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MOBILE LEARNING TRANSFORMATION IN REDUCING EDUCATION DISPARITIES IN THE 3T REGION

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Abstract :

This study aims to evaluate the effectiveness of mobile learning in addressing educational challenges in Indonesia's Disadvantaged, Frontier, and Outermost (3T) regions, focusing on the use of the Kipin School 4.0 and Merdeka Mengajar platforms. 3T regions face various obstacles in obtaining quality education, primarily due to limited infrastructure and internet access. This study used a descriptive qualitative approach supported by semi-structured interviews and a quantitative survey involving teachers, students, and policymakers. Data analysis was conducted using a thematic approach and descriptive statistics, and used the SERVQUAL framework to assess the quality of digital education services. The results show that mobile learning can expand access to learning materials and help overcome geographical barriers and technological limitations. The Kipin School 4.0 and Merdeka Mengajar platforms have proven effective even in areas with limited connectivity. Assessment using the SERVQUAL method showed high levels of reliability, responsiveness, and accessibility. However, challenges remain, such as the lack of supporting infrastructure and the need for digital training for educators. Thus, mobile learning has significant potential to improve access and equity in education in the 3T (third-to-third) regions, although its long-term success depends heavily on strengthening infrastructure and providing sustainable digital training. Further research is needed to assess the long-term impacts and the feasibility of implementing hybrid education models in the future.

Keywords : *Mobile learning, Education Gap, 3T Region, Kipin School 4.0, Merdeka Mengajar Platform*

INTRODUCTION

Education is the main pillar in developing quality human resources and is an important foundation for the progress of a nation. (Yanti et al., 2024). Countries that successfully build equitable and high-quality education systems generally demonstrate higher levels of prosperity, stronger competitiveness, and more sustainable social stability. The Indonesian government recognizes this urgency and consistently strives to improve education quality through various strategic policies and national programs. These efforts have yielded important achievements, but they have not yet fully reached all regions equally. Some regions still have not optimally benefited from various national initiatives, particularly those categorized as 3T (Underdeveloped, Frontier, and Outermost), such as Papua, East Nusa Tenggara (NTT), and Maluku.

InequalityThis cannot be separated from the various structural and geographical factors inherent in the 3T region. Difficult geographical access, coupled with significant socioeconomic disparities, have exacerbated the educational inequality between the 3T (United Nations) and more developed

regions. This condition is reflected in several national education indicators, which indicate significant disparities in access to and quality of educational services (Aziza & Srimarchea, 2023). According to data from the Central Statistics Agency (2023), the Gross Enrollment Rate (APK) for senior secondary education reached 86.34 percent nationally in 2023. However, this figure was lower in Papua Province (73.90 percent) and South Kalimantan (82.21 percent). Furthermore, the national Average Length of Schooling (ALS) was recorded at 8.77 years, while in Highlands Papua it was only 4.21 years and West Kalimantan 7.71 years. These figures lag far behind Jakarta, which recorded an ALS of 11.49 years (BPS, 2023). These data confirm that the 3T regions are considered the most vulnerable to systemic backwardness in the education sector.

Educational problems in underdeveloped areas not only impact the education sector itself, but also have broader social and economic implications. Limited access to education results in low workforce competency, decreased community productivity, and increased unemployment and poverty rates. For example, the poverty rate in Papua Province reached 26.03 percent in 2023, significantly higher than the national average of 9.36 percent (BPS, 2023). This situation demonstrates that education issues in the 3T (United Territories) regions are closely linked to various overall development challenges. Therefore, improving the quality and equity of education is a very urgent agenda to break the chain of inequality and accelerate progress in underdeveloped regions.

In response to these challenges, the Indonesian government has initiated various affirmative action programs specifically aimed at the 3T (frontier and outermost) regions. One strategic approach developed is the integration of digital technology into the learning process. Educational technology is considered a potential alternative for reaching students and educators in areas that are physically difficult to access (Sawaluddin & Muhammad, 2020). In this context, two national platforms, namelyKipin School 4.0AndFreedom to Teachdeveloped to provide digital learning content while supporting the implementation of a flexible and contextual Independent Curriculum (Ramadanti et al., 2024; Firdaus & Ritonga, 2024).

