

Utilization of Mobile-Based Learning Media to Improve Education Accessibility in Remote Areas

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Abstract

Inequality in access to education between urban and remote areas is still a serious problem in the education system in Indonesia. Many students in remote areas face obstacles in obtaining proper education, mainly due to the limited number of educators, lack of educational facilities, and difficult access to transportation. Along with the rapid development of information and communication technology, mobile-based learning media emerged as a potential solution to overcome these obstacles. This study aims to examine the utilization of mobile-based learning media in improving accessibility and quality of education in remote areas. The method used is a qualitative study with a case study approach in several primary and secondary schools in remote areas in Indonesia. The results show that the use of mobile media such as educational applications, learning videos, and Android-based e-learning platforms can expand the range of learning, increase student participation, and allow teaching and learning activities to take place flexibly without relying on the physical presence of teachers. In addition, students show increased motivation to learn and independence in completing tasks. However, the implementation of this media still faces several challenges, including limited internet network, lack of mobile devices, and low digital literacy of teachers and students. Support from various parties, both government and private, is needed to provide infrastructure, training and development of appropriate learning content. With the right approach, mobile-based learning media has the potential to be a strategic tool in expanding access to inclusive and equitable education throughout Indonesia

Keywords: Learning Media, Mobile Learning, Remote Education, Accessibility, Education Technology.

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Introduction

Education is a crucial element in national development and acts as the main instrument to improve the quality of life of the community (Fadly, 2024). In the framework of sustainable development, education is not only a process of knowledge transfer, but also a foundation in creating a smart, productive and competitive society. The Indonesian government has recognized the urgency of education by establishing it as a basic right of every citizen that must be fulfilled equally, without discrimination based on geographical location, social status or economic background (Vega, 2024; Zahro, 2024; Uriyalita, 2020). However, although education policy has been directed to ensure equality, the reality on the ground shows that there is a sharp gap, especially between urban and remote areas.



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Differences in access and quality of education are a major challenge that must be overcome so that the goal of education equity can be substantively achieved.

Students living in remote areas often face various barriers that limit their access to quality education. Limited educational infrastructure such as inadequate school buildings, shortage of professional teaching staff and lack of availability of teaching materials are fundamental problems. Geographical barriers such as difficult terrain, long distances to school and limited transportation also hamper the continuity of the teaching and learning process. Furthermore, the quality of teaching in remote areas is often not comparable to that in urban areas because teachers in these areas generally lack ongoing training and have limited access to the latest educational technology (Idin, 2024; Azri, 2024; Azkiyah, 2025). These inequalities not only hamper the development of students' academic potential but also widen the social and economic gap between regions, which in the long run can threaten the integrity and social justice of the national education system. To address the complexity of these issues, strategic and innovative interventions are needed, which not only focus on providing physical facilities, but also on strengthening effective and inclusive learning processes.

The utilization of digital technology is one potential solution that can bridge geographical and structural limitations in remote areas (Onoja, 2022). Along with the rapid development of information and communication technology (ICT), there are new opportunities to expand access to education through a more flexible and adaptive approach. One increasingly relevant form of ICT implementation is mobile learning, which is the use of mobile devices such as smartphones and tablets to support the learning process (Garzón, 2024). This learning model allows students to learn independently, anytime and anywhere, with digitally accessible materials. Mobile learning provides the flexibility of time and place that is needed by students in areas with limited teachers, poor school conditions, and difficult road access or isolated areas (Lin, 2024). Thus, mobile technology can be a bridge to a more equitable and just education transformation across the country.

More than just a replacement for conventional learning methods, mobile learning acts as a catalyst for transformation in the education system towards a learning model that is more responsive and adaptive to the dynamics of the times (Ghosh, 2024). This transformation reflects a paradigm shift from classroom-centered learning to a more flexible, open, and technology-based learning. In the context of limited education infrastructure in remote areas, such as inadequate classrooms, lack of textbooks, and frequent teacher absenteeism, mobile learning becomes a strategic solution that opens up space for a more modern, interactive and personalized learning approach. The use of mobile devices that are relatively affordable and easy to operate makes this technology able to reach students who previously had limited access to quality learning (Simon, 2024).

