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TECHNOLOGY INTEGRATION FOR INNOVATIVE LEARNING IN SECONDARY EDUCATION: EVIDENCE FROM SENIOR HIGH SCHOOLS IN BAGAN SINEMBAH DISTRICT, INDONESIA

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ABSTRACT

This study investigates the integration of digital technology for innovative learning in senior high schools in Bagan Sinembah District, Indonesia. The rapid development of information and communication technology (ICT) has significantly transformed educational practices, shifting traditional teacher-centered instruction toward more interactive and student-centered learning environments. This research aims to explore how teachers implement digital tools such as projectors, internet resources, and animation videos in classroom instruction, as well as to identify the opportunities and challenges of technology integration in secondary education. A qualitative approach was employed through interviews and classroom observations involving teachers in selected senior high schools. The findings reveal that technology is actively used to support teaching and learning processes, enhancing students' engagement, motivation, and conceptual understanding. Teachers also reported that digital media contributes to more interactive and meaningful learning experiences. However, challenges such as limited infrastructure, unstable internet connectivity, and varying levels of digital competence among teachers were also identified. The study further highlights that successful technology integration is strongly influenced by teachers' pedagogical readiness, creativity, and positive attitudes toward ICT. In addition, school leadership and institutional support play an essential role in sustaining innovation in classroom practices. Overall, technology integration is not merely a supporting tool but a strategic component in promoting innovative learning in secondary education.

Keywords: Technology Integration, ICT, Innovative Learning, Secondary Education, Digital Media, Teacher Competence

1. INTRODUCTION

The rapid advancement of digital technology has brought significant changes across various sectors, including education (Salmia & Yusri, 2021). These developments have not only influenced the way people access information but have also transformed teaching methods and the ways students understand learning materials. Technological innovations such as the internet, social media, mobile devices, and artificial intelligence have had a substantial impact on educational systems at all levels, from primary schools to higher education institutions (Ahmadi, as cited in Nuraeni, 2024). This transformation requires educational institutions to adapt their instructional practices to remain relevant to the evolving needs of learners in the digital era.

In line with these developments, modern education is expected to equip students with essential twenty-first-century competencies, including creativity, critical thinking,

communication, and collaboration. These skills are considered fundamental for preparing learners to respond effectively to global challenges in an increasingly dynamic world. Consequently, teachers are required not only to deliver academic content but also to facilitate innovative learning experiences through the effective use of technology. In this context, educators must demonstrate initiative, continuously develop innovative teaching strategies, and encourage positive changes in students' learning processes and outcomes (Amelia, 2023).

The integration of technology in education has become an essential element in promoting innovative learning practices in the twenty-first century. Digital technologies enable teachers to create interactive, student-centered learning environments that foster collaboration, creativity, critical thinking, and problem-solving skills. In secondary education, the use of digital tools not only improves access to learning resources but also enhances the quality of instruction when supported by appropriate pedagogical approaches. Empirical evidence shows that effective technology integration contributes significantly to improving teaching practices and student learning outcomes, particularly when teachers possess adequate digital competence and schools provide institutional support (Konstantinidou & Scherer, 2022; Sosa-Díaz et al., 2022). Therefore, technology integration is increasingly viewed as a strategic approach to strengthening innovative learning and preparing students with the competencies required in the digital era.

Despite the growing importance of educational technology, its implementation in schools remains uneven, especially in rural and non-urban areas. Challenges such as limited infrastructure, inadequate teacher training, lack of pedagogical support, and unequal access to digital resources continue to hinder the effective integration of technology into classroom practices. Studies indicate that the presence of technological facilities alone does not guarantee innovative learning outcomes unless schools are able to align technology use with pedagogical goals and institutional readiness (Petko et al., 2018; Scherer et al., 2021). Furthermore, recent reviews highlight that successful technology integration in secondary education depends on a combination of teacher readiness, leadership support, and systematic school planning, all of which are often underdeveloped in less advantaged educational contexts (Dlamini & Mbatha, 2024). These findings suggest that technology integration should be understood not merely as access to devices, but as a comprehensive process involving pedagogical, organizational, and contextual dimensions.

