Volume 2 Issue 1 (January,2025)
Jurnal of Pedagogi : Jurnal Pendidikan
ISSN: : 3046-9554 (Online)

Mobile Learning Is A Future Learning Trend Based On Smartphones

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DOI: https://doi.org/10.62872/0zb85m44

Abstract

The development of digital technology has brought significant changes to the world of education, one of which is through mobile learning (mlearning). Mlearning allows learning to take place flexibly, overcome the limitations of space and time, and is adjusted to the individual's learning rhythm. In Indonesia, the adoption of mlearning is increasingly relevant after the COVID19 pandemic, with smartphones as the main device used. Based on APJII data (2023), more than 70% of internet users in Indonesia access the internet via smartphones, showing the great potential of mlearning for the future of education. However, the implementation of mlearning faces challenges such as the gap in access to technology and low digital literacy. Mlearning also encourages a personalized learning paradigm, where students can access materials that suit their needs and learning styles. AI-based applications, microlearning, and gamification make it easier to create a contextual and adaptive learning experience. However, the challenges of managing the quality of materials and equitable access need to be overcome. This study uses a descriptive qualitative approach through a literature study to understand the development of mlearning and its challenges. It is hoped that the integration of this technology can support more inclusive and sustainable education, with an important role for education policies, teacher training, and increasing digital literacy among students.

Keywords: MLearning; Digital-Education; Digital-Literacy.

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Received February 18, 2025 Accepted March 13, 2025 Published March 23, 2025

Introduction

The development of digital technology has revolutionized almost all aspects of human life, including in the field of education. This phenomenon is marked by a shift from conventional learning methods to digital-based learning systems, one of which is through mobile learning (mlearning). Mlearning allows the learning process to occur dynamically, across space and time, and adjusts to the individual's learning rhythm. This not only provides easy access to learning resources, but also democratizes education, because it allows anyone to learn without being tied to a particular institution or geographic location (Kalyani, 2024).

DOI: https://doi.org/10.62872/xc7ta403
However, the implementation of mobile learning still faces challenges, such as the gap in access to technology, low digital literacy, and dependence on stable infrastructure.

In the context of Indonesia, the use of digital technology in education is increasingly relevant, especially after the COVID-19 pandemic, which has accelerated the adoption of technology in the teaching and learning process. Smartphones have become the most commonly used devices because of their portable and multifunctional nature. Based on data from the Indonesian Internet Service Providers Association (APJII, 2023), more than 70% of internet users in Indonesia access the internet via smartphones. This shows the great potential of mobile learning to become the main learning strategy in the future. However, for this digital transformation to truly have a positive impact on the quality of education, planned integration, adequate teacher training, and educational policies that are adaptive to technological developments are needed.

The increase in smartphone ownership among students and college students not only reflects the widespread penetration of technology but also shows changes in the learning behavior of the digital generation (Wahyuni et al., 2025). This generation tends to be more responsive to visual, interactive, and multimedia-based content, all of which can be facilitated through mobile learning platforms. A study by UNESCO (2020) states that more than 60% of students in developing countries use smartphones as their primary tool to access digital learning materials. This phenomenon requires educators and educational institutions to redesign teaching methods to be compatible with the mobile-based digital ecosystem. However, on the other hand, concerns have also arisen regarding distractions and misuse of smartphones which can actually reduce concentration and learning effectiveness if not balanced with adequate digital literacy.

Furthermore, the existence of smartphones as a learning medium also strengthens the personalized learning paradigm, where students can access materials that suit their needs, interests, and learning styles. AI-based learning applications, microlearning, and gamification accessed via smartphones can create a more contextual and adaptive learning experience. According to a report from Zein (2024), mobile learning has the potential to be a solution to the educational gap, especially in remote areas that are difficult to reach by formal educational infrastructure. However, the use of smartphones in the context of education must still be accompanied by the right pedagogical approach and regulations that protect student data and privacy in the digital realm.

