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Optimizing The Utilization of Information and Communication Technology as Learning Resources in The Digital Era at SMPN 4 Bataguh

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A B S T R A C T

This study aims to describe the optimization of Information and Communication Technology (ICT) utilization as a learning resource in the digital era at SMPN 4 Bataguh. The research focuses on teachers' strategies in utilizing ICT to support the effectiveness and interactivity of the teaching and learning process. A descriptive qualitative approach was employed, with data collected through observations, interviews, and documentation. The findings indicate that ICT has been applied in various forms, including online learning applications, interactive learning media, and digital-based academic administration. Nevertheless, the utilization of ICT has not been optimally implemented. Several obstacles were identified, such as limited internet infrastructure, differences in teachers' digital literacy levels, and the absence of continuous professional training related to ICT use in learning. These conditions affect the consistency and effectiveness of ICT integration in classroom practices. Therefore, strengthening teachers' digital competencies and improving ICT facilities are essential to support effective and sustainable learning processes.

1. Introduction

The transformation of education in the digital era demands that schools integrate Information and Communication Technology (ICT) across all aspects of teaching and learning. ICT is no longer perceived merely as a supplementary tool, but as an essential component of modern education systems that promote active, collaborative, and data-driven learning environments (Amin, 2025). Through digital technology, learning becomes more flexible, supports personalized instruction, and enables faster and broader access to information (Amrullah et al.,

2025). Despite these advantages, empirical evidence shows that many schools particularly those located in non-urban areas have not yet optimized ICT as an effective learning resource. SMPN 4 Bataguh represents one such school that has begun integrating digital technology into instructional and academic management processes, although the level of utilization remains varied.

At the secondary education level, ICT plays a critical role in expanding access to knowledge, increasing instructional efficiency, and fostering independent learning habits among students. However, the success of ICT integration is not solely determined by the availability of technological infrastructure. Equally important are the readiness, competence, and pedagogical skills of teachers who are responsible for integrating technology into meaningful learning activities. Preliminary observations at SMPN 4 Bataguh indicate that while ICT has been introduced into classroom practices, not all teachers are able to fully exploit its pedagogical potential. This situation underscores the importance of examining how ICT can be strategically optimized as a learning resource within the school context.

The utilization of ICT in education encompasses various practices, including online learning platforms, interactive multimedia, and digital learning management systems. Research by Putra and Yuliani (2023) confirms that the application of digital technology in secondary schools contributes positively to student learning outcomes and improves instructional efficiency. Nevertheless, challenges persist, particularly in relation to teachers' digital competencies and the adequacy of school infrastructure issues that are more pronounced in non-urban regions. These findings suggest that ICT optimization should extend beyond the provision of hardware and focus on strengthening teachers' digital pedagogical capacities.

In Indonesia, the importance of digital transformation in education has been emphasized through the Merdeka Belajar policy. The Ministry of Education, Culture, Research, and Technology (Kemendikbudristek, 2021; Mulyati & Rosmaladewi, 2025) highlights that ICT should function as a foundational element in developing innovative and data-driven education systems. Digital platforms such as Merdeka Mengajar and Rapor Pendidikan are designed to support schools in planning, implementing, and evaluating learning processes. Despite these initiatives, ICT implementation remains uneven across regions, particularly in junior secondary schools where access to technological resources and institutional support is often limited.

Globally, rapid technological advancements over the past decade have reshaped educational practices and learning environments. ICT has emerged as a strategic resource that supports interactive, collaborative, and student-centered learning. Arifin and Rahayu (2022) argue that ICT has evolved into a core learning resource capable of enhancing the effectiveness and efficiency of instructional processes. Consequently, schools are required to adopt strategic approaches in optimizing ICT utilization to ensure that learning aligns with the demands of the digital era.

The integration of ICT is closely aligned with the principles of 21st-century learning, which emphasize the development of critical thinking, communication,

collaboration, and creativity. Digital tools enable students to engage actively with learning materials, collaborate with peers, and express ideas creatively. Supporting this view, Putra and Yuliani (2023) demonstrate that the use of digital media significantly increases student engagement and enriches learning experiences. However, the implementation of ICT in schools often encounters practical constraints, including limited internet connectivity, varying levels of digital literacy among educators, and insufficient institutional support for sustained technological innovation.