The integration of technology for innovative learning has been widely discussed in educational research, particularly regarding its role in enhancing student engagement, improving instructional quality, and developing twenty-first-century skills. Previous studies have shown that digital technology can support interactive and student-centered learning when teachers possess adequate digital competence and schools provide sufficient institutional support (Konstantinidou & Scherer, 2022; Sosa-Díaz et al., 2022). However, much of the existing literature has focused on general patterns of technology integration in urban or well-resourced educational environments. As a result, there remains limited empirical evidence on how technology integration is implemented in rural secondary schools where infrastructural limitations, unequal access to resources, and varying teacher readiness may significantly influence instructional innovation.

Although technology integration has increasingly been recognized as a strategic approach to fostering innovative learning in secondary education, its implementation in many schools remains inconsistent, particularly in rural contexts. Recent studies indicate that while digital tools are available in many educational settings, teachers often struggle to integrate them effectively into student-centered pedagogical practices. Technology use in classrooms frequently remains at the substitution level, serving only as a medium for presenting content or distributing

assignments, rather than enabling interactive, collaborative, and inquiry-based learning experiences (Tondeur et al., 2023; Zhao et al., 2024). This suggests that the transformative potential of technology to support creativity, critical thinking, communication, and collaboration has not yet been fully achieved in many secondary schools.

The challenges of technology integration are more pronounced in rural schools, where limitations in infrastructure, internet connectivity, digital literacy, and institutional readiness continue to impede effective implementation. Recent evidence shows that teachers in under-resourced schools often lack both the technological competence and pedagogical support necessary to design innovative learning experiences using digital tools (Cabero-Almenara et al., 2024; Falloon, 2024). Furthermore, school leadership and policy support are often insufficient to sustain meaningful integration practices, causing a disconnect between educational technology policies and classroom realities. As a result, innovative learning remains difficult to implement consistently, and the intended benefits of digital transformation for improving student engagement and learning outcomes are not fully realized.

These issues are particularly relevant in senior high schools in Bagan Sinembah District, where differences in school readiness, teacher capability, and access to technological resources may significantly affect the implementation of innovative learning practices. Despite increasing expectations for schools to integrate technology into instruction, empirical studies examining how teachers in rural Indonesian secondary schools adopt and utilize digital technology for innovative learning remain limited. In particular, there is inadequate understanding of the contextual barriers teachers encounter and the institutional factors that support successful implementation in such settings (Howard et al., 2023; Ifinedo et al., 2024). Without this understanding, efforts to promote innovative learning through technology integration may fail to address the specific needs of rural schools. Therefore, examining technology integration practices in senior high schools in Bagan Sinembah District is necessary to identify the actual challenges and formulate context-based strategies for strengthening innovative learning.

Another gap in the literature concerns the contextual understanding of technology integration practices in Indonesian secondary education, especially in rural districts. Although several studies have examined barriers to educational technology adoption, they often emphasize technical constraints such as infrastructure and internet access while paying less attention to the pedagogical and organizational dimensions of implementation. In particular, there is insufficient research exploring how teachers in rural schools integrate technology into classroom instruction to promote innovative learning, how school conditions affect this process, and what contextual challenges hinder effective implementation. This gap is important because successful technology integration depends not only on the availability of digital tools but also on the readiness of teachers and institutions to use those tools meaningfully in teaching and learning processes.

Based on these gaps, the novelty of this study lies in its focus on the implementation of technology utilization for innovative learning in senior high schools located in Bagan Sinembah District, Indonesia, a rural educational context that has received limited scholarly attention. Unlike prior studies that mainly investigate general technology adoption, this research specifically examines how technology is used pedagogically to support innovative learning, identifies the contextual barriers faced by teachers, and explores the institutional factors that influence implementation in rural secondary schools. Therefore, this study offers a context-specific contribution by providing empirical evidence on the realities of technology integration in underrepresented educational settings and by generating practical insights for developing strategies to strengthen innovative learning through technology in rural secondary education.

2. METHODOLOGY

Mixed-methods research integrates both quantitative and qualitative data in a single study to obtain a more complete understanding of complex research issues. Similarly, Sugiyono (2016) states that combining these two approaches enhances the completeness and validity of research findings.