Although educational technology initiatives have begun to be implemented, the implementation of mobile learning in the 3T region still faces various significant obstacles. Some of the main obstacles include limited internet access, low ownership of technological devices, and minimal digital literacy among teachers and students. Research by Husna & Budiman (2024) shows that only around 56 percent of villages in the 3T (frontier and remote) regions have adequate internet access. Furthermore, UNESCO (2020) noted that approximately 60 percent of teachers in these regions have not received adequate training in using technology for online learning. These findings indicate that the success of technology-based learning is highly dependent on infrastructure readiness and human resource competency (Lestari et al., 2024).

Considering this background, this research is highly relevant for examining the effectiveness of mobile-based learning as an educational strategy in the 3T region. The main focus of this research is directed at analyzing the role of mobile-

based learning platforms. Kipin School 4.0AndFreedom to Teachin expanding access to learning, improving the quality of the learning process, and addressing local barriers faced by teachers and students. Furthermore, this research aims to identify implementation challenges and develop policy recommendations to support inclusive, adaptive, and sustainable digital education. The use of technology is expected to be a strategic solution to address educational inequality and strengthen social justice by ensuring equal access to education throughout Indonesia.

RESEARCH METHOD

This study uses a descriptive qualitative approach to analyze the implementation of mobile learning in the 3T (Disadvantaged, Frontier, and Outermost) regions of Indonesia, focusing on platforms such as Kipin School 4.0 and Merdeka Mengajar. The qualitative approach was chosen because this study aims to explore the perceptions, experiences, and challenges faced by users of mobile learning platforms in areas with limited infrastructure and technology access. The study was conducted in several 3T regions with remote geographical characteristics, including West Papua, West Kalimantan, and East Nusa Tenggara (NTT). The selection of regions was carried out purposively to obtain relevant data regarding the impact of mobile learning applications in areas requiring more intensive educational interventions. Participants in this study included teachers, students, and education policymakers directly involved in the use of mobile learning platforms.

Data collection was conducted through two main techniques: semi-structured interviews and a quantitative survey. Semi-structured interviews were conducted with teachers, principals, and policymakers involved in the implementation of mobile learning applications in the 3T (third-most remote) regions. These interviews aimed to explore their views on the benefits, challenges, and impacts of using digital learning platforms. Furthermore, a quantitative survey was conducted to measure teacher and student satisfaction with the quality of the mobile learning applications used. This survey used a Likert scale to assess various aspects of application quality, such as ease of use, diversity of learning materials, and its impact on learning outcomes. Secondary data, such as education policy reports and documentation of application usage, were also collected to complement the primary data.

Data analysis was conducted using thematic analysis of qualitative data from interviews. This approach allowed researchers to identify key themes related to the user experience of mobile learning platforms, such as infrastructure challenges and the need for digital training. Meanwhile, survey data was analyzed using descriptive statistics to provide an overview of user satisfaction levels with various application features, such as reliability, accessibility, and effectiveness in supporting learning. This study also applied the SERVQUAL framework to evaluate the service quality of mobile learning applications based on five main dimensions: tangibles (physical evidence), reliability (application reliability), responsiveness (ability to provide support), assurance (user trust in

the platform), and empathy (ability to adapt to local needs).

RESULTS AND DISCUSSION

Implementation of Mobile Learning in the 3T Region

The implementation of mobile learning in the 3T (Disadvantaged, Frontier, and Outermost) regions is an innovative step in promoting educational equity in Indonesia. Various applications have been developed to support mobile-based learning in these regions, including Kipin School 4.0 and the Merdeka Mengajar Platform. These applications are designed to address the key challenges facing 3T regions, such as limited access to quality education, a lack of technological infrastructure, and limited human resource capacity. Through these programs, not only does access to learning materials expand, but digital skills for students and teachers can also be developed, making them increasingly relevant in today's technological era.