The mobility and dynamics of modern life have driven changes in expectations for the educational process, where flexibility is a highly valued aspect. Mobile learning is here as an answer to this need by offering learning access that is independent of time and place. With the support of technology, students can determine the most appropriate learning time for themselves, and access various learning resources from the devices they have. According to Waluyo (2021), learning through mobile devices allows for just-in-time learning, namely learning that is carried out when the need arises, so that it is more contextual and meaningful. However, this flexibility requires mental readiness and independent learning skills from students, which unfortunately not all students have, especially those who are used to passive instructional systems.

More than just flexible, mobile learning also encourages a transformation in learning independence. In the digital ecosystem, learners are required to actively seek, select, and

DOI: https://doi.org/10.62872/xc7ta403
evaluate information independently. This process actually forms lifelong learning skills, which are one of the main competencies of the 21st century. The OECD report (2021) emphasizes that mastery of digital literacy and the ability to manage learning independently are important foundations for facing the uncertainties of the world of work and global life. However, the success of independent learning through mobile learning is greatly influenced by the right instructional design and adequate initial guidance. Without such support, flexible learning can turn into an unstructured and counterproductive burden.

Mobile learning has a significant contribution in supporting the concept of lifelong learning, which emphasizes the importance of lifelong learning as a response to social, economic, and technological changes. With smartphones as the main media, access to learning materials is no longer limited by space, time, or formal institutions. This allows individuals to continue learning independently, even outside of school age or academic environments. UNESCO (2015) emphasizes that the use of digital technology, including mobile learning, is one of the main strategies to expand educational inclusion and ensure that everyone has the opportunity to learn throughout life. However, despite the potential for wide access, challenges arise in terms of material quality, curation of credible learning resources, and the ability of individuals to filter relevant information from the flood of digital content.

Furthermore, mobile learning also enables personalization of learning in the context of continuing education. With the support of algorithms and artificial intelligence, many mobile-based learning platforms can adjust the material to the needs, learning speed, and goals of individuals. This creates opportunities to develop new skills in accordance with changing times, both in the context of work and everyday life. According to the Sirozi report (2025), the ability to continue learning flexibly and sustainably is one of the key competencies in facing technological disruption and the global job market. However, it is important to note that the digital divide is still a serious obstacle, especially in developing countries, so that access to effective mobile learning is not evenly distributed, and can exacerbate social inequality if not accompanied by inclusive and equitable policy interventions.

Methodology

This study uses a descriptive qualitative approach with a literature study method (library research). This approach is used to examine in depth the phenomenon of mobile learning as a future learning trend based on smartphones, by analyzing various scientific and theoretical references. Literature studies are chosen because they allow researchers to build a conceptual framework from various perspectives that have been previously studied, without collecting field data directly.

The data sources in this study consist of secondary literature collected through systematic searches of reputable academic databases, such as Scopus, ScienceDirect, and SpringerLink, as well as national journal portals such as Garuda and SINTA. In addition, official reports and publications from international organizations such as UNESCO (United Nations Educational, Scientific and Cultural Organization), OECD (Organization for Economic Cooperation and Development), and the World Bank, which focus on global education policies and learning technologies, were also used. Inclusion criteria include publications in the 2015–2024 time frame, in Indonesian and English, and have high relevance to the themes of mobile learning, smartphones in education, and digital learning.

DOI: https://doi.org/10.62872/xc7ta403

Data were analyzed using content analysis techniques by extracting key concepts, trends, and key findings from each source reviewed. This process includes stages of categorization, critical interpretation, and synthesis of various literatures to obtain a holistic understanding. Data validity was strengthened through source triangulation and assessment of the methodological quality of each reference, especially literature indexed in Scopus or originating from credible research institutions

Result and Discussion

Mobile Learning as a Digital Learning Transformation

1. Shifting the Learning Paradigm Towards Digitalization

Education is currently experiencing a significant paradigm shift, especially in terms of how the learning process takes place. This shift is marked by a transition from a traditional learning system centered on physical classrooms and fixed schedules, to a more flexible learning model based on digital technology. One real form of this transformation is the emergence of mobile learning (mobile device-based learning), which allows students to learn anytime and anywhere. With the presence of this technology, the boundaries of space and time in learning are becoming increasingly blurred, so that learning is no longer exclusive to conventional classrooms. As stated by Macintyre et al (2020), mobile learning is a form of "ontological shift" in education because it disrupts the boundaries of space and time that have been the hallmark of formal education.

