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THE ADAPTIVE APPROACH IN DIGITAL TRANSFORMATION OF PRIMARY EDUCATION: IMPLEMENTATION OF DIGITALIZATION IN ELEMENTARY SCHOOLS IN MALUKU

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ABSTRACT

This study investigates the adaptive strategies in the digital transformation of elementary education in Maluku, an eastern Indonesian region facing geographical and infrastructural constraints. The research aims to analyze how elementary schools respond to the imperative of educational digitalization in the disruptive era. Using a qualitative method with a descriptive approach, data were collected through in-depth interviews, observation, and literature review. The findings reveal that although digital transformation is necessary and inevitable, it is hindered by limited technological infrastructure, uneven teacher readiness, and resistance to change. Nonetheless, some schools demonstrate adaptive innovations by utilizing available technology and engaging local communities in the learning process. These practices highlight that digital transformation is not solely dependent on infrastructure but also on the mental resilience and willingness of educators to embrace change. The novelty of this study lies in its contextual focus on remote island education and its emphasis on local adaptation as a key factor in successful digital implementation. The study recommends targeted teacher training, consistent mentoring, and improved access to digital resources to support sustainable transformation. This research contributes to social sciences and humanities by offering new insights into digital education strategies in marginalized and geographically isolated regions.

Keywords*: Adaptive Education, Digital Transformation, Disruptive Era, Education Digitalization, Elementary School*

INTRODUCTION

Digital transformation in education has become an increasingly urgent issue, especially in the ongoing era of disruption. In various parts of the world, including Indonesia, major changes have occurred, forcing education systems to quickly adapt to the demands of digital technology. In more remote areas, such as the Maluku Islands, primary schools face more complex challenges in this process. The central issue in this research is how primary schools in Maluku are dealing with disruption, particularly in the implementation of digital technology as part of educational transformation. Although the government has encouraged the digitalization of education, many schools in remote areas still lag behind in implementing technology due to limitations in infrastructure and human resources (Amany, 2024). This is crucial to examine, as the success of digital transformation depends not only on access to technology but also on the mental readiness

and ability of educators to utilize it in the learning process.

Previous studies have extensively discussed the importance of technology in education. For instance, Rahmadani (2024) highlights the significant role of technology in accelerating the learning process, providing wider access to students, and enabling more interactive learning. Another study by Ambarita (2021) shows that the use of digital technology can enhance students' motivation and improve the efficiency of learning in primary education environments. However, significant challenges remain, particularly in remote regions like Maluku, where internet infrastructure is still inadequate (Sastromiharjo, 2024). Human resource readiness is also a critical issue. For example, research by Zein (2024) reveals that teachers in remote areas often lack the necessary competencies to effectively use technology in teaching.

In the context of education in Indonesia, several studies related to the implementation of technology have been conducted, particularly during the COVID-19 pandemic. Karimah et al. (2024) report that the pandemic accelerated the adoption of digital technology in education but also revealed gaps between urban and rural areas in terms of access and implementation of technology. In Maluku, this is more pronounced, where technological and infrastructure limitations have slowed the digitalization process (Yandra & Zuwardi, 2024). Another study by Maisaroh & Untari (2024) emphasizes that the main challenge in implementing technology in remote areas is the lack of training and technical support for teachers.

However, despite the numerous studies on educational digitalization, few have focused on remote areas, particularly at the primary school level. Most existing studies tend to focus on urban areas or regions that are more technologically advanced (Rachmad et al., 2024). This research aims to fill that gap by exploring in-depth how primary schools in the Maluku Islands are adapting to the challenges of the era of disruption and digitalization. The adaptive approach taken by these schools not only focuses on the application of technology but also on changing the mindset of educators in managing education.

Therefore, the aim of this research is to emphasize the importance of a holistic digital transformation in primary schools in the Maluku Islands and to present strategies that can be implemented to overcome existing barriers. This study also seeks to provide recommendations on how to enhance the capacity of human resources in the education sector to support the success of digitalization in elementary schools in remote areas. This transformation is urgently needed to prevent the widening of the education gap between remote and urban areas.

