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Role of Mobile Learning and Low-Bandwidth Technologies in Education in Remote Areas

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Abstract

The rapid growth of mobile technologies has completely changed the face of education, providing students in underserved and rural locations with previously unheard-of opportunities. Low-bandwidth technologies and mobile learning have become indispensable instruments for improving educational access in underprivileged and distant locations in recent times. This review-based research study examines how these technologies can help close the digital divide, emphasizing how they can offer accessible, adaptable, and cost-effective learning options. The study explores the advantages of mobile learning through a review of the literature, taking into account its affordability, adaptability to different learning environments, and ability to support asynchronous learning and its effect on learning outcomes It also addresses how low-bandwidth technology might help with infrastructure problems like old devices and poor internet access. The review provides insights into significant issues and best practices by highlighting case studies from different locations where successful implementations of mobile learning initiatives have taken place. It also discusses the drawbacks of mobile learning, including problems with student engagement, instructor preparation, and content quality. In order to fully realize the potential of mobile learning and low-bandwidth technologies to enhance educational fairness in rural and underserved places, the study ends with recommendations for future research initiatives and legislation. This article also emphasizes how important technology is to

democratizing education and provides a road map for utilizing mobile solutions to get over the obstacles that prevent learning in the most underprivileged populations. This paper employed a systematic review approach to analyse the role of mobile learning and low-bandwidth technologies in education for underserved areas. The results demonstrate the potential of mobile technology to enhance educational outcomes in rural settings.

Keywords - Educational access, remote areas, underserved areas, low band with technologies, digital divide.

Introduction

Technology has already made its way into almost all spheres of our lives and also penetrated deep into educational settings. With the advancements and growth of numerous gadgets, digital platforms, and online resources education has become more affordable, accessible, and flexible. these advances have led to improved overall quality of education. Education still plays an essential role in promoting social and economic advancement in a world that is becoming more linked. For millions of students, especially in developing nations, access to high-quality education remains a major obstacle in isolated and underdeveloped locations. For several reasons, this study—which examines how low-bandwidth technology and mobile learning can help with these issues—is extremely significant. Internet access today has connected all the parts of the world and brought them into one frame. Easily education can be acquired and distributed to any part of the world. M-Learning or Mobile Learning has great potential in making education transferrable in all parts of the country both in developed and developing countries. In developing countries; like India, both rural and urban areas now Have access to Internet due growth of the technological era. Because mobile learning offers insights into how contemporary technology might be used to address the ongoing issues of access, quality, and equality in education, research on the role of mobile learning and low-bandwidth technologies in remote places is crucial. The study adds to academic understanding and informs practical tactics for educators, governments, and organizations working to achieve educational parity in some of the most difficult locations on the planet by emphasizing scalable, affordable, and flexible solutions.

Mobile learning or M-learning refers to learning acquired through mobile or other devices such as mobile, laptops, tabs, etc. Which can be carried along so that there can be no hindrances in learning.

Low-bandwidth technology and mobile learning have come to light as viable remedies for these discrepancies. Using portable devices like tablets and smartphones, mobile learning provides an adaptable and convenient way to distribute educational content. Low-bandwidth solutions fill the gaps in traditional online platforms by facilitating educational participation in situations when internet connectivity is scarce or inconsistent. When combined, these technologies can close the achievement gap by giving students who might not otherwise have access to learning resources.

Low bandwidth technology is a way to transmit data over a limited capacity and is often used in situations where high-speed connections are unavailable or impractical. Slow internet transmission is also because of too many devices connected to one network, slower internet speed, and or issues with an internet-enabled device. **(Brown B.B & Haras Catherine 2022)**

Review of related literature

K., Matsuoka. (2022). This study examined the use of low-bandwidth, or low-tech, teaching practices to address issues with digital access in this intricate educational setting. It then examines how this affected students who, in a time of extreme uncertainty, had to swiftly switch to an entirely new method of instruction. Lastly, certain low-tech teaching and learning practices are suggested to take future interruptions into account.

In the context of open and distance learning, mobile learning (mLearning) is promising and offers novel, interesting prospects. Understanding the nature of the phenomena is essential to comprehending and seizing these opportunities in a variety of settings and situations.