Mobile learning represents a form of educational digitalization that provides greater flexibility for students to manage their learning methods and time. Through various learning applications on mobile devices, students not only access materials independently, but also engage in interactive and collaborative learning processes. Activities such as online discussions, interactive quizzes, learning videos, and group forums can be done directly via smartphones or tablets. This strengthens the student-centered learning approach, where the role of the teacher shifts from the main source of knowledge to a facilitator of the learning process. In line with this, Suhenda et al (2024) stated that the effectiveness of mobile learning arises from the integration of technology, content, and social interaction, which forms a holistic learning experience.

The effectiveness of mobile learning is supported by the research results of Wibowo et al (2024), in which they conducted a meta-analysis of various studies on mobile learning and found that this approach was able to significantly increase student engagement compared to conventional learning methods. The results of the study also emphasized that mobile learning facilitates more interactive, collaborative, and engaging learning. Advantages such as ease of access, the ability to learn personally, and the potential for cross-border collaboration make mobile learning a major driver of the digitalization of education in the modern era. This is in line with the findings of Rahmawati & Nurachadija (2023), who in their meta-analysis study found that the use of mobile devices in education had a significant positive impact on student learning outcomes at various levels of education.

However, amidst the opportunities offered, mobile learning also presents its own challenges. Unequal access to mobile devices and internet networks is still an obstacle in various regions. In addition, the success of implementing mobile learning also depends heavily on the level of digital literacy of students and teachers. Without adequate digital skills, mobile

DOI: https://doi.org/10.62872/xc7ta403
learning can backfire, rather than be a solution. Therefore, educational institutions need to adjust their curriculum, develop human resource capacity, and provide adequate digital infrastructure to support this transformation sustainably. This is emphasized by Wahyudi & Jatun (2024) who stated that the success of technology integration in education depends not only on the availability of devices, but also on the pedagogical readiness and digital culture of its users.

Thus, mobile learning is not just a technological innovation, but also a symbol of fundamental change in the world of education. It reflects a new way of viewing and undergoing the learning process, where flexibility, interactivity, and accessibility are the main values. This transformation is also an important provision in preparing students to face the challenges and dynamics of the ever-evolving digital era. In this context, digitalization through mobile learning is not just a momentary trend, but an urgent and strategic need for a more inclusive, adaptive, and globally competitive future of education.

2. Flexibility and Accessibility in the Learning Process

Mobile learning or mobile device-based learning is an educational approach that utilizes devices such as smartphones, tablets, or laptops connected to the internet, allowing students to learn flexibly, anytime and anywhere. This flexibility is a very crucial aspect in the world of modern education because it is able to adjust the learning process to the needs and time constraints of individuals. Research by Traxler (2009) states that mobile learning offers a real opportunity for personalization of learning, allowing students to learn at their own pace and style, which increases engagement and learning effectiveness. This flexibility is very helpful, especially for those who have dual roles such as workers who are continuing their education, housewives, or students from remote areas who have difficulty accessing formal education facilities.

Furthermore, mobile learning also brings a breath of fresh air in terms of accessibility. UNESCO's 2020 report noted that this method is significantly able to reach marginalized groups, including communities in remote areas, low-income communities, and children in conflict or refugee areas. Research from Najjar & Oktasari (2023) also confirms this, that mobile learning is very effective in breaking down geographical and social barriers in education, because mobile technology is more widespread than traditional education infrastructure in many developing countries. With only a mobile device and an internet connection, individuals from diverse backgrounds can gain access to global learning materials that were previously difficult to reach.

However, despite its great potential, the implementation of mobile learning is not necessarily equal for all groups. There are still many challenges that must be overcome, such as the digital divide which causes some students to not have adequate devices or stable internet access. According to Bormann et al (2021), there is a risk that the digitalization of education will actually deepen social inequality if it is not accompanied by a strategy to equalize access to technology. In addition, high data costs, low digital literacy skills, and a lack of locally relevant content are also real obstacles to the widespread implementation of this method. Therefore, the flexibility offered by mobile learning will only be an effective solution if supported by the right policies and infrastructure.