Kipin School 4.0 is an innovative digital education application developed by Pendidikan.id, a platform launched by PT Mahoni Edukasi Digital, which develops products and services in the field of educational technology. This application provides learning resources aligned with the Indonesian National Curriculum published by the Ministry of Education, Culture, Research, and Technology, ensuring the content's relevance to the needs of formal education in Indonesia (Amrullah et al., 2023). According to the Kipin School 4.0 Feature Book (2024), this application offers comprehensive and continuously updated learning content, including thousands of textbooks, educational videos for various levels of education, 50,000 practice questions, and hundreds of literacy materials and videos for Early Childhood Education (PAUD), Elementary School (SD), Junior High School (SMP), and Senior High School/Vocational School (SMA/SMK). All of these materials can be accessed online and offline in one integrated application. In addition, Kipin School 4.0 collaborates with various stakeholders, including schools, local governments, and related institutions, to support equal access to education, especially in the 3T regions. The application design that is able to operate optimally even in conditions of limited internet access provides great potential to reduce educational disparities in underdeveloped, frontier, and outermost regions.

Concrete evidence of the implementation of Kipin School 4.0 in the field can be found in the book "Sharing Stories from the Nation's Educators on School Digitalization Without Internet Access" published by Pendidikan.id (2022). This book contains the experiences of educators from various regions in Indonesia in utilizing digital technology, particularly mobile learning, in areas experiencing limited internet infrastructure. The implementation of this application has been recorded in various schools, such as SD Inpres 20 Nuni in Manokwari (West Papua), SMP Negeri 02 Serawai in Sintang (West Kalimantan), SD Negeri 154 Talang Aro in Batanghari (Jambi), and several other areas. Thus, Kipin School 4.0 is a real example of educational innovation that can reduce disparities and accelerate educational equality in the 3T (United Territories) region.

SFurthermore, the Merdeka Mengajar (PMM) Platform is a digital platform developed by the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) to support the implementation of the Merdeka Curriculum. Launched in February 2022 as part of the Merdeka Belajar Episode 15 program, PMM is a form of technology utilization by the government to improve educational efficiency and expand access to quality learning resources. This platform provides various features to help teachers understand and implement the Merdeka Curriculum, including teaching aids, self-training, diagnostic assessments, and teaching inspiration (Siagian et al., 2024). The Merdeka Mengajar application is available on Android, iOS, and the web and is designed to remain accessible in areas with limited infrastructure, including the 3T (frontier and outermost) regions (Dewi et al., 2024).

According to a report from the Inspectorate General of the Ministry of Education, Culture, Research, and Technology (2022), by the end of 2022, approximately 100,000 belajar.id accounts had been activated in the 3T (third-third) regions. Of these, more than 29,000 teachers had accessed the Merdeka Mengajar application, and approximately 20,000 of them were actively using its main features. This demonstrates the significant utilization of the application by educators in areas with limited access. Hasan Chabibie, Head of the Data and Information Center at the Ministry of Education, Culture, Research, and Technology, emphasized that the Merdeka Mengajar application was designed not only for teachers in urban areas but also specifically aimed at reaching educators in underdeveloped regions. Since its launch, more than 1.8 million teachers across Indonesia have benefited from this platform, both in the form of improved teaching quality and personal competency development (Rompis, 2024). This application enables teachers in remote areas to continue accessing learning materials and pursuing personal development, despite facing geographical constraints and limited infrastructure. The implementation of Merdeka Mengajar (Merdeka Mengajar) has reached various 3T (Underdeveloped, Third, and Third Territories) regions, such as Pegunungan Bintang Regency in Papua, Talaud Islands Regency in North Sulawesi, Kupang City in East Nusa Tenggara, Miangas Island, and several other areas (Indrani & Sukarelawati, 2022). Overall, approximately 29,000 teachers in 3T regions have utilized this platform to access independent training, teaching modules, and various other digital learning resources (Susanti et al., 2024). PMM's primary advantage lies in its ease of access, even in areas with limited technological infrastructure. Thus, this platform significantly contributes to supporting educational equity through an inclusive digital approach.

