

The Digital Transformation Journey of Rural Primary Schools in Sabah: Challenges and Best Practices

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ABSTRACT

Digital transformation in education presents significant challenges particularly in rural school settings where limitations in infrastructure and resources may hinder implementation. This qualitative case studies explore the digital transformation journey of three rural primary schools in the Tuaran district Sabah. The study aims to examine the challenges encountered during the adoption of digital practices and to identify best practices that support successful digital transformation in rural schools. Data were collected through semi structured interviews with head teachers and teachers from three participating schools and analyzed using thematic analysis. The findings revealed several key challenges including limited digital infrastructure, inadequate technical expertise, resistance to change and difficulties in integrating digital tools into teaching practices and administrative work. Despite these challenges, the study identified several effective practices that facilitated digital transformation including mentoring programs, professional learning communities (PLCs), change management strategies and the gradual implementation of digital platforms to support adaptation among school staff. These practices contributed to improving data management, enhancing teaching and learning processes and greater readiness for digital implementation in schools. The study highlights the importance of context specific leadership, continuous professional development and sustained institutional support in advancing digital transformation in rural schools. The findings provide practical insights for policymakers, educational leaders and practitioners seeking to strengthen digitalization initiatives and promote equitable access to quality digital education in rural contexts.

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Contribution/Originality: This study contributes to the existing literature by providing empirical evidence on the digital transformation journey of rural primary schools in Sabah, Malaysia. It identifies context-specific challenges and leadership best

practices that facilitate digital adoption in resource-constrained settings, offering practical recommendations for policymakers, school leaders, and future rural digital education initiatives.

1. Introduction

The digitalization of education has become a global trend, with significant advancements in technology transforming traditional teaching and learning methods. From interactive online platforms to digital resources, these innovations offer new opportunities to enhance educational delivery, promote student engagement, and streamline administrative processes. However, the integration of digital tools and practices is not a one size fits all, and rural schools often face unique challenges compared to their urban counterparts.

The primary research problem is understanding how rural primary schools in the Tuaran district navigate the challenges of adopting digital practices. This study seeks to explore the challenges faced by these schools and how they manage to integrate digital tools into their teaching and administrative processes. By examining the experiences of educators and school leaders in the Tuaran district, the study will offer insights into the digital transformation process in rural education.

The findings of this study are critical in informing educational policies and strategies for supporting digitalization efforts in rural schools. As the global education system moves increasingly towards digitalization, it is important to ensure that rural schools are not left behind. By identifying effective strategies for overcoming the challenges of digitalization in rural areas, this research contributes to the ongoing efforts to bridge the digital divide in education and promote equitable access to technological resources for all schools.

1.1. Research Objectives

The objectives of this study are:

- i. To explore the challenges encountered by rural primary schools in adopting digital practices.
- ii. To identify the best practices that support successful digital transformation in rural primary schools.

2. Literature Review

The digitalization of education has been widely researched, with scholars highlighting both the potential benefits and the challenges associated with its implementation in various contexts. This section reviews the existing literature on digitalization in education, focusing on rural settings.

2.1. Internet Access

The literature consistently highlights infrastructural barriers as a key obstacle in the process school digitalization. Among the most cited challenges is the lack of reliable internet connectivity. Arreerard (2022) notes that many rural schools either do not have

internet access or, when available, experience slow and unstable connections. This issue is also evident in the studies by Martin (2021), Mihai (2017), and Mudra (2018), who emphasize that even when schools have access to the internet, its quality is often insufficient to support the consistent use of digital tools. Fikuree et al. (2021), Kusuma (2022), and Singh et al. (2021) further reinforce this, citing unreliable internet connectivity as a major barrier to technology adoption in rural settings.

2.2. Technical support

In addition to infrastructure, the absence of technical support staff has emerged as a significant challenge for rural schools. Rahim et al. (2020) report that even when schools have access to technology devices, they often lack the necessary staff to troubleshoot issues or maintain the equipment. This creates a situation where teachers, already burdened with their teaching duties, are left to resolve technical problems without proper support. Furthermore, teachers express the need for technical staff who understand the pedagogical application of technology, as their requirements go beyond mere troubleshooting (Jerry & Yunus, 2021; Rundel & Salemin, 2021). The literature suggests that to effectively integrate technology into teaching practices, schools need support staff who can assist in both technical and instructional capacities.