Brown, T. & Mbati, L. (2015). This paper uses critical reflection to dispel common misconceptions about learning and to clarify what it is. After acknowledging the knowledge gained from prior experience, the writers investigated the possibilities that learning offers. The paper discusses the future of mobile learning, acknowledging its achievements and encouraging open and distance learning while minimizing the potential negative effects of technological, social, and pedagogical changes.

Pathan et.al (2024). The paper analyses how mobile learning (m-learning) affects collaboration, feedback, participation, and instructional methods in educational settings, suggesting a comprehensive evaluation of m-learning's effectiveness The study possibly contains qualitative evaluations of instructors' and students' experiences with mobile learning, even though the context given lacks specifics on methodology.

Mark, A, Knepper. (2022) The authors of this article talk about their experiences implementing a basic mobile social networking platform for primary education stakeholders

in a remote Indian district. This platform has shown to be beneficial in fostering the provision of high-quality educational services in several ways.

Kumar Anuj et.al (2010) In this study, the authors contend that cell phones are the ideal tool for providing rural children with access to education at times and locations that are more convenient than traditional schools. To find chances for mobile learning in their daily lives, we conducted participant observations. Next, we looked into how willingly rural kids would utilize cell phones to acquire instructional content throughout 26-week research. Their findings indicate a respectable degree of academic motivation and learning. We also discuss the societal background of these findings. The objectives were to assess the viability of mobile learning in after-school programs in rural, impoverished communities and to assist other researchers in gaining the skills necessary to carry out similarly challenging studies on mobile computing in developing nations.

Koole .M et.al (2010) the study reports the results of an innovative study investigating the social interaction, learning potential, and usability of mobile access to online course materials in a distance education university in Canada. Students used a range of mobile devices to access Moodle course materials via a system known as Mobi Glam. Using the Framework for the Rational Analysis of Mobile Education (FRAME) model **(Koole, 2006),** the intricacies of this mobile system, as well as its apparent utility and possible effects on distant learners, were investigated. The experts advise more research on how to match the requirements of distant learners with the limitations and regulations of social media. Is it possible to strike a balance between promoting technological adaptability and a stronger sense of "connectedness" among students? Because of the study, the researchers continue in preference to "device-agnostic" mobile tools that give distant learners the most flexibility.

Akshay, N. et.al (2012). This study presented the design of a project that involved the deployment of computerized vocational training courses. The courses were delivered using automobile units and consisted of multimedia-enhanced video lectures, virtual reality games, and inexpensive haptic device-based simulations built on mobile learning platforms. The purpose of these mobile vocational education units was to serve as a model for improving the accessibility of vocational education and training for India's rural and tribal people. The study described the architecture and communication interface for the m-learning application and provided an overview of the design of the mobile vocational education modules. It went on to detail the vocational education application's software architecture, which was made especially to be flexible and quickly scalable across a variety of vocational trades and delivery languages.

Manjunath, et.al. al. (2024) The purpose of this study was to look into how mobile learning apps affect rural India's higher education outcomes. The study focused on the problems, usage, and integration of mobile learning applications in higher education. The research looked at the differences in rural India's higher education outcomes. A case study methodology was utilized to examine the influence and incorporation of the applications for mobile learning. The study's conclusions would help in solving issues related to technology breakthroughs and overcoming integration process obstacles.

Methodology

Secondary sources of data collection like research papers, research reports articles of journals, and magazines were used for analysis and comprehension of data.

Findings and discussion

Mobile learning and low bandwidth technologies have a great impact and provide great support for learning in remote areas. Due to their ability to overcome infrastructure obstacles and offer significant learning support, mobile learning, and low-bandwidth technologies are essential for improving education in rural areas

Low bandwidth refers to a limited amount of data that can be transmitted over a network connection in a given period. This can cause slow internet speeds, which can make it difficult to perform tasks like downloading large files or streaming videos.

Like expressways, bandwidth has lanes. If you compare bandwidth to lanes on a freeway, more lanes let more traffic flow through at once. Performance on a network can be slowed by low bandwidth. Speeds might be considerably slowed down when several network requests are handled by a low bandwidth connection.

One technique for web design is low-bandwidth optimization. The goal of this tactic is to transfer less data between the client and the server. Those who utilize low-end gadgets or have pricey or restricted internet access will find it extremely helpful. streaming with little bandwidth. Generally, 2 to 3 megabits per second is regarded as low bandwidth streaming.