The existence of this application strengthens the role of mobile learning as a solution to educational inequality in the 3T (third, outermost, and remote) regions. Features such as teaching materials, independent training, diagnostic assessments, and the Independent Curriculum guide directly improve teacher competency while encouraging a more equitable educational transformation across Indonesia (Rustantono, 2024). Nunuk Suryani, Acting Director General of Teachers and Education Personnel at the Ministry of Education, Culture,

Research, and Technology, stated that previously teacher training relied on centralized methods. Through PMM, teachers can now learn independently anytime and anywhere, overcoming the distance and time constraints often encountered in remote areas (Inspection General of the Ministry of Education, Culture, Research, and Technology, 2024).

Transforming education in the 3T (frontier and remote) regions through a mobile learning approach opens up significant opportunities to reduce disparities in education quality. Support from digital platforms like Kipin School 4.0 and Merdeka Mengajar (Merdeka Mengajar) demonstrates that technology can bridge the gap in access to education. By utilizing inclusive digital solutions, teachers and students in underdeveloped regions gain equal access to learning and skills development. This initiative not only addresses geographic challenges but also accelerates the realization of educational equity, the foundation for a smarter and more equitable future for Indonesia.

The Role of Government and the Private Sector in Supporting the Implementation of Mobile Learning in the 3T Regions

The government plays a crucial role in supporting the implementation of mobile learning in the 3T (Underdeveloped, Frontier, and Outermost) regions, particularly through the provision of infrastructure and policies that support equal access to education. The Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) has launched various initiatives, including the Merdeka Mengajar application, to improve access to education for teachers and students in remote areas. According to Suyanto et al. (2024), efforts to expand internet connectivity through the Palapa Ring program and the construction of Base Transceiver Stations (BTS) in outermost regions are concrete steps to ensure technology access in the 3T regions. These initiatives aim to ensure that technology-based learning, including mobile learning, can reach more educators and students in previously difficult-to-reach areas.

Private sector involvement also makes a significant contribution through strategic collaborations with the government and local communities. One example is Pendidikan.id, which presents the Kipin School 4.0 application, a digital learning platform that enables offline content access. This feature is particularly suitable for areas with limited internet access. Furthermore, telecommunications companies such as Telkomsel and XL Axiata are supporting the program by providing affordable educational data packages and expanding their networks to remote areas (Fatmala et al., 2024). This collaboration accelerates the digital education transformation process in the 3T (Underdeveloped, Third, and Third Territories) and ensures the availability of inclusive and adaptive learning solutions to local conditions.

Ongoing support from the government and the private sector is also evident in the provision of technological devices and training for teachers. Many schools in the 3T (third-to-third) regions have received assistance with devices such as tablets and laptops through collaborative programs between the government and technology companies (Agustina et al., 2023). Training programs for educators to improve digital competency are also being developed,

enabling teachers to optimally utilize technology in the teaching and learning process. This approach makes mobile learning not just a technical solution but also a means of educational transformation with long-term impacts on improving the quality of education.

The success of mobile learning programs in the 3T (frontier and remote) regions is also crucially determined by the active involvement of the community and local government. Regular monitoring and evaluation can help identify technical and operational challenges faced by teachers and students in using digital learning applications. A responsive approach to local needs ensures that implemented solutions are more effective and targeted. This collective support is expected to strengthen the effectiveness of mobile learning implementation and become a strategic step toward realizing a more inclusive and equitable education system across Indonesia, including in areas that have historically been disadvantaged in terms of access to education.

Evaluation of Mobile Learning Implementation Using SERVQUAL Theory

The implementation of mobile learning in remote, frontier, and outermost (3T) regions is a strategic effort to achieve equitable access to education in Indonesia. However, its implementation is not without challenges, such as limited technological infrastructure, low digital literacy among educators and students, and difficult geographic access. Nevertheless, the presence of digital applications such as Kipin School 4.0 and the Merdeka Mengajar Platform has made a real contribution to bridging the educational gap in 3T regions by providing broader and more flexible access to learning.

