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Digitalization System Migration in Elementary Schools

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ABSTRACT

The purpose of this study is to determine the process of transition from manual or conventional management and learning methods to the comprehensive use of digital systems and technology in elementary schools, including: (1) Human resource readiness for digital system migration; (2) Technological infrastructure readiness for digital system migration; (3) Digital application system readiness for digital system migration. Data collection techniques include interviews, observations, and documentation. The analysis process involves data condensation, data presentation, and conclusion drawing. The research results indicate.

Keywords: *System Migration, Digitalization of Education*

INTRODUCTION

Educational transformation plays a central role in creating equal access to quality education, especially in countries with significant social, economic, and geographical disparities such as Indonesia. Previously, quality education was often only available to those living in urban areas or with a better economic background. However, through the integration of technology, education can now reach remote areas that were previously difficult to access, providing equal learning opportunities for students who may not have access to adequate physical educational facilities. Technologies such as e-learning platforms, online classes, and interactive educational applications enable students, teachers, and schools to connect without being limited by geographical distance (Candra Dewi et al., 2023) .

Digitalization is characterized as the transition from manual information carriers to information carriers with the help of computers or technology. Digitalization is a fundamental process in which information and data that were previously in manual or physical form are converted into digital format. This change allows data to be stored, accessed, and processed using computers and digital technology. The goal is to improve efficiency, accuracy, and ease of information management across various sectors (Yulianti & Prastowo, 2021) . In the era of digital transformation, educational institutions are faced with the need to improve the effectiveness and efficiency of managerial data management. Schools are required to adapt to more modern and technology-based systems.

Technology plays a crucial role in the digitalization of education, simplifying various aspects such as administrative management, new student admissions, and the teaching and learning process. Communication, as the core of education, can now utilize various digital media such as mobile phones, computers, the internet, and email (A. Suparman, 2022) . Currently, interaction between teachers and students is no longer limited to face-to-face meetings. They can communicate and interact effectively through digital media. One clear example of the role of digitalization is e-learning. E-learning enables distance learning to be more efficient and effective, ultimately resulting in better learning outcomes.

The development of innovations such as educational digitalization undoubtedly poses challenges for teachers. However, this progress is seen as an opportunity to strengthen teachers' potential and sharpen students' abilities in facing the evolving times. Enhancing teachers' ability to use technology facilitates their delivery of educational content (Sugiman et al., 2022) .

Teachers' potential and competencies are the key to achieving digitalization in education. Hasanuddin et al., (2022) state that optimizing human resource competencies, particularly those of teachers, facilitates the implementation of digitalization in education. This demonstrates that teachers' competencies play a central role in the success of digitalization initiatives. Human resources play a vital role in implementing and executing digitalization because technology or digitalization is managed and operated by humans. Therefore, teachers play a crucial role in digitalization.

In addition to human resources, which are a key component of digitalization success, technological infrastructure and support are also vital. Technology in educational digitalization plays an important role in simplifying various aspects, from administration and student enrollment to the teaching and learning process. Additionally, technology also changes communication methods in education, enabling the use of digital media such as phones, computers, the internet, and email as effective learning tools (A . This means that education becomes more accessible and manageable thanks to technological assistance.

The above description indicates that transitioning to a digital system requires adequate human resources, technological infrastructure such as computers and other devices, as well as readiness for e-learning applications and those related to online learning.

Based on an initial study, the migration to a digital system at SDN 11 Tibawa and SDIT Lukmanul Hakim has adequate human resource readiness. Infrastructure readiness, such as stable internet connectivity and adequate technological devices, is a strength in the migration to a digital system. Application readiness includes the use of Erl Book reader and Google Workspace, as well as digital administration applications such as Dapodik and ARKAS. The use of a combination of manual and digital attendance methods ensures accuracy and flexibility in managing student data.