K. Matsuoka (2022) In remote education, low-tech and low-bandwidth techniques such as mobile learning are essential for overcoming problems with digital access, particularly in places with little resources and poor connectivity.

By effectively linking stakeholders through cost-effective information and communication technologies, mobile-based social networking platforms contribute significantly to the improvement of educational service delivery and the promotion of high-quality education in remote places. **Mark, A, Knepper. (2022)**

Low-bandwidth mobile technology enhances tele-learning experiences in places with inadequate telecommunications infrastructure by transferring critical robot data in settings with restricted connectivity. **Markus, Sauer. (2018)**

As demonstrated in rural India, mobile learning and low-bandwidth technology like educational applications and WhatsApp lower absenteeism, increase instructor effectiveness, and improve student achievement in remote places **Prem (2018)**

Mohamed, (2017) mobile technology can significantly enhance academic performance and ICT skills, particularly in remote areas. The Aptus system and tablets offer a flexible educational solution that can help reach marginalized students, especially girls facing educational barriers. Recommendations include scaling the project to benefit more students in disadvantaged areas and leveraging mobile technology to innovate education globally.

Using low bandwidth and mobile learning technologies causes:

● **Increased Teacher Effectiveness**: The use of WhatsApp and other apps led to improvements in teaching techniques and educational resources. Teachers were able to communicate more effectively, which enhanced their performance

● **Improved Student Performance**: The study reported that the combination of technology and consistent monitoring resulted in better student performance. This was measured through attendance and engagement in lessons

● **High Engagement in Communication**: A total of 8,968 messages were analyzed, with teachers sending the majority (90%) of these messages. The most common type of communication was related to monitoring student performance, indicating a focus on accountability and engagement

● **Effective Monitoring System**: The study highlighted the effectiveness of a multifaceted monitoring system involving cluster coordinators and technology, which allowed for better oversight of educational activities and reduced the need for frequent field visits

Mobile learning (m-learning) and low-bandwidth technologies play a crucial role in enhancing education in remote areas by facilitating communication, engagement, and resource accessibility. These technologies address the unique challenges faced by learners in such

Improving Interaction and communication

• M-learning encourages cooperation between educators and learners, offering prompt feedback and raising engagement, especially in distance learning environments (**Pathan et al., 2024).**

•Particularly in low-tech settings, mobile phones are essential tools for fostering community involvement and raising sociopolitical awareness **(Hasanah & Pradipta, 2021).**

Overcoming Infrastructure Issues

• Despite having restricted internet connectivity, low-bandwidth techniques are crucial for overcoming socioeconomic hurdles and enabling remote learning **(Matsuoka, 2022).**
• In resource-constrained locations, basic mobile-based platforms have proven successful in bringing together educational stakeholders and guaranteeing the provision of high-quality services **(Knepper, 2022). (Vijayalakshmi, 2022).** Mobile learning has several advantages, but in order to fully realize its potential in distance learning, concerns including device security, internet accessibility, and socioeconomic inequality must be addressed.

Conclusion

The above study clearly emphasizes how unavailability, the inadequacy of traditional teaching methods, lack of reach of proper education facilities in rural or remote areas have led to the emergence and high usage of mobile technologies or mobile learning. Low bandwidth technology has proved to be very effective and efficient in remote areas when it comes to education. Mobile learning technologies allows great access to information anytime and anywhere, that is it facilitates an asynchronous mode of education which is particularly beneficial for distance education. This flexibility enhances learning opportunities for students who may not have access to traditional educational resources

This study also discussed various mobile devices used in education, such as mobile phones, PDAs, and portable audio recorders, emphasizing their role in facilitating distance learning. The study aims to clarify the effectiveness of mobile learning technologies in distance education by examining both their advantages, such as increased accessibility, and disadvantages, which may include potential distractions and varying levels of technology adoption among students. these offer a flexible accessible solution to educational challenges faced by students, and learners in remote areas thus bridging the education gap there. Additionally, low-bandwidth technologies let students access important study resources without requiring very high-speed internet, which is still a problem in a lot of remote locations. Education can be accessed even in places with minimal infrastructure by using strategies like interactive voice response systems, compressed data formats, and offline access. These technologies support interaction, collaboration, and customized learning experiences, asynchronous modes of learning in addition to content delivery. Overall mobile learning technologies and low bandwidth technologies make education available for all

learners despite their background or geographical areas they reside in. It makes education equitable, affordable, and available for every learner. They also enhance the quality of learning; they make learning interesting. MOOCs can also be made available and accessible. these technologies can help the countries to reach their goal of universal education for all.

