

Challenges of Digital Technology in Promoting Digital Learning at SMP Islam Terpadu An-Nur

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Abstract: This study examines the challenges of digital technology in promoting digital learning at An-Nur Integrated Islamic Junior High School amidst the era of disruption and the Industrial Revolution 4.0. The urgency of this research lies in the vital need for educational institutions to adapt and equip students with 21st-century skills through technology integration. The goal is to build a holistic and sustainable digital learning ecosystem. The study employed a qualitative approach with a comprehensive strategy, emphasizing teacher capacity building as a key pillar. This was achieved through regular training and the use of artificial intelligence (AI), supported by adaptive leadership. Data collection techniques included observation, in-depth interviews, and documentation. Findings indicate that although the school has provided modern hardware and software, significant challenges arise related to infrastructure, particularly internet access and stability, due to limited service providers. The school responded by considering proactive solutions such as satellite internet and community education, as well as implementing adaptive budget allocations for teacher training and educational technology. An integrated monitoring and evaluation system, including regular teacher meetings that facilitate discussion and collaborative problem-solving, ensures the initiative runs optimally. In conclusion, SMP IT An-Nur has demonstrated significant progress in fostering a culture of innovation and experimentation through budget flexibility, KPI-based human resource development, and transformational leadership to address digital challenges.

Keywords: Digital Technology, Digital learning, Digital Infrastructure, Adaptive Leadership, SMP IT An-Nur

Abstrak: Studi ini meneliti tantangan teknologi digital dalam mendorong pembelajaran digital di SMP Islam Terpadu An-Nur di tengah era disrupsi dan Revolusi Industri 4.0. Urgensi penelitian ini terletak pada kebutuhan vital lembaga pendidikan untuk beradaptasi dan membekali siswa dengan keterampilan abad ke-21 melalui integrasi teknologi. Tujuannya adalah membangun ekosistem pembelajaran digital yang holistik dan berkelanjutan. Studi ini menggunakan pendekatan kualitatif dengan strategi komprehensif, menekankan peningkatan kapasitas guru sebagai pilar utama. Hal ini dilakukan melalui pelatihan reguler dan penggunaan kecerdasan buatan (AI), yang didukung oleh kepemimpinan adaptif. Teknik pengumpulan data meliputi observasi, wawancara mendalam, dan dokumentasi. Temuan menunjukkan bahwa meskipun sekolah telah menyediakan perangkat keras dan perangkat lunak modern, tantangan signifikan muncul terkait infrastruktur, khususnya akses dan stabilitas internet, karena keterbatasan penyedia layanan. Sekolah menanggapi hal ini dengan mempertimbangkan solusi proaktif seperti internet satelit dan pendidikan masyarakat, serta menerapkan alokasi anggaran adaptif untuk pelatihan guru dan teknologi pendidikan. Sistem pemantauan dan evaluasi terpadu, termasuk pertemuan guru reguler yang memfasilitasi diskusi dan pemecahan masalah bersama, memastikan inisiatif berjalan optimal. Kesimpulannya, SMP IT An-Nur menunjukkan peningkatan signifikan dalam mengembangkan budaya inovasi dan eksperimen melalui fleksibilitas anggaran, pengembangan sumber daya manusia berbasis KPI, dan kepemimpinan transformasional untuk menghadapi tantangan digital.

Kata Kunci: Teknologi Digital, Pembelajaran Digital, Infrastruktur Digital, Kepemimpinan Adaptif, SMP IT An-Nur

INTRODUCTION

In this disruptive era, marked by revolutionary technological acceleration and an unstoppable wave of globalization, the education sector now faces a crucial turning point. Traditional learning paradigms, which are unidirectional and memorization-based, are no longer relevant in preparing the next generation to face the complexities of an ever-changing world. The Industry 4.0 revolution, with all its implications for automation, artificial intelligence, and digital connectivity, has fundamentally reshaped the landscape of work and social life, demanding educational institutions to undertake fundamental adaptations. This adaptation is not merely optional but a necessity to equip the younger generation with essential 21st-century skills, such as critical thinking, creativity, collaboration, and effective communication. In this dynamic context, the comprehensive integration of digital technology into the learning process, which might previously have been considered an innovative and futuristic option, has now transformed into an essential prerequisite to ensure the relevance and competitiveness of graduates (Daga, 2025). Acknowledging the urgency of this pressing adaptation, SMP Islam Terpadu An-Nur, as an educational institution with a progressive vision and commitment to quality, acutely recognizes the imperative of this digital transformation as an integral part of their educational mission.