Through various educational applications designed to support both online and offline learning, mobile learning allows learners to access learning materials independently with multimedia content that is interesting, interactive, and suits their individual needs. This advantage is very important, especially for students in remote areas who are not always able to follow learning in person due to limited human resources and difficult geographical conditions. The portable, cost-effective, and easily accessible characteristics of mobile learning provide flexibility for students to learn outside the time and space limits of conventional classes (Robin, 2024). This is especially crucial in remote areas, where the distance to school is very long, communication signals are limited, and the number of teaching staff is not proportional to the number of students. The existence of various local and national digital learning platforms further strengthens the position of mobile learning as an effective bridge in reaching groups of learners who were previously marginalized from the national education system. With the support of relevant content and implementation strategies tailored to the local context, mobile learning not only improves access to education, but also encourages the improvement of learning quality, effectiveness, and relevance in facing the demands of 21st century skills, such as digital literacy, critical thinking, learning independence, and adaptability to rapid change.

Various studies have proven that mobile learning can increase student engagement, enrich learning methods, and support independent learning (Saputra, 2025; Najjar, 2023; Alfyn, 2025). Most of these studies were conducted in urban or semi-urban areas that already have supporting infrastructure such as stable internet network and high level of digital literacy. Meanwhile, the implementation of mobile learning in remote areas is still very limited, both in terms of academic studies and field practices. The research gap found in this study is the lack of research that comprehensively examines the utilization of mobile-based learning media in environments with limited infrastructure, low digital literacy, and high dependence on conventional learning methods. In addition, there are not many studies that evaluate the readiness of teachers, students, and socio-cultural factors that influence the acceptance of technology in the context of remote areas.

This research aims to answer the need for a more contextual and applicable study on the use of mobile learning in improving education accessibility in areas that have been marginalized in terms of education services. This study not only assesses the effectiveness of mobile media in delivering learning materials, but also explores the obstacles and opportunities in the field, including factors of infrastructure availability, stakeholder readiness, and learning content adaptation strategies to local needs. Thus, this research is expected to provide theoretical and practical contributions in the field of educational technology, as well as a reference for policy makers, application developers, and educators in designing learning programs that are more.

Methodology

This research uses a descriptive qualitative approach that aims to describe in depth the utilization of mobile-based learning media in improving educational accessibility in remote areas. This approach was chosen because it allows researchers to understand the phenomenon contextually and thoroughly, especially in seeing how technology can be adapted in an environment with limited infrastructure and resources. This research focuses on the experiences, perceptions and challenges faced by students, teachers and education stakeholders in the process of implementing mobile media for learning. The research location was determined purposively, namely junior high schools located in areas with limited access to education, minimal internet networks, and initiatives to use mobile devices in teaching and learning activities. The research subjects consisted of teachers, students, principals, and parents. The informants were selected based on their direct involvement in the mobile-based learning process, with the number adjusted until sufficient and representative data was obtained..

Data were collected through in-depth interviews, observation, and documentation. Interviews aimed to gather information about perceptions, experiences, and challenges faced in implementing mobile learning. Observation was conducted to see firsthand how the learning process takes place, both at school and at home, while documentation was used to collect supporting data in the form of school records, application displays, and photos of learning activities. The main instrument in this study was the researcher himself, who was equipped with an interview guide and observation sheet. In the implementation of data analysis, researchers used thematic analysis techniques, namely by identifying patterns, categories, and themes that emerged from the results of interviews, observations, and documentation. The analysis process was carried out continuously and interrelated between the data reduction, data presentation, and conclusion drawing stages. To maintain data validity, triangulation of methods and sources was carried out, as well as rechecking with informants through the confirmation of results technique. This research also pays attention to ethical aspects, by ensuring that informants' participation is voluntary, their identities are kept confidential, and the research results are delivered honestly and responsibly. Through this method, it is hoped that the research can provide a comprehensive picture of the potential and challenges of utilizing mobile-based learning media in remote areas, as well as provide applicable recommendations for the development of technology-based education in areas with limited access