The main findings of this article are that digital transformation in primary schools in Maluku does not solely depend on the availability of technology but more on the mental readiness, skills, and adaptation of educators. This is a new contribution to the literature, as many previous studies have overlooked the importance of mindset change in the context of educational digitalization in regions with geographical and infrastructural challenges. This research offers a fresh perspective on how primary schools in remote areas can adapt to the digital era, while also providing practical recommendations for the development of education in the future.

RESEARCH METHOD

This research employs a descriptive qualitative approach, a method that allows researchers to deeply explore the experiences and views of informants in real-world contexts, particularly in addressing the challenges of digital transformation in remote regions such as Maluku. The qualitative method was chosen because it is better suited to capture the dynamics occurring at Halong Public Elementary School in its specific context, which cannot be adequately explained through mere numbers or statistics (Wicaksono, 2022). Thus, this approach enables the researcher to explore the complexities of the digitalization phenomenon in the school in greater detail.

The research focuses on Halong Public Elementary School in Maluku. This location was chosen because it represents the characteristics of schools in remote areas facing challenges related to infrastructure, technological access, and limited human resources, issues that are often overlooked in studies on educational digitalization (Suhartawan et al., 2024). Halong Public Elementary School is a concrete example of how a primary school in a remote area navigates the process of digital transformation, despite such limitations.

This study involved 25 informants, selected using a purposive sampling technique. This technique allows the researcher to select informants who are directly related to the research topic, thus providing relevant and rich data (Handoko et al., 2024). The informants consist of the school principal, teachers, students, parents, and the school committee, all of whom play key roles in supporting and experiencing the digital transformation process at the school. The school principal, as the primary decision-maker, the teachers who are directly involved in the digital teaching process, the students who benefit from the technology, the parents who support their children from home, and the school committee involved in school management and policy-making all provide a comprehensive perspective on the implementation of digitalization at Halong Public Elementary School.

To collect data, the study uses three main methods: in-depth interviews, participatory observation, and a literature review. In-depth interviews were conducted to gather the experiences and views of the informants directly. This method allows the researcher to understand the challenges faced by the school in implementing digitalization from different perspectives. The interviews were semi-structured, giving the researcher flexibility to follow the informants' flow of conversation (Enala et al., 2024). In addition to interviews, participatory observation was carried out in the school environment to directly observe how digital technology is used in daily learning processes and how teachers and students interact with the technology. The literature review complements the primary data by providing a theoretical foundation and connecting this research with other relevant studies, such as the research by Andi Baso & Etin (2024) which highlights the importance of infrastructure readiness and teacher training in the application of technology in schools.

The data obtained from these three methods were then analyzed using thematic analysis. This process began with the transcription of the interview and observation results, which were

then manually analyzed to find the main themes related to the challenges and strategies in digital transformation at Halong Public Elementary School. Thematic coding was carried out to identify patterns in the data that indicated important aspects such as teacher readiness, infrastructure challenges, and the role of parents in supporting digital learning (Subroto et al., 2023). After these themes were identified, the researcher grouped the findings into broader categories to facilitate data interpretation.

To ensure the validity and reliability of the data, this study applied source and method triangulation techniques. Source triangulation was done by comparing data from various informants (teachers, principals, students, parents, and the school committee), while method triangulation was done by combining data from interviews, observations, and literature reviews. The member-checking technique was also used to confirm the initial findings with the informants, ensuring that the researcher's interpretations aligned with the experiences and views of the informants (Taufik, 2024). With this comprehensive method design, the study is expected to provide a deep and valid portrayal of the implementation of digitalization in Halong Public Elementary School. The findings of this research are hoped to contribute to other schools in remote areas facing similar challenges, as well as to education policymakers in developing better adaptive strategies in this era of disruption.