SMP Islam Terpadu An-Nur does not merely follow trends; the school has actively formulated and established its vision not just to accommodate technology, but to build a holistic, sustainable, and future-adaptive digital learning ecosystem. This vision extends beyond the mere use of tools or applications; it instills a strong ethical commitment among all members of the school community, from educators and administrative staff to students, to actively participate and contribute to every technological initiative. The goal is to create a learning environment that is not only dynamic and relevant to the demands of the times, but also adaptive to unexpected changes and challenges, making technology a key catalyst for continuous pedagogical innovation (Missouri *et al.*, 2025). To realize this ambitious vision, the transformation from an ideal concept to concrete reality requires the implementation of a series of measurable, comprehensive, and continuous strategies. Among these strategies, strengthening the capacity of teachers through continuous professional development is its primary pillar (Rahayu *et al.*, 2025). Teachers do not only function as material deliverers but as skilled digital facilitators, pedagogical innovators, and mentors who can inspire in the digital era.

Regular training programs have become a planned and systematic routine agenda in efforts to strengthen teacher capacity. These programs are carried out through relevant government initiatives aligned with the national curriculum and internal school programs specifically designed to leverage the cutting-edge potential of artificial intelligence (AI) in supporting interactive learning and profound personalization. In the context of implementing these innovative programs, adaptive leadership plays a crucial role, not only as decision-makers but as proactive and responsive facilitators of change. An adaptive leadership approach enables school leaders to effectively engage teachers in every stage of planning, implementation, and evaluation related to digitalization programs, fostering a strong sense of ownership and collaboration (Elmanisar *et al.*, 2024). However, even though the spirit of innovation burns in every corner of the school and implementation strategies have been carefully designed with full consideration, the journey towards perfect and seamless digital learning is not free from various challenges, especially those related to adequate supporting infrastructure (Inayati *et al.*, 2025).

The availability and stability of fast and reliable internet access have become the lifeline for all digital learning operations, from rich online material access to interactive collaboration platforms and accurate and efficient computer-based evaluation. In reality, SMP IT An-Nur faces limitations where only one internet service provider is available, creating potential vulnerability to disruptions and fluctuations in service quality. Although the school has made strenuous efforts to provide adequate modern hardware such as Chromebooks for every student and teacher, as well as installing various sophisticated learning support software, network disruptions are often the main obstacle that can hinder the smooth flow of the learning process (Muntu, 2025). An effective response to dynamic infrastructure challenges and proactive support for various evolving digitalization initiatives that demand continuous updates requires high budgetary flexibility and an unwavering commitment to human resource development as the school's greatest asset (Anggraini *et al.*, 2025).