It's good that the bright side of technology can be viewed by us but somewhere we cannot neglect that conventional classroom teaching cannot be replaced by technology in any form. We must be technology friendly but at the same time, we must ensure that we can also experience student-teacher relationships. that cannot be denied.

References

1. Akshay, N., Sreeram, K., Anand, A., Venkataraman, R., & Bhavani, R. R. (2012, January). MoVE: Mobile vocational education for rural India. In *2012 IEEE International Conference on Technology Enhanced Education (ICTEE)* (pp. 1-5). IEEE.

2. Ally, M. (2014). Increasing access to education for all through mobile learning. Vancouver: Commonwealth of Learning. Retrieved from http://oasis.col.org/handle/11599/703

3. Brown, T. & Mbati, L. (2015). Mobile Learning: Moving Past the Myths and Embracing the Opportunities. International Review of Research in Open and Distributed Learning, 16(2), 115–135. https://doi.org/10.19173/irrodl.v16i2.2071

4. Habibullah, Pathan., Sedigheh, Shakib, Kotamjani., Sabah, Mohamed, Abbas, Hamza., Richa, Rastogi. (2024). Analyzing the Deep Learning-Based Mobile Environment in Educational Institutions. doi: 10.3991/ijim.v18i09.49029

5. K., Matsuoka. (2022). Learning with Low Tech: Challenges of Moving to Remote Learning in a Time of Disruption. 55-73. doi: 10.1007/978-3-031-12718-2_4

6. Koole, M., Letkeman McQuilkin, J., & Ally, M. (2010). Mobile learning in distance education: Utility or futility.

7. Kumar, A., Tewari, A., Shroff, G., Chittamuru, D., Kam, M., & Canny, J. (2010, April). An exploratory study of unsupervised mobile learning in rural India. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 743-752).

8. Mark, A, Knepper. (2022). Mobile based social networking platform for remote school ecosystem in resource-constrained areas – An Indian case study. doi: 10.1109/ghtc55712.2022.9910982

9.   Manjunath, D. G., Nellore, C. P., & Guduri, S. (2024). Assessing The Impact of Mobile Learning Applications on Higher Education Outcomes in Rural India: A Case Study Approach. *Available at SSRN 4899898.*

10.   Mohamed, Ally., Venkataraman, Balaji., Anwar, Abdelbaki., Ricky, Cheng. (2017). Use of Tablet Computers to Improve Access to Education in a Remote Location.

11.   Mohamudally, N. (2011). The technological challenges in mobile networks and communications in view of unleashing the full potential of m-learning. *Formatex 2011*, 548-555.

12.   Merve, Erguney. (2017). 20. The role of mobile learning technologies in distance education.   doi: 10.7816/ULAKBILGE-05-13-02

13.   Prema, Nedungadi., Karunya, Mulki., Raghu, Raman. (2018). 8. Improving educational outcomes & reducing absenteeism at remote villages with mobile technology and WhatsAPP: Findings from rural India. Education and Information Technologies, doi: 10.1007/S10639-017-9588-

14.   P. Mondal, S. Misra and I. S. Misra, "A low-cost low bandwidth real-time virtual classroom system for distance learning," 2013 IEEE Global Humanitarian Technology Conference: South Asia Satellite (GHTC-SAS), Trivandrum, India, 2013, pp. 74-79, doi: 10.1109/GHTC-SAS.2013.6629892

15.   Simba, F., Trojer, L., Mwinyiwiwa, B. M., Mvungi, N. H., & Mjema, E. (2011). Broadband access technologies for rural connectivity in developing countries. *International Journal of Research and Reviews in Computer Science (IJRRCS)*, *2*(2), 312-319.

16.   Sugata, Mitra., Ritu, Dangwal., Leher, Thadani. (2008). 18. Effects of remoteness on the quality of education: A case study from North Indian schools. Australasian Journal of Educational Technology, doi: 10.14742/AJET.1219

17.   X. Ding. Rural area distance learning: contributions today and benefits for all future generations. http://- www.chinaonlineedu.com/media/200314/zl3.asp, 2003