From a theoretical perspective, ICT consists of hardware, software, and network systems that facilitate communication, information processing, and data storage (Hartati et al., 2025; Mustika et al., 2024; Harini et al., 2024). In educational contexts, ICT functions both as a learning medium and as a learning resource that enhances interaction between teachers and students. Kajian et al. (2025) classify ICT utilization in education into three primary functions: instructional support tools, independent learning resources, and technology-based evaluation media. Similarly, Khosyiin & Khoiiri (2024) emphasizes that ICT significantly improves instructional effectiveness when integrated appropriately into learning processes.

Conceptually, optimizing ICT utilization as a learning resource is not determined merely by the presence of digital devices. Instead, it is shaped by the interaction among infrastructure readiness, teachers' digital pedagogical competence, and institutional leadership support (Sudi et al., 2024; Han, 2024; Susanti et al., 2023). These dimensions collectively influence how ICT is managed, utilized, and sustained within school environments. While various ICT-based instructional models such as blended learning or flipped classrooms have been widely studied, this research focuses on ICT as a strategic learning resource rather than on the effectiveness of specific instructional models.

Although numerous studies have examined ICT integration in education, most focus on measuring teachers' digital literacy or evaluating the effectiveness of particular digital platforms using quantitative approaches. These studies are predominantly conducted in urban or well-resourced schools, where technological infrastructure and institutional support are relatively adequate (Putra & Yuliani, 2023; Arifin & Rahayu, 2022; Faza et al., 2024). As a result, limited attention has been given to how ICT is strategically managed and optimized in non-urban school contexts.

Furthermore, existing research often treats ICT primarily as a technical tool, rather than as an institutional learning resource shaped by leadership policies, pedagogical decision-making, and organizational support systems. Studies exploring the roles of school leadership, teacher practices, and contextual challenges in non-urban junior secondary schools remain scarce. In addition, prior research tends to emphasize outcome-based perspectives such as student achievement—while providing limited insight into the processes, strategies, and challenges underlying ICT integration in everyday teaching practices. This creates a significant gap in understanding how ICT utilization is systematically planned, supported, and evaluated within schools, particularly in contexts with limited resources.

Therefore, this study aims to analyze strategies for optimizing the utilization of Information and Communication Technology (ICT) as a learning resource at SMPN 4 Bataguh. The study focuses on teachers' instructional practices, institutional support, and contextual challenges within a non-urban junior secondary school setting. By identifying both supporting and inhibiting factors, this research is expected to contribute practical recommendations for schools and policymakers in strengthening sustainable and context-sensitive ICT-based learning practices.

2. Methodology

This study employed a qualitative research design with a descriptive approach, as proposed by Suriyati & Ramadani (2024). A qualitative descriptive method was considered appropriate because it allows for an in-depth and contextual understanding of social phenomena as they naturally occur within real-life settings. In this research, the approach was used to explore and describe how Information and Communication Technology (ICT) is utilized and optimized as a learning resource at SMPN 4 Bataguh, particularly in relation to teaching practices, school management, and institutional support.

The research subjects consisted of the school principal, three teachers, and two educational staff members selected through purposive sampling. Participants were chosen based on their direct involvement and active roles in the planning, implementation, and management of ICT within the school environment. The school principal provided insights related to leadership, policy direction, and institutional decision-making regarding ICT integration. Teachers represented classroom-level ICT implementation in instructional practices, while educational staff contributed perspectives on technical support, administrative management, and the operational use of digital systems.

Data were collected using multiple qualitative techniques to ensure depth and credibility. In-depth interviews were conducted to capture participants' experiences, perceptions, and strategies related to ICT utilization in learning activities. Direct observations were carried out to examine the actual implementation of ICT during classroom instruction, school administrative processes, and the conduct of Computer-Based National Assessments (ANBK). Documentation studies were also undertaken to analyze relevant school records, lesson plans, digital learning platforms, assessment reports, and institutional policy documents related to ICT use. Data collection was conducted over a two-month period, from August to September 2025, allowing sufficient time for repeated observations and follow-up interviews.

Data analysis followed the interactive model proposed by Miles and Huberman (2014), consisting of data reduction, data display, and conclusion drawing or verification. During data reduction, interview transcripts, observation notes, and documents were systematically reviewed, coded, and categorized to identify emerging themes related to ICT utilization and optimization. The data display stage involved organizing the reduced data into narrative descriptions and thematic

matrices to facilitate pattern recognition and interpretation. Conclusions were then drawn through continuous comparison across data sources, with verification conducted throughout the analysis process to maintain analytical rigor.