SMP IT An-Nur implements an adaptive and responsive budget allocation system, where funds can be dynamically adjusted to meet urgent needs and constantly changing strategic priorities. This includes significant investment in teacher training costs to ensure they are always at the forefront of digital competence and technology-based pedagogy, as well as the development of the most relevant and innovative educational technology in line with the latest developments. The commitment to improving human resource quality is institutionally strengthened through the implementation of strict yet supportive and constructive Key Performance Indicators (KPIs). These KPIs explicitly require every teacher to attend at least two digital training sessions per year, encouraging continuous professional development and ensuring skill relevance. Moreover, the supervision system has now transformed into digital-based supervision, allowing for more efficient monitoring and evaluation and providing constructive feedback to ensure that new knowledge and skills can be applied optimally and effectively in the classroom, bringing a real impact on learning quality (Hidayat *et al.*, 2025). This proactive budgetary flexibility and continuous HR development form a solid foundation for shaping a culture of innovation and courage to experiment among educators, encouraging them to explore new and more effective methods (Pramanda & Priyatmono, 2025). To ensure that all these crucial initiatives are on track and deliver optimal impact, as well as to identify and overcome potential obstacles that may arise from the spirit of experimentation and collaboration, SMP IT An-Nur implements an integrated monitoring and evaluation system. Regular teacher meetings function not just as ordinary administrative forums, but as active and collaborative discussion spaces where operational difficulties, complex pedagogical challenges, and potential innovations are discussed openly, transparently, and constructively (Idris *et al.*, 2025). The meetings that involve various perspectives reflect transformational leadership practices that empower teachers, staff, and other stakeholders to actively contribute to the formulation of innovative solutions (Cinantya *et al.*, 2024). Acknowledging this urgency, this research focuses on mapping the Challenges of Digital Technology and how these challenges contribute to Digital Learning at SMP Islam Terpadu An-Nur.

METHOD

This research adopts a descriptive qualitative approach, enriched with an in-depth analysis of policies and implementation in the field, to comprehensively uncover how An-Nur Integrated Islamic Junior High School designs, implements, and evaluates its digital learning program in the face of disruption. The qualitative approach was chosen because it allows researchers to gain a

holistic and contextual understanding of the phenomenon under study, namely the school's digital transformation, including the dynamics of interactions between actors, perceptions, and emerging challenges and solutions (Setiyani *et al.*, 2026). Therefore, this method goes beyond description but also explores the meaning and rationale behind each policy and practice implemented, providing a rich, detailed and nuanced picture. This aligns with the research objective of exploring best practices and innovations implemented by the school, as well as their impacts on educational quality and student learning motivation.

The subjects of this study were all stakeholders directly involved in the digital learning process at An-Nur Integrated Islamic Junior High School. This includes the principal, who sets strategic policies, and one of the teachers who implements digital learning. In addition, a student representative will be involved to provide their perspective as the primary beneficiary of the digitalization program, ensuring that the collected data is richer and reflects diverse perspectives. Subject selection is based on their vital role in the school digitalization ecosystem, ensuring that the information obtained is representative and comprehensive from various levels of implementation (Firdaus, 2025). The sampling technique used is purposive sampling, i.e., selecting subjects based on the consideration that they are key informants with relevant knowledge and experience related to the research topic. For example, the principal has a general view of the direction of digitalization of learning in schools, teachers were selected because they have direct experience with the challenges and potential of digital digital learning, and students are the primary beneficiaries of the digitalization program.

To collect relevant and in-depth data, this study will use a combination of data collection techniques, including in-depth interviews, participant observation, and documentation studies. In-depth interviews will be conducted with all research subjects to elicit information about their visions, strategies, challenges, responses, innovations, and the impact of digitalization from their respective perspectives. Interview questions will be semi-structured, allowing flexibility to explore issues that emerge organically during the conversations. Next, participant observation will be conducted within the school environment, specifically in classrooms and computer laboratories, to directly observe digital learning practices, teacher and student use of technology, and interactions. This observation will also include observations of infrastructure conditions and responses to emerging obstacles. Finally, a documentation study will involve analyzing internal school documents such as digitalization strategic plans, teacher training program reports, budget data, digital learning materials, and monitoring and evaluation results to obtain quantitative and qualitative data to support the findings from the interviews and observations.