RESULTS AND DISCUSSION

Technological Infrastructure Readiness for Digitalization in Public Elementary Schools in Maluku

One of the key aspects of digital transformation in education is the readiness of technological infrastructure. The findings of this research indicate that the technological infrastructure at SD Negeri Halong is relatively adequate compared to other schools in the Maluku region, though it still faces several limitations. Field observations revealed that the school has access to the internet, which is a prerequisite for implementing digital learning. However, the internet connection is often unstable, with varying speeds, which negatively impacts the smooth operation of technology-based learning processes. This issue frequently disrupts teaching and learning activities, especially when teachers or students attempt to access online learning materials or use digital platforms for interactive assignments.

In an interview with the principal of SD Negeri Halong, he emphasized the importance of reliable infrastructure to support educational transformation in the digital era. The principal stated, "Unstable internet connection is a major challenge for us in implementing technology-based learning methods. We have tried to improve the service quality, but the results are still inadequate." This statement underscores that although the school has basic infrastructure like internet access, instability in the connection quality is a major obstacle to the optimal use of technology. This finding supports previous research by Zein (2024), which highlights that robust infrastructure is a crucial prerequisite for the successful digitalization of education, particularly

in regions underserved by modern technology.

From a sociological perspective, the analysis of infrastructure readiness at SD Negeri Halong can be explained through Manuel Castells' theory of technology as a social structure. Castells argues that technology does not exist as a neutral entity but is integrated into the social structure, significantly impacting how societies and institutions function. In the context of SD Negeri Halong, the limitations of technological infrastructure, particularly the unstable internet access, indicate that the school has not yet fully integrated into the global network driven by digital transformation. Schools in this region face challenges in adapting to the demands of modern education, which increasingly relies on digital technology as the main medium of instruction. Unstable internet not only affects the technical implementation of learning but also shapes the mindset of educators and students regarding the effectiveness of technology in education.

Interviews with several teachers at SD Negeri Halong also revealed concerns about the dependence on digital technology. One teacher expressed, "Sometimes we worry that if we keep relying on unstable internet, we will end up wasting more time than using it effectively for learning." This statement highlights uncertainty in adapting to technology, reinforced by inadequate infrastructure conditions. Within the framework of Talcott Parsons' structural functionalism theory, technological infrastructure can be considered one of the "subsystems" supporting the overall education system. When this subsystem does not function well, such as when internet access is unstable, the entire education system is disrupted, ultimately affecting educational goals.

Moreover, the challenges faced by SD Negeri Halong in preparing technological infrastructure are also related to the geographical context and conditions of the Maluku region. As the principal explained, "Our region is quite remote, and that affects the quality of internet services we receive. We have submitted requests for network improvements, but the process is slow." The difficult-to-access geographical location and the island's conditions exacerbate the challenges faced by schools in Maluku in providing adequate technological infrastructure. This aligns with findings in the literature that schools in remote areas of Indonesia often face far more significant limitations than schools in urban areas, both in terms of physical infrastructure and access to digital resources (Firdaus & Ritonga, 2024).

Given the importance of adequate technological infrastructure, the government and educational policymakers need to pay greater attention to improving internet quality in remote areas like Halong. This intervention will not only help schools implement digital technology in learning but also reduce the digital divide between urban and rural areas. As one teacher at SD Negeri Halong said, "We would love to adopt better technology, but without stable infrastructure support, it's difficult for us to compete with schools in the city." This shows that infrastructure issues are not just about technology but also about equity in access within the national education system. The technological infrastructure readiness at SD Negeri Halong is a critical indicator in assessing how schools in the Maluku region can adopt digital transformation. While some

positive steps have been taken, significant improvements are still needed in the quality and stability of internet services. Adequate infrastructure will enable schools to optimize the use of technology in learning, which will ultimately contribute to improving the quality of education in the region.

Teacher Readiness and Human Resource Development

The digital transformation in education relies not only on adequate technological infrastructure but also on the readiness and skills of human resources, particularly teachers, who play a central role in the teaching and learning process. The findings of this research highlight the urgent need to improve teachers' capacity to effectively utilize digital technology. The low level of human resource readiness, especially in the use of technology, is one of the primary challenges faced by elementary schools in Maluku in implementing educational digitalization. Observations and interviews with educators indicate that continuous training and technical support are crucial in preparing them for this major shift. This is in line with Jamal (2021), study, which states that human resource development is the foundation for successfully implementing digital transformation in the education sector.