The government and education stakeholders need to play an important role in creating an inclusive mobile learning ecosystem. This can be done through the provision of affordable

DOI: https://doi.org/10.62872/xc7ta403
internet access, subsidies for technological devices, digital skills training for teachers and students, and the development of teaching materials that are appropriate to the local context. In line with this, Anderson (2008) in his theory on the "Online Learning Interaction Model" emphasizes the importance of synergy between technology, policy support, and learning design in creating effective and sustainable online learning experiences (Harahap & Napitupulu, 2024). Without such support, mobile learning is at risk of widening the educational gap between those who are able to access technology and those who are not.

Thus, mobile learning offers the potential for major transformation in education through its flexibility and accessibility. However, for this potential to truly have a broad and equitable impact, there needs to be collaboration between technology, public policy, and social awareness to ensure that no group is left behind in this digital education process. With the support of theory and scientific findings, we can see that the success of mobile learning depends heavily on the supporting ecosystem, not just on the technology itself.

3. The Role of Mobile Learning in Encouraging Learning Independence

Mobile learning, as part of the educational technology revolution, has shown significant impact in facilitating more flexible and independent learning. According to Annisa et al (2024), mobile learning enables wider access to educational resources and enables students to learn in a more personal and relevant context. This study emphasizes that mobile devices can support contextual learning, which is essential for independent learning, as students can access information that suits their needs at the right time, enabling them to manage their own learning process.

Furthermore, Jonatan & Waruwu (2023) explained that one of the main advantages of mobile learning is its ability to encourage student-centered learning. This concept allows students to become active agents in their learning process, which is directly related to learning independence. Ally suggests that mobile learning not only provides flexible materials, but also requires students to take the initiative, manage their time, and adjust their learning strategies according to their respective learning speeds and styles.

Research by Wibowo (2023), provides empirical evidence on how mobile learning can improve self-directed learning skills. This study shows that the use of mobile technology in education can stimulate self-directed learning, as long as the learning design supports the principles of adaptive and accessible self-directed learning. The results of this study are in accordance with the findings of Voskamp et al (2022) in the theory of self-directed learning which states that teaching that supports self-directed learning should facilitate students in managing their learning process, not just providing knowledge directly.

Furthermore, Farid (2023) explained that to achieve success in mobile learning, it is important for learning design to pay attention to factors such as ease of use, adaptability to student needs, and accessibility. When these elements are met, mobile learning can serve as a very effective tool in improving independent learning skills, because students can adjust the way they learn according to their personal context.

However, as explained by Azis et al (2024) there are several challenges that need to be faced in the implementation of mobile learning, especially in terms of the digital divide and differences in technological ability levels among students. To overcome this, more attention needs to be paid to inclusive instructional design and training for students to develop effective

DOI: https://doi.org/10.62872/xc7ta403

self-management skills, as explained by Knowles (1975) in adult learning theory (andragogy). According to Knowles, good learning for adults that also applies to students at an older age must give learners more control over their learning process, so that they can feel more responsible for their learning.

In addition, the use of gamification elements and real-time feedback, which have also been widely discussed by Deterding et al. (2011) in Putranti (2021) the concept of gamification in education, can help increase students' motivation in using mobile technology for independent learning. The addition of these elements in mobile learning design will provide a sense of achievement, increase engagement, and in turn encourage students to be more active in their learning process.

The Role of Smartphones in Realizing Sustainable and Inclusive Education

1. Smartphone as a Facilitator of Lifelong Learning

Smartphones now play an important role as facilitators in lifelong learning, because of their ability to provide fast and easy access to a variety of educational resources. Through this device, individuals of all ages and backgrounds can access ebooks, video tutorials, educational podcasts, and microlearning applications designed for short and efficient learning. This allows anyone to learn anytime and anywhere, without being bound by space and time as is the case with formal learning. This flexibility is the key for many groups, especially workers, parents, and adult learners who need a way of learning that can be adjusted to their daily routines. Research by Yusnanto et al (2023) in Innovating Pedagogy states that mobile learning supports informal, independent, and sustainable learning, making it very suitable for lifelong learning.