2.3. Professional Development for School Leadership

School leadership plays a crucial role in driving the successful integration of digital tools in rural schools. Rahim et al. (2020) and Wang et al. (2022) advocate for professional development programs aimed at equipping school principals with the knowledge and skills necessary to manage technology integration. These programs should cover both technology usage and policy development, ensuring that principals are prepared to lead their schools through the digital transformation.

2.4. Government Support and IT Staff

The importance of government intervention is also highlighted in the literature. Rahim et al. (2020) suggest that governments should provide trained IT staff to schools equipped with technological devices. The presence of trained professionals would ensure that rural schools have the necessary support to maintain and use their digital tools effectively. Without this support, the burden often falls on teachers, exacerbating their already heavy workloads and contributing to negative attitudes toward technology integration (Molise & Dube, 2020).

2.5. Teacher Workload and Attitudes Toward Technology

The literature further indicates that the increasing workload associated with technology adoption is a key concern for rural teachers. Que (2021) found that teachers in rural schools struggle to find the time to prepare materials for technology-assisted classes, often resulting in burnout and frustration. This issue is compounded by the additional technical problems they are expected to solve, with Mihai and Nieuwenhuis (2015) noting that many teachers perceive technology as an added burden rather than a helpful tool. Consequently, teachers' attitudes towards technology integration tend to be negative, particularly in environments where sufficient support and training are lacking (Molise & Dube, 2020).

2.6. Addressing Technological Literacy

To address these challenges, the literature recommends targeted interventions to improve technological literacy among rural teachers. Fan et al. (2020) and Howell (2018) suggest that teachers in rural schools should undergo ICT training to enhance their digital competencies.

Moreover, supervision and peer support are identified as critical components for fostering a supportive learning environment. Fikuree et al. (2021), Molise and Dube (2020) all emphasize the role of peer mentorship and collaborative learning in helping teachers overcome their apprehension towards technology.

2.7. Solutions for Device Access and Compatibility

Another persistent challenge in rural schools is the lack of technological devices for personal use by teachers. In response to this issue, Srinivasan et al. (2021) propose utilizing alternative ICT platforms that are compatible with the devices already available to teachers and students. This approach minimizes the financial burden on schools while ensuring that teachers can still integrate technology into their classrooms using the resources at hand.

2.8. Gaps in Knowledge

Despite the extensive research on digitalization in education, there is still a lack of studies focusing specifically on the rural context, particularly in regions like Sabah, Malaysia. Most of the research has been conducted in urban or semi-urban settings and in neighboring countries. As a result, there is a need for more studies that explore how rural Sabah schools can overcome their unique challenges and successfully integrate digital tools.

3. Research Methods

3.1. Research Design

This study adopts a qualitative research design to explore the challenges and best practices related to digitalization in rural primary schools. Qualitative methods were selected to capture the in-depth experiences of school leaders and teachers involved in digital transformation efforts. The research is exploratory in nature, as it aims to understand the specific challenges faced by rural schools in the Tuaran district, Sabah, and identify effective strategies for overcoming them.

3.2. Sample Selection

The sample for this study consisted of three rural primary schools located in the Tuaran district. These schools were selected based on their involvement in digitalization efforts initiated by the Ministry of Education. Within each school, the group in study is the headteacher and three teachers.

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3.4. Instruments

Semi-structured interviews were the primary data collection instrument used in this study. The interview questions were designed to cover key topics, such as challenges in implementing digital tools, strategies used to integrate technology into teaching, and perceptions of the effectiveness of these strategies. The interviews allowed open-ended responses, enabling participants to express their views and experiences in detail.

3.5. Instrument Validity and Reliability

To ensure the validity of the interview guide, a pilot test was conducted with two teachers from rural schools not included in the main study. Feedback from the pilot test was used to refine the questions and improve clarity. The reliability of the interview data was enhanced using member checking, where participants were provided with transcripts of their interviews to verify the accuracy of the recorded responses.

3.6. Data Collection Process

Data collection was conducted over a two-month period. All interviews were carried out in person at the schools. The interviews were recorded with the consent of the participants and transcribed verbatim for analysis. Each interview lasted approximately 45 minutes to one hour, allowing ample time for participants to elaborate on their experiences and perspectives.

3.7. Data Analysis

Thematic analysis was used to analyse the interview data. This approach involves identifying, coding, and grouping themes that emerged from the data. The analysis was conducted in several stages: initial coding, theme identification, and the refinement of themes based on the relationships between them. The use of thematic analysis allowed for a structured examination of the challenges and best practices related to digitalization in schools, as well as the underlying factors contributing to these challenges and successes.