To collect the data, this study used questionnaires and interviews as the primary research instruments. The questionnaire was distributed to students to obtain quantitative data related to their perceptions of technology use in the learning process. This instrument was intended to identify students' views regarding the effectiveness, accessibility, and benefits of digital technology in supporting innovative learning activities. Meanwhile, semi-structured interviews were conducted with teachers to gather qualitative data concerning their experiences, perceptions, and strategies in utilizing technology to enhance classroom instruction. As explained by Cohen, Manion, and Morrison (2018), the use of questionnaires and interviews in mixed-methods studies enables researchers to gather both measurable responses and in-depth explanatory information, thereby strengthening the interpretation of the findings. The use of these two instruments in this study made it possible to obtain a comprehensive picture of how technology was integrated into innovative learning practices in the selected schools.

This study was conducted in the context of senior high schools in Bagan Sinembah District, Rokan Hilir Regency, Indonesia, which were selected as the research location due to the implementation of technology in learning activities. The selection of this area was based on purposive considerations, particularly the presence of varying levels of technology integration across schools, making it relevant for investigating innovative learning practices. The participants of this study consisted of students and teachers as key informants who were directly involved in classroom learning processes supported by digital technology.

The quantitative data obtained from questionnaires were analyzed using descriptive statistical techniques to describe students' perceptions of technology use in learning. Meanwhile, qualitative data from interviews with teachers were analyzed using descriptive thematic analysis by identifying patterns and themes emerging from participants' responses.

3. RESULTS

The rapid development of digital technology has significantly transformed various aspects of life, including education. These transformations have changed not only how information is accessed but also how teachers design instruction and how students engage with learning materials. Recent studies emphasize that information and communication technology (ICT) plays a crucial role in improving teaching and learning processes by enabling access to resources, fostering collaboration, and supporting personalized learning experiences (Msafiri et al., 2023). In this regard, ICT is increasingly recognized as a fundamental component in modern education systems. Empirical research highlights that effective ICT integration requires not only technological access but also pedagogical competence and institutional support to ensure meaningful learning experiences (Social Sciences & Humanities Open, 2024). This indicates that technology use in education must be aligned with instructional goals rather than used as a supplementary tool.

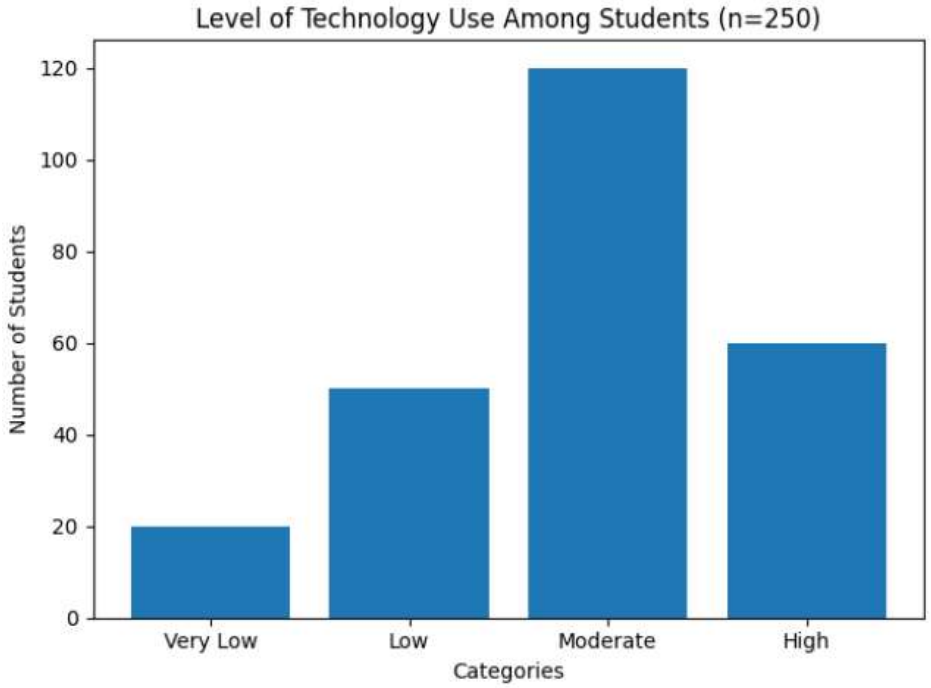
The rapid development of information and communication technology (ICT) has significantly transformed various sectors of life, including education. In contemporary learning environments, the integration of digital technology is considered essential for improving educational quality and enhancing students' learning experiences. Research shows that the use