The data collected through these three techniques will then be analyzed using a qualitative thematic approach. The analysis process will begin with the transcription of all recorded interviews with the Principal, Teachers, and Students, as well as observation notes related to the digitalization of learning at SMP IT An-Nur. The data analysis process will begin with open coding. Here, each line of a sentence or key phrase, such as 'internet access constraints' or 'teacher training is not intensive enough', will be identified and labeled with an initial code to uncover hidden meanings. Next, axial coding will be conducted to find relationships between these codes; for example, the code 'internet access constraints' can be linked to 'inadequate infrastructure' and 'impact on student motivation', creating categories such as 'Digital Infrastructure Challenges' or 'Impact of Technological Limitations on the Learning Process'. Finally, selective coding to integrate all categories around a central theme most relevant to the research objectives, ensuring that the developed storyline is logical and coherent (Nurhayati *et al.*, 2024). Selective coding will integrate

all categories around the theme "Digital Technology Challenges in Driving Digital learning at SMP IT An-Nur," ensuring that the overall analysis provides a coherent and in-depth picture of the phenomenon. For example, by highlighting how various challenges (infrastructure, human resources, curriculum) interrelate in hindering or encouraging innovation.

Data validity will be ensured through source triangulation, namely by comparing information from interviews, observations, and documents, as well as method triangulation to verify the consistency of findings. Thus, the analysis results will provide an accurate, valid, and accountable picture of the "Research Method" applied by SMP IT An-Nur in its efforts to transform learning in the digital era.

RESULT AND DISCUSSION

This research profoundly examines the implementation and impact of digital learning at SMP Islam Terpadu An-Nur. Amidst the dynamics of modern education that demand adaptation to technological advancements, SMP IT An-Nur has taken proactive steps in integrating digital technology into the teaching and learning process. This discussion will outline various important aspects of this digitalization journey, ranging from the initial vision that underpins it, the comprehensive strategies implemented, to the challenges faced, and the innovative solutions developed. By analyzing qualitative data, including in-depth interview results with relevant parties, this research aims to present a complete picture of how the digitalization of learning at SMP IT An-Nur is not just about technology adoption, but also a cultural transformation supported by adaptive leadership and human resource capacity building.

Digital Learning and a Strong Vision

This research shows that digital learning at SMP Islam Terpadu An-Nur began with a strong vision to create a learning environment that is adaptive and relevant to the challenges of the Industrial Revolution 4.0 era. This vision is realized through the formulation of comprehensive strategies that include the development of technology infrastructure, a digital-based curriculum, and human resource capacity building. The implementation of this strategy is carried out in stages, starting with the procurement of hardware and software that support interactive learning activities, followed by the development of an e-learning platform, and the integration of digital media in every subject. This process does not only focus on technical aspects but also on changing the learning paradigm from conventional to digital, thereby creating a holistic and sustainable educational ecosystem.

"So, in our school now, we are building a sustainable learning ecosystem where learning not only uses conventional learning but adapts to the times, namely digital learning. So, all school members must track technology. In fact, now we are helped by the existence of AI, machine learning, and technology tailored to our needs."

(Interview with Teacher A, April 21, 2026)

This statement from Teacher A clearly illustrates SMP Islam Terpadu An-Nur's commitment to adapting to the times through digitalization. This reflects the school's efforts to build a sustainable learning ecosystem, where technology, including AI and machine learning, is integrated to enrich students' learning experiences and equip them with 21st-century skills.

This aligns with the findings of Mustakim *et al.* (2025) who assert that technological developments, especially e-learning, bring about major changes in education and are key to meeting 21st-century learning needs. As emphasized by Irfan *et al.* (2026) in their research on digital

transformation in educational institutions, a clear vision and structured implementation strategy are the primary foundations for successful digitalization, which must involve curriculum adaptation and human resource capacity development simultaneously.

Comprehensive Strategy and Human Resource Capacity Building

In its journey, SMP IT An-Nur faced various challenges in the digitalization process, ranging from limited budgets, digital competency gaps among educators, to resistance to change. However, these challenges actually spurred the school to develop innovative solutions. Budget limitations were overcome by optimizing existing resources and seeking funding through strategic partnerships, while competency gaps were addressed through intensive training programs and continuous mentoring for teachers and staff. Rapid adaptation to technological dynamics and changing student needs is key to the school's success in maintaining the relevance and quality of digital learning, which then directly contributes to human resource capacity building and infrastructure development.

“Our strategy began with strengthening teacher capacity, where teachers were given training. Even now, there are many training sessions organized by the government for this digital learning. Then, we integrate technology in lesson planning, the practice of which is the use of AI for more interactive learning.”