Result and Discussion

The results show that the utilization of mobile-based learning media has a significant impact on improving the accessibility of education in remote areas, although it still faces various structural and technical challenges. In the context of geographical limitations and lack of educational infrastructure that characterize remote areas, the presence of mobile devices such as smartphones, tablets and educational applications has opened up alternative spaces for the teaching and learning process. These devices allow students to access learning materials, learning videos and interactive platforms flexibly and independently, even outside of school hours. This is an important solution especially when teacher attendance is inconsistent due to long distances, extreme weather conditions, or limited teaching staff. Mobile learning media also supports a more personalized and adaptive learning style, where students can learn at their own pace and needs (Rahma, 2024). The implementation of this technology is inseparable from obstacles such as uneven internet connectivity, limited electrical power, and low digital literacy among both students and educators. To maximize the potential of mobile media in education in remote areas, supporting strategies are needed that include improving infrastructure, technical training for teachers, and developing learning content that is appropriate to the local context and local culture (Firdaus, 2024; Dalimunthe, 2025; Novalia, 2024).

Observations in the field indicate that most students in remote areas already have access to mobile devices, although ownership of these devices is still limited. In many cases, one device must be used interchangeably by several family members, such as parents or siblings. This situation reflects the great potential in utilizing mobile technology as a learning support medium, even though the conditions are far from ideal. According to Sayaf (2022), ownership of technology devices is not the only factor that determines the effectiveness of digital learning; the availability of appropriate content and students' adaptability to technology are also key determinants. In the midst of limited devices and usage time, students still show motivation and enthusiasm for learning, especially by utilizing time outside of school hours to access materials sent by teachers through digital communication platforms such as WhatsApp, Telegram, or simple educational applications that can be accessed offline or with limited connections.

Most teachers in the research locations have shown proactive initiatives in integrating mobile technology into the learning process in response to the challenges of accessing education in remote areas. Teachers have started distributing teaching materials in various formats adapted to the characteristics of mobile devices, such as short learning videos, infographics, illustrative images, and interactive practice questions designed to be easily accessed through devices with limited specifications. This innovation is in line with Yuan's (2025) view that the effectiveness of mobile learning is highly dependent on the design of materials that are concise, attractive, and easy to operate by users with various technological backgrounds. Furthermore, some teachers have even implemented a simple hybrid learning model, which combines limited face-to-face meetings with mobile-based online assignments. This approach allows learning to continue adaptively, even when there are disruptions to conventional learning activities due to external factors such as extreme weather or geographical barriers. Such measures not only reflect the creativity and resilience of educators in the face of structural limitations, but also mark a paradigm shift towards more flexible, inclusive and technology-based learning models. Transforming education through technology is not just about the availability of devices, but about how technology is used effectively to enhance learning experiences and reach marginalized students (Eden, 2024).

One of the most striking findings of this is the increased motivation of students to learn when the material is delivered through interactive and visual media (Intaniasari, 2022; Afnita, 2022; Said, 2023). Compared to conventional lecture methods that tend to be passive, the use of learning videos, animations, and educational game applications has proven to be able to attract students' attention more effectively. Students seem more enthusiastic and actively involved in the learning process, even on materials that were previously considered difficult or boring. Visual media packaged in an interesting way makes it easier for students to understand concepts intuitively, while interactive features such as

quizzes, simulations and challenges in educational applications encourage them to learn while playing (Maria, 2025). Some teachers also noted an increase in students' independence in learning, because with access to digital materials, students can repeat lessons at any time and adjust the learning rhythm to their own abilities. Apart from the students, positive changes were also seen in the role of parents. Although most parents have a low level of education and limited understanding of technology, there is an increasing awareness of the importance of utilizing mobile devices as a learning tool for their children. Many parents are starting to show active support, such as helping their children access materials, providing study time at home, or even simply ensuring the device can be used properly. This support shows a transformation in the mindset of parents, who are starting to see technology not as a distraction, but as a practical tool that is relevant to today's educational challenges, especially in areas with limited formal education infrastructure. This change opens up opportunities for increased synergy between schools and families in building a more conducive and adaptive learning environment.