To ensure the trustworthiness of the findings, this study applied several validation strategies commonly used in qualitative research. Source triangulation was conducted by comparing information obtained from different participants, while method triangulation was achieved by cross-checking data from interviews, observations, and documentation (Namiri et al., 2023). Member checking was also employed by returning preliminary findings to participants to confirm the accuracy and credibility of interpretations. These procedures were implemented to minimize researcher bias and enhance the dependability and confirmability of the findings.

It is important to clarify that this study did not adopt a Systematic Literature Review (SLR) methodology. Therefore, procedures typically associated with SLR such as structured database search strategies (e.g., Scopus, Web of Science, or ERIC), predefined inclusion and exclusion criteria, formal quality assessment instruments, and transparent synthesis flow diagrams were not applied in this research. The literature reviewed in this study served solely as a theoretical and conceptual foundation to support data interpretation and discussion, rather than as the primary data source. Consequently, the credibility and validity of the findings were ensured through empirical field data, methodological triangulation, and rigorous qualitative analysis, rather than through bibliometric coverage or systematic literature synthesis.

3. Results and Discussion

Utilization of ICT in Teaching and Learning at SMPN 4 Bataguh

The findings reveal that ICT utilization at SMPN 4 Bataguh is not uniform among teachers, indicating varying levels of pedagogical integration rather than mere frequency of use. While most teachers employ ICT for preparing instructional materials and delivering content through PowerPoint, Canva, and Google Classroom, a smaller group demonstrates deeper pedagogical integration by using ICT to facilitate collaborative learning, independent inquiry, and project-based activities. This pattern suggests that ICT use at the school operates along a continuum from substitutional use to more transformative practices rather than a single homogeneous model.

Comparatively, these findings partially align with Khusnainy & Rosmaladewi (2025), who reported that ICT integration significantly enhances student engagement when it is embedded within student-centered pedagogical approaches. However, unlike the contexts described by Khusnainy & Rosmaladewi, where institutional training systems were already established, ICT use at SMPN 4 Bataguh remains highly dependent on individual teacher readiness and leadership support. This contrast highlights that access to technology alone does not automatically

result in pedagogical transformation; rather, it must be accompanied by structured professional development and instructional guidance.

An important pattern emerging from the data is the role of academic supervision conducted by the school principal, as illustrated in Figure 1. Teachers who received consistent supervision and constructive feedback demonstrated greater confidence and creativity in integrating ICT beyond its use as a mere presentation tool. This finding supports Koesnandar (2020), who argues that academic supervision functions as a mediating mechanism that translates policy expectations into concrete classroom practices. The implication of this finding is that leadership-driven supervision plays a critical role in reducing pedagogical gaps among teachers and fostering more equitable ICT integration within schools, particularly in non-urban educational settings.

Figure 1. ICT-based Mathematics learning activities with supervision by the school principal at SMPN 4 Bataguh.

Utilization of ICT in the Computer-Based National Assessment (ANBK)

The implementation of the Computer-Based National Assessment (ANBK) at SMPN 4 Bataguh represents a distinct and contrasting form of ICT utilization when compared to its use in daily classroom instruction. While the integration of ICT in teaching and learning activities varies significantly among teachers due to differences in digital competence and pedagogical readiness, ICT use in ANBK is standardized, structured, and mandatory for all participants. This condition leads to a more uniform and consistent adoption of technology among both teachers and students during the assessment process. However, such uniformity is primarily procedural in nature, as the assessment format allows limited space for pedagogical innovation or instructional creativity. Therefore, assessment-driven ICT integration tends to emphasize operational efficiency and compliance rather than flexible and transformative learning practices.

In comparison with Adinda et al. (2025) findings, which emphasize ICT as a tool for administrative efficiency and learning effectiveness, the ANBK implementation

at SMPN 4 Bataguh confirms the administrative efficiency dimension but only partially addresses learning transformation. While ANBK strengthens students' digital literacy and familiarity with technology-based systems, it does not automatically translate into innovative instructional practices. This suggests that assessment-based ICT utilization functions more as an entry point rather than a comprehensive driver of digital pedagogy.

The broader implication of this pattern, as presented in Figure 2, is that repeated exposure to ICT through assessment mechanisms can gradually normalize digital practices within the school culture and reduce resistance toward digital systems. Over time, both students and teachers become more familiar and confident in using technology as part of routine academic activities. However, without deliberate pedagogical alignment, such exposure risks positioning technology merely as a technical requirement rather than as a meaningful learning tool. Consequently, ICT utilization may reinforce a procedural and compliance-oriented understanding of technology, instead of fostering the development of critical thinking, creativity, and problem-solving skills. This concern is consistent with previous studies, which emphasize that technology adoption driven primarily by policy mandates often prioritizes functionality and efficiency over deeper pedagogical transformation.