4. Results

The data collected from the interviews with headteachers and teachers revealed several challenges and best practices related to the digitalization efforts in rural primary schools. These findings are categorized into major themes and subthemes based on the analysis of the interview data.

Table 1: Themes and Subthemes on Rural School Digitalization Challenges and Best Practices

Themes	Subthemes	Description
Limited Infrastructure	Internet Connectivity	Schools faced unstable or slow internet connections, limiting access to digital resources and tools.
	Limited devices	Schools have limited number of devices, teachers often share limited resources for digital teaching.
Technical Expertise	Need for Training	Teachers voiced the need for digital trainings.
	Limited Support	There was insufficient technical support to help teachers troubleshoot digital issues.
Resistance to Change	Teacher Hesitance	Teachers were hesitant to shift from traditional methods to digital practices due to unfamiliarity.
	Workload Concerns	Many teachers feared that adopting new technologies would increase their workload.
Mentoring Programs	Peer Support	Tech-savvy teachers mentored their less experienced colleagues, offering hands-on assistance.
	Confidence Building	Mentoring programs helped boost teachers' confidence in using digital tools.
Gradual Introduction	Phased Implementation	Schools introduced digital platforms slowly and in phases, reducing the overwhelm felt by teachers.
	User Feedback	The gradual rollout allowed teachers to provide feedback based on their needs.
Professional Learning Communities	Collaborative Learning	Teachers engaged in regular discussions to share experiences and strategies for digital integration.
	Problem-Solving	PLCs provided a space for teachers to collectively address common challenges in digital adoption.
Change Management Strategies	Leadership Role	School leaders played a key role in guiding the digitalization process and managing resistance.
	Clear Communication	Effective communication helped align staff with the goal of digital transformation.

4.1. Challenges Encountered by Rural Schools

4.1.1. Limited Infrastructure

The major challenge faced by all three schools was a shortage of technological infrastructure. While internet services are present, the connection was often unstable at times. Schools reported frequent issues with internet speed and reliability that may be caused by the geographical location and sometimes influenced by the weather. This posed a major barrier to integrating digital tools into teaching practices, especially for online resources that needed stable connections to work well. Computer and laptop devices were also provided but is not sufficient for all teachers. Teachers shared a limited number of devices, affecting their capacity to implement digital lessons consistently. Some teachers chose to bring their own devices, both for teaching purposes and handling administrative tasks.

4.1.2. Technical Expertise

Teachers felt they needed more support when it came to troubleshooting technical issues. While many expressed a willingness to learn, the teachers emphasized the need for professional development opportunities specifically tailored to their unique

challenges. The lack of onsite technical support meant that when teachers encountered difficulties with digital tools, they had to rely on their own limited knowledge or wait for external assistance, causing delays and discouraging further use.

4.1.3. Resistance to Change

A recurring theme was resistance to change, particularly from senior teachers who were accustomed to traditional methods of teaching and manual administrative data management. This resistance stemmed from a lack of confidence in using new technologies and concerns about the time and effort required to learn new systems. Education platforms and administrative websites are always updated with enhanced and newer features periodically. Due to the fast paced and the ever-progressing shifts in education platforms, some teachers struggle to catch up. Some feared that they would not be able to adapt to these new tools effectively. Teachers voiced concerns that the introduction of digital tools would add to their existing workload. Many were worried that the time required to learn and implement these technologies would take away from their instructional time.

4.2. Best Practices to Support Digital Implementation

4.2.1. Mentoring Programs

To address the resistance and skill gap, schools implemented mentoring programs where tech savvy teachers mentored their peers. These programs were reported to be highly effective in building confidence and facilitating the adoption of digital tools. Mentoring also fostered a collaborative environment, encouraging knowledge sharing and mutual support among teachers.

4.2.2. Gradual Introduction of Digital Platforms

The schools also adopted a gradual approach in digital implementation. Rather than introducing multiple platforms at once, they started with simpler technologies, such as basic tools and learning management systems, before advancing to more complex digital tools and platforms in phases. This allowed teachers to adapt slowly and reduced the likelihood of resistance.

Teachers also become familiar with each platform at a more manageable pace. The phased rollout also allowed teachers to provide feedback on the tools, leading to improvements and adjustments that made the platforms more user-friendly. This phased approach minimized resistance and allowed for adjustments based on teacher feedback.