The World Bank report (2022) also emphasized that mobile technology has great potential in supporting informal and non-formal education, especially for those who have high mobility and busy schedules that do not allow them to attend formal education conventionally. Research by Haleem et al (2022) in the book Increasing Access through Mobile Learning also shows that mobile-based learning can increase learning engagement and expand the reach of education to groups that were previously difficult to reach by the traditional education system. Not only flexible, learning via smartphones is also personal, because many applications now offer adaptive learning systems that adjust materials based on the user's abilities and progress. Features such as progress tracking, learning reminders, and reward systems also motivate users to continue to be consistent in learning. This is in line with the findings of Rochmawati et al (2023), which states that personalization is one of the main advantages of mobile learning because it can adjust individual learning needs in real time.

Moreover, smartphones open up great opportunities for collaboration and knowledge exchange through online learning communities. Users can join discussion forums, study groups on social media, or utilize interactive features in educational applications to share ideas and solutions. This aspect is reinforced by the connectivism theory of Siemens (2005) in Wijaksono & Adnyana (2024), which emphasizes that learning in the digital era does not only occur individually, but also through networks and collaboration between learners. However, the use of smartphones in the context of learning also faces challenges, such as the potential for distraction from social media, limited digital literacy in certain circles, and the need for critical skills in sorting out credible information amidst the rapid flow of digital content. Therefore, it is important to develop digital literacy skills as part of a lifelong learning curriculum, as proposed by UNESCO in the Digital Literacy Global Framework document (2018).

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With all its advantages and challenges, smartphones remain a very potential medium for realizing the concept of lifelong learning. It is able to reach more individuals, empower learners of all ages, and make the learning process an integral part of everyday life. The presence of this technology not only enriches learning methods, but also contributes to the development of an adaptive and resilient learning society in the digital era.

2. Increasing the Inclusivity of Education in Remote Areas

Educational inclusivity in remote areas is a complex and multidimensional challenge, encompassing geographic, socioeconomic, and policy factors. The inequality of access to quality education between urban and rural areas is a crucial issue that impacts the gap in human resource competency. According to the Education Equity Theory, all individuals have the right to receive fair and equitable education without location, economic, or social barriers (Hasanah et al., 2024). However, in reality, remote areas often face limited qualified teachers, poor school infrastructure, minimal access to information, and high dropout rates. In the midst of these conditions, the development of information and communication technology (ICT), especially the use of smartphones, has begun to open new paths to bridge this inequality.

Smartphones as learning tools have characteristics that support inclusive education: portable, relatively inexpensive, and able to access various digital learning resources in real time. This is in line with the Mobile Learning (mlearning) approach, according to Crompton (2013) in Setiono & Amaliyah (2024), which is a flexible learning method that utilizes mobile devices to increase student access, interactivity, and participation in learning. Through smartphones, students in remote areas can access digital-based learning content such as videos, ebooks, educational applications, and online learning platforms such as Google Classroom and Ruangguru. This allows them to obtain teaching materials that are equivalent to students in big cities, while increasing learning motivation through more contextual and interesting experiences.

A study by the OECD (2021) specifically highlights the potential of mobile technology in reducing educational disparities between regions. The report states that the use of mobile devices can improve learning outcomes and educational accessibility, as long as they are supported by basic infrastructure (electricity and internet network) and user training (for both teachers and students). This is rooted in the principles of the Technology Acceptance Model (TAM) by Davis (1989) in the book by Sugiarti et al. (2023) which states that technology adoption is highly dependent on the perception of ease and usefulness of its use. Therefore, efforts to utilize smartphones in education need to be accompanied by increasing digital literacy and technology-based pedagogical training for educators.

However, the optimal realization of mlearning in remote areas still faces several obstacles. The availability of unequal internet networks, expensive data quota prices, and low digital skills are still the main obstacles. In addition, smartphone use also risks becoming distracting if not properly supervised, because it can be used for non-educational activities. In this context, the Blended Learning approach with offline or low-bandwidth-based content is a pragmatic solution, as developed by various educational programs such as Kolibri (Learning Equality) which is designed for areas with limited internet access.