(Interview with Teacher A, April 21, 2026)

Teacher A's statement underscores SMP IT An-Nur's core strategy in addressing digitalization challenges by focusing on human resource development, especially teachers. This shows that the school not only invests in technology infrastructure but also in enhancing educators' capabilities through training and AI integration, aligning with the needs of modern learning.

This is in line with the findings of Syakhrani & Usman (2025) who state that organizations that succeed in the digital era are those that see challenges as opportunities to innovate and adapt, not as hindering obstacles. Choiriyah (2025) systematically reviews that the development of digital technology has profoundly transformed education, especially in the use of digital-based learning strategies, media, and evaluation. This research emphasizes the importance of a harmonious integration between strategy, media, and evaluation to create meaningful learning experiences. This directly supports the school's approach that focuses on strengthening teacher capacity as a foundation, which is then followed by the integration of technology in lesson planning.

Adaptive Leadership and Vision Support

Human resource capacity building is a main pillar in the success of digitalization at SMP IT An-Nur, where training programs not only cover technical skills in using digital platforms and applications but also digital pedagogy that allows teachers to effectively integrate technology into the teaching and learning process. This capacity building is supported by the provision of adequate technology infrastructure, including stable internet access, the availability of computers and projectors in every classroom, and the development of a modern computer laboratory. The availability of these resources significantly increases the effectiveness of digital learning and facilitates the exploration of pedagogical innovations by educators, which ultimately simplifies the monitoring and evaluation process.

“As a school principal, I often involve teachers in the program planning process. So, teachers feel involved, and they feel ownership of the program. Thus, they can understand and support this digital learning.”

(Interview with Principal, April 21, 2026)

This statement from the Principal indicates that active teacher involvement in program planning is the main key to fostering a sense of ownership and commitment to digitalization initiatives. By feeling involved, teachers not only become implementers but also agents of change who fully understand and support the implementation of digital learning.

This aligns with research by Fradito *et al.* (2025) which emphasizes that investment in teacher professional development and the provision of robust technology infrastructure are crucial factors in maximizing the potential of digital learning. This is also stated by (Purnama *et al.*, 2025) that involving teachers in program planning is a very effective strategy to indirectly improve teacher competence, create a sense of belonging, and accountability that encourages increased professionalism and competence.

Challenges and the Role of Technology Infrastructure

The increase in human resource capacity is a main pillar in the success of digitalization at SMP IT An-Nur, where training programs not only cover technical skills for using digital platforms and applications, but also digital pedagogy that enables teachers to effectively integrate technology into the teaching and learning process. This capacity building is supported by the provision of adequate technology infrastructure, including stable internet access, the availability of computers and projectors in every classroom, as well as the development of a modern computer laboratory. The availability of these resources significantly increases the effectiveness of digital learning and facilitates the exploration of pedagogical innovations by educators, which ultimately simplifies the monitoring and evaluation process.

"At our school, the budget is flexible depending on our needs at school. Well, we usually budget for teacher training costs, but they find their own training providers. Based on our habits, we also usually hold for the development of educational technology, which, as I said earlier, is adjusted to the needs of the school."

(Interview with the Principal, April 21, 2026)"

The Principal's statement indicates that although SMP IT An-Nur has made significant investments in providing digital hardware, with a total of 30 Chromebook units through assistance in 2023 and 2025, and also providing various supporting applications, there are serious obstacles on the internet connectivity side. Dependence on a single provider with frequent disruptions can hinder the smooth running of digital learning processes that require a stable connection. The specific impacts include hindered student and teacher access to e-learning platforms, difficulties in downloading or uploading learning materials, and delays in online communication, which can ultimately reduce the effectiveness of utilizing the hardware and software that has been provided.