4.2.3. Professional Learning Communities

The formation of professional learning communities (PLCs) within the schools provided a platform for teachers to collaborate and share their experiences with digitalization. Through regular meetings and discussions, teachers were able to identify common challenges and develop collective strategies to address them. This sense of community helped address common problems and encourage collaboration among teachers.

4.2.4. *Change Management Strategies*

Headteachers implement change management strategies to ensure successful digital transformation of these schools. The headteachers played a crucial role in facilitating this process by providing clear and open communication, setting clear achievable goals, offering ongoing support and fostering an environment that supported gradual change. Their leadership helped to mitigate resistance by clearly communicating the benefits of digitalization and providing support to teachers.

4.3. Discussion

The key challenges identified in the findings such as limited infrastructure, lack of technical expertise, and resistance to change closely mirror the issues highlighted in the literature review. Fikuree et al. (2021), Kusuma (2022), and Singh et al. (2021) emphasize unreliable internet connectivity as a significant barrier to technology adoption in rural areas, which aligns with the infrastructure limitations observed in the study. Similarly, Rahim et al. (2020) points out that, even when schools have access to technology, the lack of technical staff to maintain and troubleshoot devices hampers effective integration. This is consistent with the study's finding on the lack of technical expertise. Additionally, Molise and Dube (2020) highlight teachers' negative attitudes towards technology in environments where support and training are insufficient, which is aligned to the resistance to change noted in the study. Thus, the findings reflect the common challenges documented in the literature regarding digitalization in rural education.

The study also uncovered several best practices, including the implementation of mentoring programs and Professional Learning Communities (PLCs) as suggested by Fikuree et al. (2021) and Molise and Dube (2020). Additionally, the change management strategies observed in this study lines up with the descriptions by Rahim et al. (2020) and Wang et al. (2022), where school leaders are suggested to be equipped with the necessary knowledge and skills to manage technology integration. This approach should also be coupled with the gradual integration of digital tools in the schools as part of the initiatives of best practices.

The findings of this study have significant implications for the management of rural schools. School leaders play a critical role in guiding the digital transformation process, as evidenced by the success of change management strategies. Headteachers must adopt a supportive, flexible approach, providing clear communication and setting realistic expectations for teachers. Additionally, the importance of mentoring programs and professional learning communities suggests that school administrators should foster a collaborative learning environment that encourages peer-to-peer support.

One limitation of this study is its reliance on a small sample of schools in a specific rural district. While the findings provide valuable insights, they may not be generalizable to all rural schools, particularly those in different geographical regions with varying levels of infrastructure and resources. Furthermore, the study focuses primarily on the perspectives of headteachers and teachers, leaving out the views of other stakeholders, such as students and parents, who may have valuable insights into the challenges and benefits of digitalization.

Future research could expand on this study by including a larger and more diverse sample of rural schools from different regions. It would also be beneficial to explore the perspectives of students and parents regarding the digitalization of education. Additionally, future studies could investigate the long-term impacts of digitalization on student performance in rural schools, particularly in terms of narrowing the educational achievement gap between urban and rural students.

5. Conclusion

This study explored the challenges and best practices associated with the digitalization of rural primary schools in the Tuaran district, Sabah. The research was conducted to address the gap in understanding how rural schools manage the transition to digital education amidst their unique challenges.

The study identified several challenges, including limited access to reliable infrastructure, a lack of technical expertise, and resistance to change among educators. The study also revealed best practices that have proven effective in overcoming these challenges.

Mentoring programs, the gradual introduction of digital platforms, professional learning communities, and change management strategies were all found to be effective in facilitating the successful adoption of digital tools.

By addressing the challenges and implementing these best practices, the schools in this study were able to improve their data management and educational delivery, ensuring that students in rural areas are not left behind in the digital age. The study's findings offer important implications for policymakers and educators, emphasizing the need for tailored strategies and support for rural schools.

In conclusion, this study contributes to the ongoing discourse on digital equity in education by providing insights into how rural schools can overcome barriers to digitalization.

Future research should continue to explore this topic, focusing on long-term outcomes and strategies that further enhance digital access and skills in rural education.

Ethics Approval and Consent to Participate

This study adhered to accepted ethical principals for research involving human participants. Informed consent was obtained from all participants prior to data collection. Participation was voluntary, and confidentiality and anonymity were maintained throughout the study.

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Conflict of Interest

The authors declare no conflict of interest.

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