Based on interviews with teachers from several elementary schools, including SD Negeri Halong, it is evident that teacher readiness to apply digital technology varies. One teacher said, "We really want to use technology, but sometimes we don't know the best way to integrate it into our teaching." This statement reflects the low confidence levels among educators in utilizing technology as a teaching tool. Most of them feel that the training provided has been insufficient and has not offered a deep understanding of how to effectively use technology in the teaching-learning process. These findings are supported by Isma et al. (2023), who also emphasize the importance of improving teacher skills as a key factor in successfully implementing educational digitalization in Indonesia.

Within the framework of educational sociology theory, Pierre Bourdieu offers a relevant analysis regarding the need for human resource development through the concepts of habitus and social capital. According to Bourdieu, habitus is the mindset, actions, and habits formed from an individual's experiences within a particular social environment. In this context, educators accustomed to conventional teaching methods find it difficult to adapt to digital technology because their habitus has not yet formed to face these changes. The lack of adequate training hinders the development of a new habitus that aligns with the demands of the digital era. Additionally, the social capital that teachers possess also affects their readiness for digital transformation. Teachers with better access to training and technical support tend to be more prepared and confident in integrating technology into the learning process, while those with limited access face greater challenges.

An interview with one of the teachers at SD Negeri Halong revealed that although there is an effort to increase the use of technology, the limitations in the training provided often reduce the effectiveness of digitalization implementation in schools. "We want to make better use of

technology, but without clear guidance and more intensive training, we often don't know where to start," the teacher explained. The lack of structured training programs creates a gap between the potential of available technology and the ability of teachers to use it. Teachers need more practical and field-relevant guidance, especially regarding how technology can be applied in the classroom.

A more sustainable training approach based on the contextual needs of educators should be a priority. According to this research, most teachers expressed a desire to participate in training programs that not only focus on the use of hardware or applications but also on relevant pedagogical strategies to use digital technology to enhance student interaction and learning outcomes. Practical, hands-on training, such as workshops involving simulated teaching using technology, would help teachers become more confident and skilled in adopting digital approaches.

From Talcott Parsons' perspective, the improvement of human resource skills can be understood within the framework of structural functionalism. Parsons argues that every part of a social system must function effectively to support the whole system. In the context of educational digital transformation, teachers, as "actors" within the education system, must have adequate capacity to perform their roles. When teachers are not equipped with the necessary skills, it disrupts the balance and smooth functioning of the overall education system, ultimately affecting the achievement of educational goals. Therefore, the development of teacher skills is an essential element that cannot be overlooked in broader digital transformation efforts.

Furthermore, human resource skill development is also related to power structures and social relations within the education system itself, as posited by Michel Foucault. According to Foucault, knowledge and skills are tools of power. Teachers with better digital skills will hold a more dominant position within the education structure, while those who are less skilled are likely to be marginalized in the wave of technological change. Thus, effective training not only strengthens individual capacities but also shifts the balance of power within the education system, allowing more teachers to actively participate in digital transformation and contribute to the improvement of educational quality.

Human resource skill development is a crucial step in ensuring the success of digital transformation in the education sector. Without adequate readiness from educators, digital technology will only become a less effective tool and fail to reach its potential in enhancing the quality of education. Therefore, the government and education stakeholders need to strengthen continuous and relevant teacher training programs, so that educators can better integrate technology and confidently face the challenges of the disruption era.

Resistance to Change: Challenges in Shifting Mindsets

One of the key findings from this research is the presence of resistance to change among educators, particularly in adopting technology. The reluctance to embrace technology remains one of the main obstacles in the process of digitalizing education in elementary schools in

Maluku. Interviews and observations revealed that while most teachers acknowledge the importance of technology in learning, they still feel doubtful and anxious about their ability to use it effectively. This condition aligns with Sutisna's (2024), view, which emphasizes that resistance to change often stems from uncertainty and fear of being unable to adopt new technologies. Fullan highlights that teachers often feel anxious about failing to meet the complex and rapidly changing demands of technology, making them hesitant to fully engage in the digital transformation process.