The research also revealed a number of complex and multidimensional barriers to the implementation of mobile-based learning media in remote areas. One of the most striking challenges is the inequality of access to technological devices. Not all students have their own smartphones, and in many cases, they have to rely on their parents' or other family members' devices. The limited economic conditions of families make the purchase of digital devices a financial burden that is difficult to fulfill, especially when basic needs such as food and health are still a top priority. As a result, students' learning time becomes limited and erratic, depending on the availability of devices at home. In certain situations, students can only access learning materials when parents are done using the cell phone for informal work, communication, or other daily needs. In addition to the problem of device ownership, another crucial technical obstacle is the limited access to a stable and affordable internet network. While some educational apps have been designed to work offline, much learning content still requires a minimal internet connection to download, synchronize or update materials (Rafee, 2024). In some research areas, internet signals are only available sporadically or at certain points that are located quite far from residential areas. In some extreme cases, students even have to walk several kilometers or climb hills and trees to get an adequate signal, which poses safety risks and physical exhaustion. This emphasizes the very real digital divide between urban and rural areas.

Another important challenge is the low level of digital literacy among both students and teachers, which is a major obstacle in optimizing the use of mobile-based learning media (Baroroh, 2024; Latief, 2025; Hartika, 2025). Many teachers in remote areas are not accustomed to utilizing digital media effectively in a pedagogical context. They often experience difficulties in developing learning materials that are not only informative, but also interesting, interactive, and easily understood by students when accessed through mobile devices. Reliance on conventional teaching methods, such as lectures and written exercises, makes the process of adapting to technology slow (Kubikova, 2024). The lack of formal training and technical assistance in the use of educational apps, online learning platforms and other visual aids means that most teachers do not feel confident in integrating technology consistently into the learning process. In fact, some teachers still consider the use of digital devices as an additional burden, not as a potential learning support tool. On the other hand, students' digital literacy also shows many limitations, basic skills such as operating learning applications, finding valid and relevant information, and managing learning time independently are still a big challenge. Some students use mobile devices only for entertainment, such as playing games or accessing social media, due to a lack of understanding of how to utilize technology as a learning tool. This unpreparedness is exacerbated by the lack of assistance at home due to parents' limited digital literacy. As a result, students often have difficulty following teacher instructions, completing online assignments or understanding the digital content provided. This situation suggests that improving digital literacy should be an integral part of the mobile-based learning implementation strategy, not only by providing devices and internet connections, but also by continuous education programs that target all stakeholders-teachers, students and parents-holistically.

These results show that although mobile learning has great potential as a solution to reach areas that have been left behind from the mainstream of national education, its successful implementation cannot be separated from a number of interrelated supporting factors. The potential of mobile technology as an educational transformation tool will be difficult to realize if it is not accompanied by the readiness of human resources, especially teachers and students, who have the competence and motivation to utilize technology effectively. The availability of basic infrastructure such as electricity, internet networks, and adequate devices are also crucial elements (Azizah, 2024; Sari, 2024). Moreover, the approach used in implementing mobile learning should be contextual and participatory, taking into account local socio-cultural conditions and involving all stakeholders in the planning and implementation. Without an inclusive approach, there is a risk that technology will actually deepen existing inequalities.