METHOD

This study employs a qualitative approach with a case study research design, specifically *a multiple case* study. The qualitative approach is used to understand phenomena experienced by subjects, such as perceptions, motivations, behaviors, and actions, in a holistic manner, described in words and language within a specific and natural context (Moleong, 2011:6). The *multi-case* study aims to directly investigate phenomena related to teaching supervision in a natural setting, focusing intensively and in detail on a particular event. This research follows several stages, namely (1) the research stage, (2) the design development stage, (3) the data collection stage, and (4) the report writing stage.

The research was conducted in two schools with different characteristics, namely SDN 11 Tibawa and SDIT Lukmanul Hakim. Data collection was carried out using interviews, observation, and document study. The interview technique used was a combination of structured and unstructured interviews. Meanwhile, purposive sampling was used to determine the informants for the interviews based on the relevance and depth of information. The observation technique chosen was participant observation, with the basic consideration of conducting observations and listening as carefully as possible, even to the smallest details. Documentary studies were used to collect data from non-human sources. Documentary studies consisted of documents, photos, pictures, and recordings.

Data analysis is the process of systematically searching for and organizing interview transcripts, field notes, and other materials collected by the researcher. The analysis is carried out by examining the data, organizing it, dividing it into manageable units, synthesizing it, looking for patterns, finding what is meaningful, and what is being researched, and reporting it systematically. Given that this study uses a multi-case study design, data analysis is conducted in two stages: *individual case* data analysis and *cross-case analysis*. Individual case data analysis is conducted on each different object or substance of the school, namely SDN 11 Tibawa and SDIT Lukmanul Hakim. Data analysis in this study refers to three concurrent activities: data reduction, data presentation, and conclusion drawing (. Data reduction is the process of selecting, focusing attention on simplification, abstraction, and transformation of "raw" data that emerges from written field notes. Data presentation is a structured set of information that enables the drawing of conclusions and the taking of action. The analysis conducted during and after data collection is used to draw conclusions, thereby identifying patterns in the events that occurred.

Cross-case data analysis is intended as a process of comparing findings obtained from each case, as well as a process of integrating cases. The findings obtained in the first case from SDN 11 Tibawa were categorized and themed, analyzed inductively and conceptually, and a narrative explanation was made, which was then developed into a specific proposition that was further developed into substantive theory I. The same was done at SDIT Lukmanul Hakim to find substantive theory II. The propositions and substantive theory I were then analyzed by comparing the propositions and substantive theory II to identify cross-case propositions and substantive theories, which were subsequently used as material to develop substantive theory findings. The cross-case analysis is schematically illustrated in the following figure.