Paputungan *et al.* (2025) emphasize that the success of innovation heavily depends on the synergy between infrastructure readiness, teacher capacity, and policy support. Although the school faces challenges on the internet connectivity side, your efforts in securing hardware (30 Chromebook units) are concrete steps in line with the "infrastructure readiness" emphasized by Paputungan *et al.*, (2025). The availability of these devices, although often used for TKA, shows a physical foundation for digital learning. This is proof that the school invests in providing the necessary tools to support digital learning.

In addition, the provision of various applications for teachers and students reflects a commitment to "teacher capacity" and "policy support" from the software side. Providing access to diverse applications empowers teachers to experiment with digital learning strategies and enables

students to interact with educational content. This shows that the school not only provides physical devices but also digital tools that support the learning ecosystem.

Thus, even though there are obstacles in internet connectivity (infrastructure), the school's initiative in providing hardware (infrastructure) and software (supporting teacher capacity and policy) is a proactive effort in line with the recommendations of Paputungan *et al.*, (2025) to create an inclusive and sustainable educational ecosystem. The existing internet challenges become a priority area for further development to achieve optimal synergy.

Budget Flexibility in Digitalization

The entire success of digitalization at SMP IT An-Nur cannot be separated from the adaptive leadership role of the principal who is able to see challenges as opportunities and mobilize all elements of the school towards change. A clear vision, the ability to motivate, and courage in making strategic decisions amidst uncertainty are decisive factors. Thus, the implementation of digital learning at SMP IT An-Nur is not just an adoption of technology, but a cultural transformation that has strengthened the foundation of education to face an increasingly complex future that demands continuous adaptation, supported by in-depth data analysis. This makes SMP IT An-Nur an inspiring model for other educational institutions in facing the era of technological disruption. Missouri *et al.* (2025) emphasize the importance of this, that adaptive and visionary leadership is the main catalyst in every organizational transformation process, especially in the context of education in a rapidly changing digital era.

"At our school, the budget is flexible depending on our needs at school. Well, we usually budget for teacher training costs, but they find their own training providers. Based on our habits, we also usually hold for the development of educational technology, which, as I said earlier, is adjusted to the needs of the school."

(Interview with the Principal, April 21, 2026)

The Principal's statement highlights a very strategic approach to budget management for teacher development. With budget flexibility tailored to needs, and the trust given to teachers to find training providers independently, SMP IT An-Nur has succeeded in creating an environment where teacher professional development becomes more relevant and impactful. This approach ensures that every training followed by teachers truly aligns with the relevance of individual and school needs, not just general training that may be less in-depth. This not only provides teachers the freedom to choose the development focus that best suits their field or the technology they want to master, but also indirectly encourages teacher initiative and ownership of their competency improvement. This flexibility also reflects adaptive leadership that bravely decentralizes decision-making regarding professional development, a crucial step in facing the dynamics of education in an ever-evolving digital era.

CONCLUSION

This research aims to analyze the implementation and impact of digital learning at SMP Islam Terpadu An-Nur, as well as identify the challenges and the role of technology infrastructure in this process. Based on the analysis, it was found that SMP Islam Terpadu An-Nur has successfully integrated digital technology holistically, supported by a school vision focused on a sustainable digital learning ecosystem, strengthening teacher capacity through training (including AI), and adaptive leadership.

Nevertheless, the initial hypothesis regarding potential technology infrastructure challenges proved significant. The availability and stability of internet access became a major obstacle due to reliance on a single service provider, directly affecting the smooth execution of teaching and learning processes. The school has made efforts to overcome this challenge through the provision of supporting hardware and software, but connection stability issues remain a concern. This scientific finding confirms that the success of digital digital learning heavily depends on the availability of robust and adaptive technology infrastructure. The cultural innovation and pedagogical experiments emerging among educators demonstrate that the foundation of implementation is strong, but still requires adequate infrastructure support.

For other schools facing similar digital infrastructure challenges, it's crucial to focus not only on technology procurement but also on diversifying internet service providers, investing in backup solutions (such as portable hotspots or 4G modems), and developing effective bandwidth management strategies. Furthermore, teacher training should include how to adapt lessons when technical challenges arise and encourage creativity in utilizing existing resources.

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