of digital tools in education can increase student engagement, motivation, and active participation when appropriately integrated into instructional practices (Fraillon et al., 2020; Tondeur et al., 2017). In secondary education contexts, technology is increasingly used to support instructional delivery, communication, and learning interaction between teachers and students.

Findings from questionnaire data collected from students in senior high schools in Bagan Sinembah District indicate that students use technology at a moderate frequency in their learning activities. The data reveal that digital devices such as smartphones, learning applications, and online platforms are commonly utilized for accessing learning materials and completing assignments. This suggests that technology has begun to be integrated into students' daily learning practices, although its use is still largely limited to supportive rather than transformative learning activities.

The level of technology use in learning in this study is categorized into four adjusted ranges. A range of 0%–20% is classified as very low usage, indicating that students rarely engage with digital tools for learning purposes. The 21%–40% range is considered low, where technology use remains minimal and mostly incidental. The 41%–70% range is categorized as moderate, showing that students occasionally use technology in learning, particularly for information access and task completion. Finally, the 71%–100% range is classified as high usage, where technology is consistently integrated into learning activities and supports more interactive and innovative learning experiences (OECD, 2019; Fraillon et al., 2020).

Overall, these findings indicate that while technology integration in senior high schools in Bagan Sinembah District has progressed, it is still in a developing stage. Strengthening teacher guidance, instructional design, and school-level support is essential to move from moderate to high-impact technology integration that truly supports innovative learning.



Picture 1. Level of Technology Use Among Students

The findings indicate that the majority of students fall within the moderate level of technology use, with 120 students (48%) categorized in this range. This suggests that digital technology is increasingly integrated into learning activities, particularly for accessing information, completing assignments, and supporting classroom instruction. However, its use

remains partially structured and not yet fully optimized for interactive or transformative learning experiences.

Meanwhile, 60 students (24%) are categorized in the high usage level, indicating that nearly one-quarter of respondents consistently engage with digital tools in their learning processes. This group reflects students who are more familiar with technology-enhanced learning environments and are able to utilize digital platforms for more active and independent learning activities.

In contrast, 50 students (20%) are classified under the low usage level, while 20 students (8%) fall into the very low category. These results highlight that a proportion of students still have limited exposure to or engagement with educational technology. This condition may be influenced by differences in access, digital literacy, or instructional practices within the classroom.

Overall, the distribution shows a positive but uneven pattern of technology integration, where most students are at a developing stage of digital learning adoption. This finding emphasizes the need for more consistent instructional design, teacher digital competence development, and school-level support to shift students from moderate to high-level technology use, thereby strengthening innovative learning practices in secondary education.

These findings are consistent with previous literature indicating that digital media can positively contribute to the development of elementary school students' character, particularly in fostering creativity and independence. Students who actively engage with digital media—for instance, by creating content or participating in educational games—tend to demonstrate stronger creative thinking skills and greater autonomy in dealing with challenges in both virtual and real-life contexts (Cipta et al., 2023).

Therefore, the roles of teachers and parents are crucial in guiding students toward the positive use of technology. Providing digital ethics education, implementing active supervision, setting reasonable screen-time limits, and maintaining open communication between schools and families are key strategies to ensure a safe, meaningful, and balanced learning environment.

4. DISCUSSION

The strategy of integrating technology for innovative learning in senior high schools in Bagan Sinembah District, Indonesia, is implemented in an active and comprehensive manner. Various digital tools such as internet access, projectors, television media, and students' smartphones are incorporated into classroom learning, while teachers maintain close supervision to ensure responsible and meaningful use.