Interviews with several school principals and teachers revealed that this resistance issue is not entirely rooted in a rejection of technology, but rather in concerns about a lack of understanding and skills. A principal noted, "We believe technology can bring positive changes, but we need to proceed with caution." This statement reflects an awareness of technology's potential but also indicates concerns about the negative impact if technology is implemented without proper preparation. This attitude suggests that although there is a willingness to adapt to change, a more cautious and structured approach is needed to ensure the success of digital transformation.

In the context of sociology, this resistance to change can be analyzed using Max Weber's theory of habitual action. According to Weber, individuals tend to act based on habits they have developed over the years, and fundamental changes in work methods often trigger resistance because they challenge the entrenched habitus. In the case of educators in Maluku, their habitus consists of traditional teaching methods that they have mastered and feel comfortable using. Therefore, the transition to technology-based teaching methods is seen as a threat to the routines they have followed for years. Anxiety over the inability to adapt to new technology further reinforces this resistance, making the digital transformation process more difficult.

The research also revealed that resistance to change is not always negative. In some cases, resistance arises from a sense of responsibility to ensure that changes are made correctly. Some educators expressed concern that technology might alter the dynamics of interaction between teachers and students, potentially reducing the quality of personal relationships that have long been the foundation of education in elementary schools. One teacher emphasized, "We want to use technology, but we are also concerned that excessive use of technology will reduce direct interaction with students, which is essential for their development." This statement illustrates that resistance to technology is not solely rooted in incompetence but also in concerns that technology could replace important personal aspects of education.

In Pierre Bourdieu's framework, this resistance can be explained through the concepts of cultural capital and social capital. Educators accustomed to traditional methods possess cultural capital built from their knowledge and experience in the conventional education system. When new technology is introduced, this cultural capital is threatened, as they feel that the skills and knowledge they have developed over the years may no longer be relevant. This creates discomfort and uncertainty, ultimately leading to resistance. Additionally, the social capital that teachers have built through interactions with their peers also influences their attitude toward

change. Teachers with strong and supportive social networks are more likely to embrace change, as they have social resources to help them overcome difficulties in adopting technology. However, for teachers who feel isolated or lack peer support, resistance to change tends to be stronger.

The study also found that attitudes toward change varied among educators. Some teachers exhibited a more positive attitude toward technology, but they remained anxious about the potential consequences. For example, one teacher stated, "We are ready to use technology, but we need more guidance on how to use it properly." This shows that although there is a willingness to change, fear of making mistakes in using technology still acts as a barrier. This resistance can also be understood within the framework of status quo bias, where individuals tend to prefer maintaining the current state rather than taking risks with uncertain changes. Educators who feel comfortable with traditional teaching methods may be reluctant to engage in digitalization, fearing that the changes could negatively affect the quality of their teaching.

To address resistance to change, a comprehensive and in-depth approach is needed. Jamal (2021) highlights the importance of mentoring and technological guidance programs to facilitate the shift in educators' mindsets. One-off training programs are not sufficient to change mindsets that have been formed over many years. Instead, continuous mentoring is needed to allow educators to practice using technology in a supportive and guided environment. Through mentoring programs, teachers can feel more comfortable exploring the use of technology and gradually build their confidence. This approach also helps reduce the fear of failure, as educators know they have consistent support and can overcome challenges together.

From Michel Foucault's perspective, resistance to technology can also be seen as a form of power and control. Technology is often interpreted as a new tool of control that regulates how teachers work and teach. Educators may feel that with digitalization, they lose control over the teaching methods and approaches they have mastered. Thus, this resistance also reflects the fear of losing authority in the classroom, where technology begins to dictate the flow of learning. To overcome this resistance, it is crucial for educational policies to actively involve educators in the design and implementation process of technology, so that they feel in control and can significantly contribute to the change.