Collaborative and cross-sectoral efforts between central and local governments, educational institutions, local communities and the private sector are needed to build a truly inclusive and sustainable digital learning ecosystem (Supriani, 2025; Budiman, 2025). Some recommended strategies include the provision of subsidies or learning device assistance for students from underprivileged families, the development of locally-based learning content that is appropriate to the cultural context, language and needs of local communities, and ongoing teacher training to enable them to integrate technology into effective pedagogical practices. Providing cheap or free internet access in public areas such as schools, village halls and community centers is essential to ensure that digital learning is widely accessible. Policies that support public-private collaboration in the provision of education technology infrastructure and services also need to be strengthened. With a planned, inclusive and adaptive approach, mobile learning can be a real bridge to realizing education equality in all corners of the country.

The success of mobile learning implementation does not solely depend on the availability of digital technology devices and infrastructure. Rather, success is largely determined by how the technology is received, interpreted, used, and contextually adapted to the needs, culture, and socio-economic conditions of the local community. As Bulathwela (2024) points out, educational technology does not exist in a vacuum but is always interacting with existing social, political, and cultural structures. Therefore, the use of technology must consider local aspects such as social norms, existing educational practices, and users' digital literacy capabilities. The adoption of digital technology in the world of education must be understood as part of a holistic social and cultural transformation process (Singun, 2025).

This study provides important insights that technological innovation will only have a significant impact if accompanied by a mindset shift at various levels, including teachers, students, parents, and policymakers. Enhancing digital literacy, strengthening the role of communities in supporting the learning process, and developing inclusive policies are essential prerequisites for mobile learning to operate fairly and sustainably (Muguwe, 2024). Especially in areas with high geographical and social challenges, an approach that positions technology as part of an adaptive and participatory educational ecosystem will be far more effective than simply providing devices or infrastructure without adequate support. Overall, these results and discussions indicate that mobile-based learning media have great potential to become an adaptive solution in expanding access to education, particularly in remote areas that have long faced geographical, infrastructure, and human resource constraints. The advantage of mobile technology lies in its flexibility and affordability, enabling the learning process to take place anytime and anywhere, even outside conventional classrooms. However, this potential can only be fully realized if supported by targeted, participatory, and sustainable implementation strategies. This includes not only providing devices and internet access but also enhancing teacher capacity, developing content relevant to the local context, and establishing an inclusive and collaborative digital learning ecosystem.

This transformation is not merely a change in teaching and learning methods, but also a first step toward a more inclusive, flexible, and future-oriented education system. A technology-based education system designed with social justice and local context diversity in mind can be an important tool for

reaching all segments of society without exception, including groups that have been marginalized due to geographical or economic limitations (Bathia, 2024). In this context, mobile learning presents a strategic opportunity to break through conventional educational boundaries by leveraging devices that have become part of people's daily lives, such as smartphones and tablets. In the long term, the use of mobile media is not only a temporary solution or alternative but can be permanently integrated into a more adaptive national education design that aligns with the times and global dynamics. The presence of mobile learning also opens up space for more effective personalization of learning, where students can learn according to their own pace, interests, and needs. With a shared commitment from the government, schools, society, and the private sector, mobile learning has the potential to become a catalyst for change in creating a more equitable, equitable, and competitive education system. Progressive regulatory support, ongoing teacher training, and the development of contextual and relevant content will be the key to the successful integration of mobile technology in Indonesia's education system

Conclusion

This study shows that the use of mobile-based learning media has great potential in improving access to education in remote areas. In difficult geographical conditions and limited educational infrastructure, mobile technology is a flexible and adaptive alternative to support the teaching and learning process. Through devices such as smartphones and simple learning applications, students can access learning materials outside of school hours and independently, even though limited internet access and devices remain a major challenge. Mobile learning media can increase student motivation and independence in learning. Materials that are presented visually, interactively, and are easily accessible encourage higher student engagement compared to conventional methods. Teachers and parents are also beginning to show positive attitudes toward the use of technology in education, although improvements in digital literacy and ongoing training are still needed. However, the implementation of mobile learning in remote areas still faces various obstacles, such as limited devices, uneven internet network quality, low digital skills, and minimal policy support at the local level. Therefore, synergy between the government, educational institutions, the community, and the private sector is needed to build an inclusive, sustainable, and contextually appropriate digital learning ecosystem.

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