To illustrate the classroom situation, a teacher explained, "*When I use the projector or online materials, students become more focused and enthusiastic. They also respond better when learning is visual and interactive*" (Teacher A, personal communication, April 15, 2026). This reflects how technology helps transform traditional instruction into a more engaging learning experience.

In addition, collaborative learning is widely applied through group-based activities that encourage students to share devices when technological resources are limited. This co-learning approach not only promotes cooperation but also increases student engagement. As another teacher stated, "*Even if we only have a few devices, students can still learn effectively because they work together in groups and help each other understand the materi*al" (Teacher B, personal communication, April 15, 2026). Such practice supports previous findings that collaborative,

technology-supported learning enhances participation and optimizes limited resources (Rizal et al., 2024).

To strengthen teachers' competence, internal training programs are routinely conducted in the school. The Curriculum Coordinator shared, "*We conduct internal training sessions, and I personally act as the resource person to demonstrate the use of projectors, television media, and internet-based learning tools*" (personal interview, April 15, 2026). This aligns with Caswita (2020), who highlights that in-house training effectively improves teachers' ability to integrate ICT into teaching practices.

The principal also plays a key role in driving innovation. One teacher noted, "*Our principal does not wait for change; he actively encourages us to try new methods and supports every creative idea*" (Teacher C, personal communication, April 15, 2026). This leadership approach creates a positive and supportive school climate for innovation.

Overall, these interactive teacher responses show that technology integration is not only a policy but also a lived classroom practice that enhances engagement, collaboration, and innovation in learning within the schools of Bagan Sinembah District

The strategy of integrating technology for innovative learning in senior high schools in Bagan Sinembah District, Indonesia, is implemented in an active and comprehensive manner. Various digital tools such as internet access, projectors, television media, and students' smartphones are incorporated into classroom learning, while teachers maintain close supervision to ensure responsible and meaningful use.

To illustrate the classroom atmosphere, one teacher explained, "When I combine explanations with videos or slides, students become more attentive. They ask more questions and seem more confident in expressing their ideas" (Teacher R, personal communication, April 16, 2026). This indicates that visual and digital media can stimulate student participation and improve classroom interaction.

Another teacher shared a similar experience, "Students are more engaged when technology is used. Even those who are usually passive become more active during interactive learning sessions" (Teacher S, personal communication, April 17, 2026). This reflects how technology helps create a more inclusive and participatory learning environment.

In addition, collaborative learning is widely applied through group-based activities that encourage students to share devices when technological resources are limited. One teacher stated, "Even with limited devices, students can still complete their tasks effectively because they support each other in groups and divide responsibilities fairly" (Teacher T, personal communication, April 18, 2026). This co-learning approach strengthens cooperation skills while maximizing available resources, in line with Rizal et al. (2024), who emphasize the effectiveness of collaborative, technology-supported learning.

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Teachers also reflect on practical challenges in implementation. One teacher noted, "*Sometimes the internet connection is unstable, so we prepare offline learning materials as an alternative solution to ensure continuity of learning*" (Teacher U, personal communication, April 20, 2026). This shows the adaptability of teachers in overcoming technological constraints.

The principal also plays an important role in driving innovation. A teacher remarked, "*Our principal is very supportive. He encourages us to experiment with new teaching methods and always appreciates innovative practices in the classroom*" (Teacher V, personal communication, April 20, 2026). This leadership approach fosters a positive and innovative school culture.

These interactive teacher responses show that technology integration is not merely a policy, but a real classroom practice that enhances student engagement, collaboration, and teacher adaptability in senior high schools in Bagan Sinembah District.

5. CONCLUSION

This study highlights that the integration of digital technology plays a significant role in supporting innovative learning in secondary education. The use of tools such as projectors, internet-based resources, and animation videos contributes to more engaging, interactive, and student-centered learning processes. These technologies help improve students' motivation, conceptual understanding, and active participation in the classroom. Furthermore, the findings indicate that technology integration is not only dependent on the availability of infrastructure, but also strongly influenced by teachers' competence, creativity, and readiness to adapt to digital learning environments. Teachers' positive attitudes toward technology significantly determine the effectiveness of its implementation in classroom practices.

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