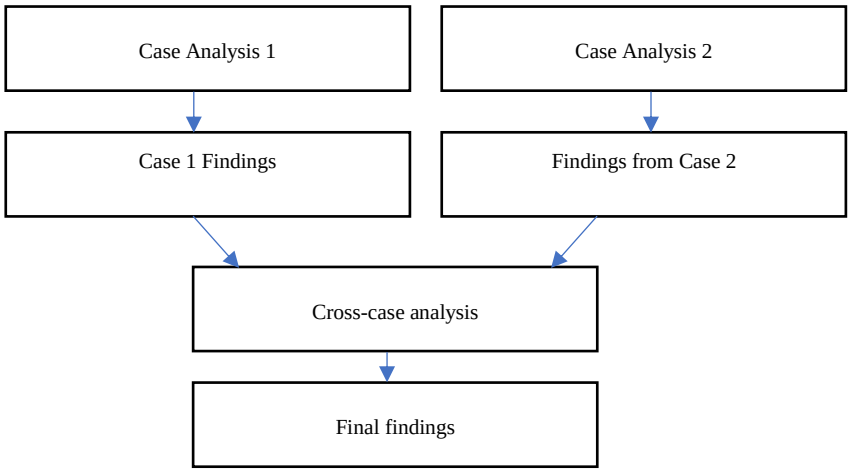

Figure 1. Analysis Procedure in Multi-Case Study

RESEARCH RESULTS

Table 1 findings of case 1 and case 2

Focus	**Case 1** **SDN 11 Tibawa**	**Case 2** **SDIT Lukmanul Hakim**
Human resource readiness	➢ 9 teachers and educational staff. (8 with a bachelor's degree and 1 with a master's degree) ➢ ICT training through pilot schools (Canva, website, video) ➢ Use of digital applications in learning such as e-report cards, Google Forms, and Kahoot.	➢ 39 teachers and educational staff (2 with master's degrees, 31 with bachelor's degrees, and 6 with high school diplomas) ➢ Internal/external training such as YouTube, GTK, Canva, and Microsoft. ➢ Use of digital applications in learning such as Canva, e-report cards, Google Forms, Kahoot, and Quizizz
Readiness of technological infrastructure	➢ 2 laptops, 15 Chromebooks, internet connection 40 Mbps (fairly stable) ➢ Devices for ANBK participants to borrow ➢ Coordination with the internet provider for repairs and borrowing	➢ 4 laptops, 1 computer, 50 Mbps internet connection (stable) ➢ Devices for ANBK collaboration with parents (borrowed) ➢ Coordinate with school participation to address internet and device shortages
Readiness of digital applications	➢ Using Dapodik, e-raport, Si Pintar, and arkas for educational administration ➢ Learning is dominated by YouTube, Google Classroom, Zoom, and Google Forms, Kahoot ➢ Central operator in administration and school operations, and student report card grading	➢ Using Excel, e-raport, simpatika, and Raudhatul Athfal in educational administration. ➢ Learning is dominated by Canva, YouTube, Classroom, Meet, Zoom, Kahoot, and Quizizz ➢ Professional operators in school administration

Table 2 Cross-case findings

No	**Research Focus**	**Findings**
1	Human Resource Readiness	➢ Teachers' and educational staff qualifications influence human resource readiness in the migration to a digital system ➢ ICT training, such as Canva, video, and Microsoft ➢ Use of digital applications in learning, such as Canva, YouTube, Kahoot, forms, and Quizizz
2	Technological infrastructure readiness	➢ 2 laptops, 15 Chromebooks, internet connection 40 Mbps (fairly stable) ➢ Devices for ANBK students to borrow and collaborate with parents ➢ Coordination with internet providers for repairs and loans

No	Research Focus	Findings
3	Digital application readiness	➢ Using Dapodik, e-raport, Si Pintar, and Arkas in public education administration. And Excel, e-raport, Simpatika, Raudhatul Athfal, in Ministry of Religious Affairs education administration. ➢ Learning is dominated by YouTube, Google Classroom, Zoom, and Google Forms, Kahoot ➢ Professional operators in administration and schools and student report card grades.

Research propositions and findings

Human resource readiness

- If teachers and educational staff have adequate qualifications, then human resources are considered ready for the digitalization system migration.
- If ICT training is provided to human resources in education, then human resource competencies are ready for the digitalization system migration
- If digital applications are used in learning, the digitalization system is ready to migrate

Readiness of technological infrastructure

- If the technological infrastructure, such as computers and laptops, is adequate, then the school is ready to migrate to a digital system
- If the devices for ANBK are available, the transition to digitalization is highly ready
- If schools have internet with a minimum speed of 50 Mbps, then schools are eligible for migration to a digitalization system

Readiness of digital applications

- If educational administration applications are adequate and well-functioning, the school is ready to migrate to a digital system
- If learning is dominated by digital-based learning and oriented towards digital, then the school is ready to migrate to a digital system
- If the operators are professional, it will facilitate the migration to the digitalization system

DISCUSSION

Human resource readiness

Research findings indicate that human resource readiness for digitalization system migration is highly dependent on several key factors. Qualified teachers and educational staff are the main foundation; when they have adequate qualifications, the overall human resources can be said to be ready for this migration. Additionally, intensive ICT training for all human resources in the education sector is directly correlated with an increase in their competencies, which in turn ensures readiness to face the digitalization system. Lastly, the use of digital applications in the learning process is an important indicator that the digitalization system is ready for effective migration. Thus, human resource readiness for digitalization system migration is achieved through a combination of qualifications, ICT training, and technology adoption in learning.