Figure 2. Utilization of ICT in the implementation of the Computer-Based National Assessment (ANBK) at SMPN 4 Bataguh

Challenges in Optimizing ICT Utilization

Despite positive developments, the findings indicate that ICT optimization at SMPN 4 Bataguh is constrained by interrelated structural and human-resource challenges. Limited internet bandwidth restricts the use of synchronous online learning, while uneven teacher competencies result in fragmented instructional practices. Comparatively, Rahmadini & Syafruddin (2024) emphasize that schools with participatory leadership models demonstrate stronger collaborative responses to similar constraints. In contrast, collaboration among teachers at SMPN 4 Bataguh

remains informal and inconsistent, limiting the sustainability of ICT-based innovation.

These challenges suggest that ICT implementation should be understood as a systemic issue rather than an individual responsibility. The interaction between infrastructure limitations, pedagogical readiness, and institutional collaboration forms a reinforcing cycle that either enables or constrains ICT optimization. Extending Kristen et al. (2017) framework, this study highlights leadership-driven collaboration and peer learning as critical mediating variables that determine whether ICT use evolves from basic adoption to meaningful pedagogical integration.

Strategies for Optimizing the Utilization of Information and Communication Technology (ICT)

The proposed strategies indicate that ICT optimization must be understood as a long-term process of institutional transformation rather than a short-term technological intervention. In non-urban school contexts such as SMPN 4 Bataguh, a gradual and context-sensitive integration of ICT, supported by strong leadership commitment, is more effective in fostering sustainable change. Continuous teacher professional development plays a crucial role in ensuring that technology is meaningfully integrated into pedagogical practices. Furthermore, the alignment between infrastructure development and teachers' pedagogical capacity building enables schools to utilize ICT in ways that are adaptable to local constraints. As a result, ICT initiatives can remain responsive to evolving educational needs while supporting long-term instructional improvement.

Methodological Limitations and Research Implications

While this study provides contextual insights into ICT utilization, several methodological limitations should be acknowledged. First, the focus on a single junior secondary school limits the generalizability of the findings, particularly when compared to large-scale quantitative studies reviewed in the literature. Second, the qualitative nature of the data emphasizes depth over representativeness, which may limit comparative claims across different institutional contexts. Third, reliance on observations and self-reported data introduces potential subjectivity, a limitation also identified in several ICT integration studies reviewed.

Nevertheless, these limitations were addressed through the application of data triangulation and prolonged engagement, which helped to ensure the credibility, consistency, and trustworthiness of the research findings. The use of multiple data sources allowed the researcher to cross-verify information and minimize potential bias arising from single-source data. Prolonged engagement in the research setting also enabled a deeper understanding of the school context and participants' actual practices in ICT utilization. Despite these efforts, further research is still needed to strengthen and expand the scope of understanding in this field. Therefore, future studies are encouraged to employ comparative multi-school designs and mixed-

method approaches to examine how leadership, infrastructure, and pedagogical training interact across diverse educational settings.

4. Conclusion

The utilization of Information and Communication Technology (ICT) at SMPN 4 Bataguh has shown meaningful progress in supporting the teaching and learning process. Teachers have integrated digital media into instructional activities, while the school principal has played an active role in providing academic supervision and managerial support to encourage the effective use of ICT. However, the optimization of ICT utilization remains constrained by infrastructural limitations and the need for sustained professional development for teachers. This condition indicates that ICT implementation at the school level requires continuous institutional support to ensure its sustainability and effectiveness.

This study underscores that the successful integration of ICT in non-urban school contexts is strongly influenced by the development of teachers' digital competencies, the availability of adequate technological facilities, and collaborative leadership between teachers and school management. The findings suggest that ICT should be positioned not merely as a technical tool, but as a strategic educational resource that supports instructional innovation and organizational learning within schools. Such a perspective reinforces the importance of aligning technological initiatives with pedagogical goals and school development strategies.

Furthermore, this study offers practical insights for schools facing similar contextual challenges by emphasizing the importance of gradual and context-sensitive ICT integration. Future research is encouraged to explore ICT utilization across different school contexts and to examine in greater depth how teachers' digital competence influences learning processes and educational quality in qualitative and mixed-method approaches. This direction is expected to enrich the understanding of ICT integration by capturing both contextual dynamics and pedagogical implications.

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