Local Adaptation and Innovation as Solutions

Despite the challenges posed by infrastructure and human resources in the digitalization of education in Maluku, several schools have demonstrated creative adaptability in overcoming these limitations. These schools have successfully developed local solutions to address obstacles such as limited internet access, scarce technological devices, and low teacher readiness in using digital technology. This shows that local innovation can be an effective solution in tackling various challenges that arise in the context of digital transformation, especially in regions with limited resources. A concrete example of this adaptation can be seen at SD Negeri Halong, where, despite unstable internet access, the school continues to find ways to keep technology-based learning

going. In an interview, the principal stated, “We use simple devices like smartphones and tablets that some teachers and students already own to carry out digital learning activities, even though the internet connection is not always reliable.” By utilizing the devices already available and optimizing their use in the learning process, the school has been able to adapt to local conditions while still providing quality learning experiences for students. This approach aligns with the concept of adaptive learning as proposed by Sastromiharjo (2024), in which educational institutions must be able to adapt to local conditions and make use of available resources to achieve learning goals.

Furthermore, several schools in Maluku have also developed digital learning materials tailored to the local cultural context. Teachers at these schools have created digital videos and modules featuring local content, such as Maluku folklore or practical activities related to the daily lives of the local community. This innovation not only helps students better understand the subject matter but also strengthens their connection to local culture. Using content relevant to students’ lives creates more meaningful and effective learning, in line with the principles of contextual learning in education.

In addition, these local innovations also involve parents and the community in the learning process. For example, when internet access is insufficient for conducting online learning, some schools have adopted offline learning methods by involving parents in distributing printed learning materials. These schools recognize that parental involvement is key to supporting the success of digital learning at home. One teacher remarked, “We coordinate with parents to ensure that the children still have access to learning materials even if they cannot attend online classes.” This collaborative approach highlights the importance of local innovation in creating solutions that meet the needs and conditions of the community.

CONCLUSION

The conclusions of this study indicate that digital transformation in elementary schools in Maluku faces complex challenges, yet it still holds significant potential for effective implementation with the right approach. One of the key factors influencing the success of digitalization is technological infrastructure. Schools with stable internet access and adequate technological devices tend to be more prepared to adopt digital learning. However, the majority of schools in Maluku still struggle with limitations in infrastructure, which poses a significant barrier to optimizing the use of technology in education. Therefore, improving access to technology in remote areas is an urgent necessity for this transformation to proceed smoothly. In addition to infrastructure, the readiness of human resources, particularly teachers, also plays a crucial role in the success of digitalization. This research shows that although there is enthusiasm for using technology, many educators feel unprepared due to a lack of relevant training. The mental readiness and skills of teachers in utilizing technology still vary, and resistance to change arises from uncertainty and a lack of confidence in using digital tools. This

indicates that ongoing training and mentoring programs are essential for enhancing teachers' competencies in adapting to rapid technological changes. Nevertheless, this study also found that some schools in Maluku have successfully demonstrated creative local adaptation and innovation. Despite facing limitations in infrastructure and resources, these schools have been able to seek alternative solutions, such as utilizing existing technological devices and involving parents and the community in the digital learning process. This innovation reflects the schools' ability to adapt to their local environment and circumstances, which is key to creating effective learning models amid these constraints.

ETHICAL STATEMENT AND DISCLOSURE

This study was conducted in accordance with established ethical principles, including informed consent, protection of informants' confidentiality, and respect for local cultural values. Special consideration was given to participants from vulnerable groups to ensure their safety, comfort, and equal rights to participate. No external funding was received, and the authors declare no conflict of interest. All data and information presented were collected through valid research methods and have been verified to ensure their accuracy and reliability. The use of artificial intelligence (AI) was limited to technical assistance for writing and language editing, without influencing the scientific substance of the work. The authors express their gratitude to the informants for their valuable insights, and to the anonymous reviewers for their constructive feedback on an earlier version of this manuscript. The authors take full responsibility for the content and conclusions of this article.

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