These findings are reinforced by (Izazi & Fudhla, 2022) , which states that qualifications need to be deepened in technical and digital pedagogical aspects. This study emphasizes that although teachers already use digital technology in learning, its operation needs to be maximized. School human resources need to adapt to technology to drive educational digitalization, which implicitly highlights the importance of qualifications relevant to digital demands (.

ICT training significantly improved pedagogical competencies in the use of ICT (from 50% to 100% in the second cycle). This demonstrates the effectiveness of ICT training in improving the readiness of human resources (Yufita et al., 2021) . ICT training for human resources is undoubtedly a response to the need for adaptation of educational human resources in the Society 5.0 era, particularly in terms of readiness for migration to digitalization systems (BBGTK Province of Central Java, 2024)

If digital applications are used in learning, then readiness for digitalization is ensured. This is reinforced by (Center for Digital Society, 2023) that the use of technology applications is very important, indicating that the widespread and equitable use of digital applications in learning and educational administration is the key to digitalization readiness. The increase in the adoption of digital learning applications in Indonesia, especially since the COVID-19 pandemic, demonstrates growing awareness and practice of technology use in the teaching and learning process (.

Based on research findings and trend analyses, it is evident that adaptability to technology, sustainable and comprehensive ICT training programs, and the widespread adoption of digital applications in education are the main pillars supporting the success of educational digitalization. This readiness is not only measured by the availability of infrastructure but also by the willingness and ability of human resources to adapt, innovate, and utilize technology

optimally to enhance the quality of education. Existing challenges, such as disparities in readiness between regions and the suboptimal utilization of technology, indicate that sustained efforts in these three areas are still very much needed.

Technological infrastructure readiness

Research findings indicate that technological infrastructure readiness is a crucial pillar in supporting schools' migration to digitalization systems. The main indicators of this readiness include the availability of adequate computers and laptops, which are directly correlated with schools' readiness to transition to a digital environment. Furthermore, the fulfillment of the necessary devices for the Computer-Based National Assessment (ANBK) is a strong indicator that schools are well prepared for the transition to a digitalization system. Finally, the availability of internet access with a minimum speed of 50 Mbps is an absolute prerequisite for schools to migrate to a digitalization system, ensuring smooth operations and accessibility to digital resources.

The findings indicate that if ICT facilities and infrastructure are adequate, schools are ready to migrate to a digital system. This is highly relevant to the research conducted by A.S.Suparman et al. (2022) , which found that the availability of ICT facilities and infrastructure such as computers and laptops is one of the key factors influencing schools' readiness to face digital learning. They found that schools with adequate ICT facilities are more likely to be ready to implement digital-based learning. The readiness of ICT infrastructure, including hardware such as laptops, computers, and other devices, is an important aspect in the digital-based learning process (Lestari & Nurkholis, 2020)

If ANBK devices are available, the transition to digitalization is well-prepared. This is as stated in Wildan, (2022) the implementation of ANBK in remote, outer, and underdeveloped areas (3T), and one of the main challenges is the availability of devices and internet networks that are still inadequate. This implicitly confirms that the availability of ANBK devices is a strong indicator of digitalization readiness. This readiness is not only for the assessment itself but also reflects a school's capacity to conduct other computer-based activities. The Indonesia Digital Society Index (IMDI) report frequently highlights disparities in internet access and quality, including in educational settings. Although specific figures of 50 Mbps are not always mentioned, the need for high-speed internet to support digital activities such as *streaming*, downloading materials, and using interactive learning platforms is widely emphasized. .

