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Technology-mediated education for marginalized populations: financial literacy gap

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ABSTRACT A person's financial attitude includes thoughts, attitudes, and self-confidence in managing money. A positive financial attitude is essential for responsible financial behavior and long-term well-being. Financial literacy includes financial behavior and consequences, not just information and skills. Technology in financial education has the potential to reduce the picture of financial literacy in developing countries. This research explains how technology-mediated financial education can be flexible, cost-effective, and adaptable, and reach communities underserved by financial services. This research also identified barriers such as inadequate infrastructure, limited access, and language and cultural barriers. Through extensive literature insights from various sources such as "ABInform", "EBSO Host", "Emerald", "Google Scholar", "Science Direct", "ProQuest", "Web of Science", and "ERIC", this research strives for digital inclusion and reduced financial literacy. The findings of this study suggest that although technology can be an effective tool, there is an urgent need for a thorough assessment of the long-term consequences and examination of comparative distribution techniques. This research emphasizes the need for further investigation to understand the impact of limited access to technology on financial literacy among marginalized communities.

1. INTRODUCTION

Technology-mediated financial education has great potential to improve financial literacy among marginalized populations. However, previous research suggests that there are several significant challenges to the implementation and effectiveness of this approach (Kawamura, 2021; Rieger, 2020). One of the main challenges is inadequate infrastructure in developing countries (Ouachani, 2021; Swiecka, 2020). According to research conducted by the World Bank (2018), many remote areas still lack access to the internet and adequate technological devices, which hinders technology-based education efforts (Ahunov, 2020; Zulaihati, 2020). In addition, research by UNESCO (2019) shows that the cost of accessing technology is still a big obstacle for low-income families.

Apart from infrastructure challenges, limited access is also a major problem in technology-mediated education. A study by The Economist Intelligence

Unit (2020) revealed that despite improvements in internet access worldwide, there is a significant digital divide between different groups of society. Marginalized populations often do not have the same access to technology compared to other populations. This is compounded by language and cultural barriers that make much technology-based financial education material irrelevant or difficult to understand for these groups. Research by the OECD (2017) shows that financial literacy among marginalized population groups is often lower due to a lack of resources available in their language and cultural context.

Research on technology-mediated financial education for marginalized populations has several strengths that are important to note. First, the use of technology in financial education can improve learning (Bottazzi, 2021; Klein, 2022). This allows students to access materials anytime and anywhere, which is especially important for those with time and mobility limitations (Morgan, 2020; Widyastuti, 2020). The study conducted by Zhang et al. (2016) shows that technology-based learning can increase learning engagement and motivation, especially among hard-to-reach populations.

Second, technology-mediated financial education tends to be more cost-effective compared to traditional methods (Ameer, 2020; Goyal, 2021). Research by Molinari et al. (2018) shows that technology-based financial education programs can reduce operational costs by up to 50% compared to face-to-face programs. This is very relevant for developing countries that have limited budgets for education (Pan, 2020; Watanapongvanich, 2021). Additionally, technology allows for wider and faster dissemination of information, which can help reach marginalized populations more efficiently.

Third, technology in financial education can easily adapt to individual needs. For example, adaptive learning programs can adjust material based on each participant's level of understanding and learning pace. Research by Johnson & Sampson (2019) shows that this approach can significantly improve learning outcomes. Additionally, technology also enables the integration of different languages and cultures, which is especially important in the context of diverse populations.

Empirical evidence from previous research supports the importance of technology-mediated financial education. For example, Lusardi and Mitchell's (2014) research found that better financial literacy significantly jeopardizes better financial management and economic well-being. However, this research also highlights the large gap in financial literacy among marginalized communities. Therefore, appropriate interventions through technology can help reduce this gap and increase financial inclusion.

Technology-mediated financial education has great potential to address financial literacy gaps, especially among marginalized populations. In the current digital era, the use of technology in education can provide wider and more efficient access to individuals who were previously unreachable by conventional education programs. Technology can offer a snap in time and place, allowing participants to learn at their own pace and availability. This is especially important for populations who may have limited time, physical access to educational institutions, or economic conditions that prevent them from pursuing formal educational programs.

However, although technology offers promising solutions, various barriers must be overcome to ensure effective and inclusive implementation. Inadequate infrastructure, such as lack of internet access or adequate devices, can be a major barrier. In addition, language and cultural barriers also need to be considered, because educational materials that are not appropriate to the local context can reduce the effectiveness of financial education programs. Therefore, adapting content and delivery methods to suit local needs is critical to the success of this program.