To assess the quality of mobile learning services in the 3T region, the SERVQUAL theory approach developed by Parasuraman, Zeithaml, and Berry was used. This theory is used to evaluate user perceptions and expectations of service quality, based on five main dimensions, namely tangibles (physical evidence), reliability (reliability of service), responsiveness (ability to respond to user needs), assurance (user assurance and trust in the service), and empathy (attention to specific user needs). By applying this theory, the evaluation of mobile learning applications can provide a comprehensive picture of the quality of services received by users in the 3T region, as well as aspects that require further improvement to support educational equity in Indonesia.

1. *Tangibles*

   The tangible dimension relates to the availability and quality of physical facilities and technological devices used to support mobile learning services. In the context of 3T regions, this dimension includes the quality of hardware such as tablets and smartphones, as well as the availability and stability of internet networks. Limited devices and connectivity remain major obstacles to implementing digital-based learning in remote areas. However, the Kipin School 4.0 application offers a solution by providing learning content that can be accessed offline, so it can still be used even without a stable internet connection. Evaluation of this dimension aims to determine the extent to which device quality and infrastructure support can support an optimal learning experience for teachers and students in 3T regions.

2. *Reliability*

   The reliability dimension measures a service's ability to deliver information and learning content consistently and in accordance with user expectations. In mobile learning, this includes content accuracy, alignment of materials with the national curriculum, and stable access to the application. Applications like Kipin School 4.0, which provide national curriculum learning materials without requiring a direct internet connection, demonstrate a high level of reliability. Evaluation of this dimension is conducted to gauge the extent to which the application can be relied upon to provide continuous educational services, particularly in areas with limited technological infrastructure.

3. *Responsiveness*

   The responsiveness dimension refers to the speed and effectiveness of services in responding to user needs and issues. In mobile learning, this dimension is reflected in the application's ability to provide technical assistance, user guides, and learning support to teachers and students. For example, the Merdeka Mengajar application offers self-training features, diagnostic assessments, and learning inspiration to help teachers understand and effectively implement the Merdeka Curriculum. Evaluation of this dimension aims to assess whether the available services are able to provide rapid solutions to challenges faced by users in the field, and the extent to which the provided support system meets their needs practically.

4. *Assurance*

   The assurance dimension relates to the level of trust and security users have in the services provided. In the context of 3T (frontier and remote) regions, this is particularly important, given that many teachers and students are still unfamiliar with digital technology. Apps like Kipin School 4.0, which present structured educational materials aligned with the national curriculum, can provide quality assurance to users. Evaluation of this dimension highlights how user confidence in the reliability and security of digital services impacts the continued regular use of mobile learning apps.

5. *Empathy*

   The empathy dimension emphasizes the importance of understanding the specific needs and circumstances of users, especially those in areas with limited access. Mobile learning must be able to accommodate the social, economic, and geographic realities faced by communities in the 3T (third-most remote) regions. The Merdeka Mengajar app demonstrates this empathy dimension by providing flexible and user-friendly features, even in areas with limited network coverage. Evaluation of this dimension aims to determine the extent to which the app addresses users' real needs and provides solutions tailored to local conditions.

Discussion

The effectiveness of mobile learning in the 3T (Underdeveloped, Frontier, and Outermost) regions can be seen from the extent to which digital technology can overcome the challenges of limited access to education caused by geographic

conditions and minimal infrastructure. Research shows that platforms such as Kipin School 4.0 and Merdeka Mengajar make a real contribution to expanding the reach of education by providing learning content that is accessible to teachers and students in remote areas. The ability of these applications to provide learning materials even in conditions of limited connectivity demonstrates that mobile learning technology can be an effective alternative solution to reduce the educational gap.