Based on findings and research discussions, the readiness of technological infrastructure is strongly supported by the latest research. The availability of adequate hardware (computers, laptops, ANBK devices) and high-speed internet access is an essential foundation for the successful migration of schools to a digital system. Research indicates that without this basic infrastructure, the implementation of digital learning and assessment will face significant obstacles. However, challenges in the distribution and optimization of this infrastructure remain a task for many regions, especially in 3T areas. Therefore, sustainable investment in the provision and improvement of technological infrastructure is key to realizing schools that are fully prepared for the digital education ecosystem.

Digital application readiness

Research findings underscore that the readiness of technological infrastructure in the migration of school digitalization systems is supported by three crucial elements. First, the availability and quality of adequate educational administration applications are the main determinants of schools' readiness to switch to digital systems. Second, the dominance of digital-oriented learning is a strong indicator that the school environment is adaptive and ready for a comprehensive digital migration. Lastly, the presence of professional operators greatly facilitates the migration process to digitalization, ensuring operational smoothness and the resolution of any technical issues that may arise.

Adequate and well-functioning educational administration applications mean that schools are ready to migrate to digitalization. Digital administration systems such as the School Management Information System (SIMS), learning management platforms (LMS), or applications for finance and human resources are the backbone of school operations in the digital age. Research b Prihantoro & Sulistiyowati (2020) in the Journal of Office Management Education discusses the implementation of academic information systems, showing that the success of technology adoption in administration heavily depends on the quality and functionality of the application. They found that user-friendly and integrated applications accelerate the digitalization of school administration. Additionally, the Journal of Educational Science highlights the importance of school information systems in improving administrative efficiency and effectiveness, which in turn supports schools' readiness for comprehensive digitalization (Permadi & Setiyowati, 2021) .

Learning is dominated by digital-based learning, so schools are ready to migrate to a digitalized system. Active utilization of technology in the learning process is a key indicator of school readiness. When teachers and students are accustomed to using digital platforms, online learning resources, and digital collaboration tools, migration to a more digitalized system will be smoother (Suparman et al., 2022) . Reports from the Ministry of Education, Culture, Research, and Technology's Data and Information Technology Center (Pusdatin) regularly show an increase in the use of digital learning platforms such as Rumah Belajar or third-party applications, reflecting a shift in learning orientation toward digitalization in response to global challenges and curriculum demands (PUSDATIN) .

Professional operators facilitate the migration to digital systems. The presence of skilled human resources serves as a bridge between technology and users. The role of school operators, particularly in the context of information technology, is vital. Research by Saputra (2021) in the Journal of Informatics and Information Systems emphasizes that the technical competencies and troubleshooting abilities of operators significantly influence the smooth implementation of digital systems in schools. They often serve as the first point of contact for technical issues, data entry, and system maintenance. Without professional operators, even the most advanced applications and devices can become ineffective. Continuous training and professional development for operators are essential to ensure they remain up-to-date with the latest technologies.

Based on the research findings and discussions, it is evident that functional administrative applications, a digital learning orientation and dominance, and the presence of professional operators complement each other to create a ready digital ecosystem. Recent research supports each of these points, emphasizing that digitalization is not just about procuring hardware and software, but also about how technology is integrated into administrative and learning processes and supported by competent human resources. Investing in these three areas will significantly enhance the likelihood of a successful transition to a digitalized education system.

CONCLUSION

The success of educational digitization depends heavily on the holistic integration of technical aspects and human resources. This highlights the urgency of sustained investment in infrastructure and human resource development. Challenges such as regional disparities and the optimal utilization of technology still require synergistic and sustained efforts to achieve a digital education ecosystem that is equitable and of high quality. To transition to a digital system, there is a need for sustainable ICT training programs, the widespread adoption of digital applications, infrastructure readiness, and a digital ecosystem supported by functional applications, digital learning, and professional operators.

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