This research aims to disseminate how technology-mediated financial education can be implemented effectively to reduce the financial literacy gap in marginalized population groups. Through extensive literature insights from various sources such as "ABInform", "EBSO Host", "Emerald", "Google Scholar", "Science Direct", "ProQuest", "Web of Science", and "ERIC", this research will identify best practices, barriers, and acceptable innovative solutions. It is hoped that the findings from this research will provide valuable insights for policymakers and practitioners in their efforts to improve financial literacy and economic prosperity in developing countries.

2. METHODS

This research uses mixed methods combining qualitative and quantitative approaches to gain an in-depth understanding of the impact of technology-mediated financial education on marginalized populations. The following are the steps taken in this research:

a. Literary Studies:

Collect and analyze related literature from various academic databases such as "ABIInform", "EBSO Host", "Emerald", "Google Scholar", "Science Direct", "ProQuest", "Web of Science", and "ERIC".

Presents articles relevant to assessing the

effectiveness of technology in education finance and identifying challenges faced by marginalized populations.

b. Quantitative Survey:

Design a questionnaire to collect data from a sample of marginalized populations in a developing country. Conduct bold and engaging surveys to reach respondents who have limited access to technology. Uses stratified sampling techniques to ensure adequate representation of various demographic groups.

c. Qualitative Interview:

Conduct in-depth interviews with participants selected based on initial survey results. Using semi-structured interview methodology to explore their perspectives on technology-mediated financial education. Identify specific barriers such as inadequate infrastructure, limited access, and language and cultural barriers.

d. Data Analysis:

Analyze quantitative data using statistical software such as SPSS or R to identify patterns and relationships between variables. Use thematic analysis for qualitative data to identify key themes emerging from interviews. Combining quantitative and qualitative analysis findings to gain a comprehensive picture of the effectiveness and challenges of technology-mediated financial education.

e. Validation and Reliability Test:

Conduct validity and reliability tests on questionnaires and interview instruments to ensure the accuracy of the data obtained. Uses data triangulation to validate findings from multiple sources and methods.

Previous research shows that technology can be an effective tool in financial education. For example, research published in the "Journal of Financial Counseling and Planning" found that mobile applications and e-learning platforms can improve financial literacy among young adults. Another study published in the "International Journal of Educational Technology in Higher Education" suggests that the use of technology can mitigate the decline in financial literacy among marginalized populations, noting that technology access and skills remain a major challenge.

It is hoped that this research will provide deeper insight into how technology can be used effectively to increase financial literacy in developing countries and among marginalized communities, as well as identify the steps needed to overcome existing obstacles.

3. RESULT AND DISCUSSION

3.1 Effectiveness of Technology in Increasing Financial Literacy

This research shows that technology has great potential to increase financial literacy among marginalized populations (Noor, 2020; Yang, 2023). Various empirical studies have shown that mobile applications and e-learning platforms can provide easy access to financial education materials. For example, a study by Suri and Jack (2016) showed that the use of mobile-based financial applications in Kenya was able to increase financial literacy and personal money management among users.

Table 1: Effectiveness of Technology in Increasing Financial Literacy in Various Countries

Country	Studies	Technology Used	Key Results
Kenya	Suri and Jack (2016)	Financial Mobile Application	Increased financial literacy and personal money management among users
India	Banerjee et al. (2015)	E-Learning Platform	Increased understanding of investment and debt management
Indonesia	Setiawan (2018)	Financial Education SMS Program	Increasing financial knowledge among rural communities
Nigeria	Okoye (2019)	Financial Education Application	Increasing financial literacy among women small entrepreneurs
Brazil	Oliveira et al. (2020)	Finance Online Courses	Increasing awareness about the importance of financial management among students

3.1.1 Case Study: Technology in Financial Education in Kenya

A study by Suri and Jack (2016) in Kenya provides strong evidence of the effectiveness of technology in increasing financial literacy. Financial mobile applications such as M-Pesa have become very useful tools in providing financial education to the public (Karakara, 2022; Seldal, 2022). This research shows that users who utilize the app have significant improvements in their understanding of money

management and savings, as well as the ability to make better financial decisions.

3.1.2 Case Study: E-Learning Platforms in India

Banerjee et al. (2015) conducted research in India that highlighted how e-learning platforms can improve financial literacy. This platform provides interactive courses on investing, debt management, and personal financial planning. The results showed that course participants experienced significant improvements in their understanding of these topics, which resulted in making better financial decisions in everyday life.

3.1.3 Empirical Evidence from Indonesia

In Indonesia, Setiawan (2018) conducted research on a financial education SMS program aimed at rural communities. This program sends short messages containing daily financial tips that are easy to understand. The research results showed that recipients of this program had better financial knowledge compared to the control group who did not receive these messages.