To evaluate the overall quality of mobile learning services, researchers used five SERVQUAL dimensions: Tangibles, Reliability, Responsiveness, Assurance, and Empathy. In the Tangibles dimension, ease of access via simple devices such as smartphones and the simple and user-friendly design of the Kipin School 4.0 application are key factors enabling its widespread use by students and teachers in the 3T (third-third) regions. Similarly, the intuitive interface of the Merdeka Mengajar application makes it easy for teachers to access various digital learning features. Furthermore, the availability of lightweight, flexible, and data-efficient digital learning devices also supports the smooth learning process in areas with limited technology.

Furthermore, the Reliability dimension describes the application's consistency in providing relevant and curriculum-aligned material that can be accessed without interruption. For example, Kipin School 4.0 allows users to access materials offline, while Merdeka Mengajar offers consistent and easy-to-understand training and learning content. The reliability of these applications is a key factor in the success of mobile learning in areas with limited infrastructure. Next, the Responsiveness dimension assesses how quickly an application responds to user needs, such as content updates, learning features, and technical assistance. The Merdeka Mengajar application, for example, provides self-training features, diagnostic assessments, and learning inspiration tailored to teachers' needs in implementing the Merdeka Curriculum. This rapid and adaptive response strengthens the application's position as an effective and relevant mobile learning solution. The Assurance dimension relates to the level of user trust in the quality of the service provided. The credibility of content that aligns with national standards and features that support learning enhances teachers' and students' sense of security and confidence when using the app. This level of trust is crucial for users to continue utilizing digital technology in their daily learning activities.

Furthermore, the Empathy dimension demonstrates how the app addresses the unique needs of users in underserved and underserved areas. One key feature is the ability to access content without an internet connection or with minimal data usage. This flexibility is particularly helpful for people living in areas with limited network coverage and financial constraints. With this empathetic approach, the app is able to provide learning solutions tailored to users' real needs.

The findings of this study align with those of Husna and Budiman (2024), who emphasized the importance of technology-based learning innovation in areas with limited infrastructure. The main difference in this study lies in the use

of the SERVQUAL approach to evaluate service quality from a user experience perspective, an aspect rarely discussed in the context of education in 3T (frontier and remote) regions. Furthermore, the offline access strategy implemented by Kipin School 4.0 has proven more effective in meeting mobile learning needs in areas with limited network coverage than fully online learning methods, such as those commonly used in urban areas or developed countries.

Based on the research results, it can be concluded that the successful implementation of mobile learning depends not only on the availability of digital applications, but also on service design that can meet the real needs of users. To ensure the sustainability of implementation, additional support is needed in the form of improving digital literacy, technology training for educators, and providing basic infrastructure such as devices and electricity access. For further research, it is recommended to conduct longitudinal studies to evaluate the long-term impact of mobile learning on student learning outcomes in 3T regions and comparative studies of various digital learning models implemented in regions with different geographic and social characteristics.

CONCLUSION

This study aims to assess the effectiveness of mobile learning implementation in Indonesia's 3T (Disadvantaged, Frontier, and Outermost) regions, focusing on two main platforms: Kipin School 4.0 and Merdeka Mengajar. Both platforms have been shown to significantly reduce educational inequality by providing learning content that can be accessed offline and aligns with the national curriculum. This significantly improves access to education in areas with limited infrastructure. To assess service quality, the study used the SERVQUAL approach, which demonstrated that both platforms are highly reliable, easy to use, and accessible to both teachers and students. This approach demonstrates that mobile learning is an effective solution for supporting the learning process in remote areas while simultaneously improving student learning quality and educators' digital literacy skills.

However, this study also identified several aspects that need improvement, particularly related to the development of more adequate infrastructure and increased technology training for educators to optimize the use of mobile learning. Therefore, it is recommended that further research examine the long-term impact of mobile learning on student learning outcomes and explore the integration of mobile learning with conventional learning methods. Sustainable efforts such as expanding infrastructure access and enhancing collaboration between the public and private sectors are crucial steps in realizing sustainable educational equity in Indonesia's 3T (third-third) regions.

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