation at the school level. Limited internet connectivity and insufficient technological devices prevent consistent use of digital platforms, leading teachers to rely on traditional instructional methods. Variations in digital pedagogical skills further contribute to inconsistent classroom practices, reflecting the need for structured and continuous capacity building programs. In addition, the absence of an internal digital roadmap and insufficient technical support hinder the school's ability to translate national digital initiatives into sustainable daily practices. Overall, this study highlights that successful digital transformation requires a comprehensive ecosystem one that integrates reliable infrastructure, strengthened human resource capacity, and coherent governance. These findings emphasize the urgency of context-sensitive strategies to ensure equitable and sustainable digital learning implementation in non-urban schools.

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Conflicts of Interest

The authors declare no conflict of interest.

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