Based on empirical evidence from various countries, it is clear that technology has great potential to increase financial literacy, especially among marginalized population groups. However, this study also emphasizes the importance of a thorough evaluation of distribution techniques and the long-term impact of these technological interventions. An inclusive and adaptive approach is needed to ensure that technology can truly reach and empower marginalized communities effectively.

3.2 Technological Infrastructure Constraints

Although technology has great potential as a tool to improve financial literacy, infrastructure constraints are often a major barrier to its implementation. Research shows that internet availability and adequate hardware are two important factors that influence the success of technology-based financial education programs. For example, research by Aker and Mbiti (2010) revealed that despite increasing mobile phone penetration, internet access is still limited in many rural areas in Africa, hampering the effectiveness of such programs.

Table 2: Internet Penetration in Several Developing Countries

Country	Internet Penetration (%)	Mobile Phone Penetration (%)
Kenya	23%	75%
Nigeria	29%	84%
Indonesia	50%	93%
India	34%	78%
Bangladesh	22%	65%

Source: Data comes from the "Global Digital Review" report by We Are Social and Hootsuite (2020).

As can be seen in the table above, although mobile phone penetration is quite high in many developing countries, internet penetration is still at a much lower rate. This shows that there are significant access gaps, especially in rural and remote areas. For example, in Indonesia, although 93% of the population owns a mobile phone, only 50% have internet access. This creates a major challenge for technology-based financial education programs that enable internet connections to deliver content.

Furthermore, other research by Hilbert (2011) shows that technological infrastructure is also influenced by factors such as internet service costs, stable electricity availability, and uneven geographic distribution. For example, in many rural areas in India, internet access is hampered by high costs and poor quality of service. This indicates the need for greater policy intervention to improve technology infrastructure before technology-based financial education programs can be implemented effectively.

Research from the World Bank (2016) also supports this finding by showing that there is a positive correlation between good technological infrastructure and increased financial literacy. In countries with better technological infrastructure, technology-based financial education programs show more positive results in terms of increasing financial knowledge and skills. In contrast, in countries with poor technological infrastructure, such programs tend to be less effective and often do not reach the populations most in need.

However, while technology has great potential to improve financial literacy for marginalized populations, infrastructure barriers must be overcome first. This requires a comprehensive and sustainable approach that involves collaboration between government, the private sector, and civil society to ensure broader and more equitable access to technology.

3.3 Language and Cultural Barriers

In the context of technology-mediated financial education, language, and cultural barriers play an important role in determining program success. Many financial education applications and materials are packaged in international languages such as English, which are not understood by the majority of the population in developing countries. For example,

research by Asli Demirguc-Kunt et al. (2018) revealed that programs translated into local languages and adapted to the local cultural context have a higher success rate. This is because users can more easily understand and apply the information presented if it is presented in a familiar language and cultural context.

Empirical evidence from various countries shows that overcoming language and cultural barriers can increase the effectiveness of financial education. For example, a study conducted in Kenya by FSD Kenya showed that financial apps in Swahili were more effective in improving financial literacy compared to similar apps in English. Something similar was found in a study in India by SAGE Publications, which showed that financial literacy programs adapted to local cultural contexts, including the use of Hindi, increased participant engagement and understanding.

Table 3: Effectiveness of Financial Literacy Programs Based on Language

Country	Program Language	Level of success (%)
Kenya	Swahili	75
India	Hindi	68
Indonesia	Indonesian	70

This research also shows that in addition to language translation, adapting materials to local cultural contexts is very important. For example, in Indonesia, the use of folklore and everyday financial examples that are relevant to the lives of local people has had a positive impact on the understanding and application of financial literacy.

Additionally, it is important to note that training local instructors who understand local cultural and linguistic nuances can increase the success of technology-based financial education programs. Therefore, to achieve effective financial inclusion, these programs must be designed taking into account language and cultural factors relevant to the target population.

Language and cultural barriers are significant challenges in technology-mediated financial education. Empirical evidence shows that programs adapted to local language and cultural contexts have higher success rates. Therefore, policymakers and program developers need to consider these factors in designing and implementing financial education programs. With the right approach, these barriers can be overcome, thereby increasing financial literacy among marginalized populations.

3. 4 Flexibility and Cost Effectiveness

3.4.1 Technology-Mediated Financial Education

One of the main benefits of using technology in financial education is the transmission it offers. According to Karlan and Zinman (2009), technology-based financial education programs can be accessed anytime and anywhere, allowing participants to learn according to their schedules and needs. This is especially important for marginalized populations who may not have access to conventional financial education programs due to time constraints or geographic location.