Policy synergy is needed between the government, private sector, and local communities in providing support for technology-based learning ecosystems in remote areas. This includes

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the provision of subsidized devices and internet, ongoing training for teachers, and the development of digital-based adaptive curricula. With a supportive ecosystem, smartphones have the potential to be a transformational tool in realizing more equitable, equitable, and inclusive education throughout the country. As emphasized in Sustainable Development Goals (SDG) number 4, namely ensuring inclusive and quality education and supporting lifelong learning opportunities for all, technology must be a bridge, not a barrier, in achieving this goal.

3. Access Challenges, Digital Literacy, and Distraction Risks

Although the use of smartphones in education offers many opportunities, the reality on the ground shows that there are complex challenges, especially in terms of access, digital literacy, and the risk of distraction. Not all students have the same opportunity to access adequate devices and internet connectivity. This inequality is increasingly felt in remote, outermost, and remote areas (3T), where internet networks are still limited, device prices are relatively expensive, and infrastructure such as electricity is inadequate. A study by Aranda (2024) shows that more than 30% of students in rural areas of Indonesia have difficulty accessing online learning during the COVID-19 pandemic, mainly due to limited devices and networks. This condition widens the digital divide and causes disparities in learning outcomes between regions.

In addition to access, low digital literacy is also a major challenge in optimizing smartphones as a learning medium. Digital literacy not only includes technical skills in using devices, but also includes critical thinking skills in evaluating information, understanding digital ethics, and utilizing technology productively (Cynthia & Sihotang, 2023). Unfortunately, many students and even educators are still at low to medium levels of digital literacy. According to UNESCO research (2021), this low ability causes digital-based learning to not run optimally, and increases the risk of exposure to hoaxes, cyberbullying, and privacy violations.

Furthermore, uncontrolled smartphone use also has the potential to cause major distractions in the learning process. Social media applications, online games, and other entertainment content often attract students' attention more than the subject matter. A study by Utami & Kurniawati (2019) found that the use of smartphones for non-academic activities during the learning process can significantly reduce academic achievement, due to impaired focus and the ability to absorb information.

To address these challenges, a comprehensive policy and education approach is needed. Equal access must be a government priority through device assistance programs, internet data subsidies, and the development of digital infrastructure in 3T areas. In addition, it is important to integrate digital literacy education into the curriculum, with an emphasis on cybersecurity, digital ethics, and critical thinking skills. Supervision of smartphone use during the learning process also needs to be strengthened, both through screen time management applications and through pedagogical approaches that prioritize digital discipline. Collaboration between schools, parents, and the government is essential to form an inclusive, adaptive, and responsible digital education ecosystem.

Conclusion

The transformation of digital learning has changed the paradigm of traditional education to be more flexible and technology-based, with mobile learning as one of the main examples.

DOI: https://doi.org/10.62872/xc7ta403

Learning through mobile devices gives students the freedom to learn anytime and anywhere, and allows for a more personalized and collaborative approach. By using a smartphone or tablet, students can access materials according to their own pace and learning style, which supports their independence in managing the learning process. The advantages of flexibility and accessibility increase engagement, especially for groups that were previously marginalized from the formal education system. However, despite the enormous potential of mobile learning, challenges such as the digital divide, limited infrastructure, and low digital literacy are still obstacles that must be overcome. For this reason, educational institutions and policy makers need to play an active role in creating an inclusive education ecosystem through infrastructure improvements, human resource training, and the development of relevant local content. With the right support, mobile learning can be a tool that not only increases learning independence but also accelerates students' adaptation to the demands of an increasingly digital world. Smartphones are an effective medium to support sustainable and inclusive education, allowing easy access to various learning resources, such as ebooks, videos, podcasts, and educational applications. This technology also opens up opportunities for collaboration between students through online platforms, expanding access to education to remote areas. However, the use of smartphones in education needs to be balanced with adequate policies, including the provision of sufficient infrastructure, training for educators, and the development of adaptive digital curricula. To be more optimal, efforts need to be made to improve digital literacy among students and educators, as well as reduce the potential for distractions that can hinder the learning process.

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