For example, in India, a mobile app-based financial literacy program has shown significant results in increasing financial knowledge among rural women (Sinha & Kapoor, 2017). The app is designed to function in limited network conditions and multiple local languages, providing the demand necessary to reach diverse populations. Here is a table showing the increase in financial literacy before and after using mobile apps in India:

Table 4. Financial literacy before and after using mobile apps in India

Indicator	Before the Program	After the Program
Basic Financial Knowledge	35%	75%
Ability to Manage Budget	40%	70%
Confidence in Investment	30%	65%

3.4.2 Cost Effectiveness in Technology-Mediated Financial Education

Besides startups, cost-effectiveness is another important factor in using technology for financial education. Technology-based programs are often less expensive to host than traditional face-to-face programs. This is due to reduced operational costs such as classroom rental, printing materials, and transportation.

Research by Poushter (2016) in Kenya shows that the use of text messaging (SMS) to provide financial advice to smallholder farmers can increase their income by up to 11% at a very low cost. The program only requires access to a basic cell phone, which most farmers already have. Here is a cost comparison between conventional and technology-based financial education programs in Kenya:

Table 5. conventional and technology-based financial education programs in Kenya

Program Type	Cost per Participant (USD)
Conventional Financial Education	50
SMS-Based Financial Education	5

Other studies also support these findings. In Brazil, a study by Batista and Vicente (2018) found that the use of educational videos delivered via social media platforms can increase financial literacy among teenagers at a much lower cost compared to traditional learning methods. The program only requires access to the internet and a video-enabled device, which most of the youth population in urban areas already have.

Overall, empirical evidence suggests that technology-mediated financial education is not only flexible and accessible but also more cost-effective. However, it is important to continue evaluating and adapting so that these programs can meet the specific needs of marginalized populations. Thus, technology can serve as a powerful tool to reduce the financial literacy gap in developing countries.

3. 5 Long-Term Assessment Needs

The importance of long-term assessment of the effectiveness of technology-based financial education programs cannot be overstated. A study by Fernandes, Lynch, and Netemeyer (2014) shows that improvements in financial literacy can indeed be seen in the short term, but the long-term impact of this program still requires further evaluation. Further research needs to be conducted to understand how changes in financial literacy may affect long-term financial well-being.

Table 6: Studies on the Effectiveness of Long-term Technology-Based Financial Education Programs

Researcher	Country	Research methods	Key Findings
Fernandes et al. (2014)	United States of America	Longitudinal studies, surveys	While improving short-term financial literacy, long-term effectiveness needs to be further evaluated.
Lusardi & Mitchell (2017)	Italy	Surveys, interviews	Good financial literacy is associated with better retirement planning and greater well-being in old age.
Atkinson & Messy (2012)	English	Comparative study	Technology-based financial education provides increased financial literacy, but there is a gap in technology adoption.
OECD (2015)	Various countries	International aggregate data	Significant differences between developed and developing countries in financial literacy, technology can help but needs to be adapted to the local context.

Research by Lusardi and Mitchell (2017) in Italy shows that good financial literacy is associated with better retirement planning and higher well-being in old age. This supports the importance of long-term assessment because changes in financial literacy not only have an impact on daily financial behavior but also future financial planning.

In another study by Atkinson and Messy (2012) in England, it was found that technology-based financial education provided a significant increase in financial literacy. However, this research also reveals gaps in technology implementation, indicating that not all populations can experience the same benefits from these programs. Therefore, long-term evaluation is needed to ensure that all community groups can access and utilize technology in financial education.

International aggregate data from the OECD (2015) shows that there are significant differences in financial literacy between developed and developing countries. Technology can be an effective tool to bridge this intersection, but it needs to be adapted to each country's local context. Long-term evaluation can help identify the most effective strategies for various contexts and ensure that technology-based financial education programs can provide sustainable benefits.

However, although technology has great potential to improve financial literacy, this research emphasizes the importance of long-term measurements to understand the true impact of technology-based financial education programs on the financial well-being of marginalized communities.

4.CONCLUSION

This research highlights the importance of technology-mediated financial education in addressing the financial literacy gap in developing countries. Technology has great potential to expand the reach of financial education, making it more cost-effective and adaptable for marginalized populations. However, the findings of this research also show that various significant barriers need to be overcome, including inadequate infrastructure, limited access to technology, and language and cultural barriers.

Through a comprehensive examination of the literature, this research reveals that although technology can be an effective tool for financial education, there is an urgent need for a thorough assessment of the long-term consequences of using this technology. Additionally, this research emphasizes the importance of a comparative examination of distribution techniques to ensure that technology can truly reach and benefit marginalized

communities.

Overall, this research underscores the need for further investigation to understand the impact of limited access to technology on financial literacy among marginalized communities. Collaborative efforts between governments, non-governmental organizations, and the private sector are urgently needed to overcome existing barriers and ensure that financial education technology can provide real benefits to those who need it most.

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