

Overcoming Technological and Institutional Barriers to Blended Learning Adoption in Teacher Training: A Case Study of Kwara State College of Education Oro

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ABSTRACT

Background. The successful adoption of blended learning in educational institutions is often hindered by technological and institutional barriers. These include constraints related to ICT infrastructure, digital literacy, and institutional policies, which collectively impede the implementation of blended learning methodologies.

Purpose. This study aimed to investigate the institutional and technological barriers to blended learning adoption at Kwara State College of Education Oro. Specifically, it focused on assessing technological constraints, institutional policies, and digital literacy levels among educators and students.

Method. A mixed-methods descriptive survey research design was employed. Simple random sampling was used to select a sample of 641 students and 90 lecturers. Data were collected using structured and unstructured questionnaires administered via Google Forms, enabling a comprehensive analysis of key trends.

Results. The findings revealed significant barriers to blended learning adoption, including inadequate ICT infrastructure, low digital literacy among educators and students, and inconsistent power supply. These challenges highlight the need for targeted interventions to overcome the obstacles to blended learning implementation.

Conclusion. The study recommends establishing a dedicated blended learning committee, developing clear institutional policies, and enhancing digital literacy training for both educators and students. Addressing these barriers is essential for the successful adoption of blended learning, which can improve educational outcomes and better prepare future educators for modern classrooms. Creating a supportive environment at Kwara State College of Education Oro is key to fostering the effective integration of blended learning methodologies.

KEYWORDS

Technological Barriers, Institutional Barriers, Blended Learning, Personalized Learning And Teacher Training

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INTRODUCTION

Globally, teaching and learning methods have altered dramatically since the introduction of information and communication technology (ICT) into the classroom. One of the most notable developments is blended learning, which combines traditional in-person instruction with online learning activities. The potential of this strategy to



enhance educational outcomes, expand access to resources, and accommodate a variety of learning styles is becoming more widely acknowledged (Graham, 2013). The reader needs to know the background to your research and, most importantly, why your research is important in this context.

Globally, teaching and learning methods have altered dramatically since the introduction of information and communication technology (ICT) into the classroom. One of the most notable developments is blended learning, which combines traditional in-person instruction with online learning activities. The potential of this strategy to enhance educational outcomes, expand access to resources, and accommodate a variety of learning styles is becoming more widely acknowledged (Barua et al., 2025; Bedenik et al., 2025; Guo et al., 2025; Hasibuan et al., 2025). Blended learning has many advantages, but implementing it in teacher preparation programs is fraught with institutional and technological difficulties, especially in developing nations like Nigeria. This study focuses on these challenges within the context of Kwara State College of Education Oro, a key institution responsible for preparing future educators.

A pedagogical strategy that deliberately blends online learning activities with in-person classroom experiences to produce a more adaptable and stimulating learning environment is known as blended learning (Pandey & Thampi, 2025; Torroba et al., 2025; Wang & Xie, 2025). The development of digital literacy skills, access to a wider variety of instructional materials, among the advantages that blended learning offers in the context of teacher preparation are opportunities for tailored learning and. But for blended learning to be successfully used in teacher training programs, a number of institutional and technological barriers must be removed.

One of the most significant barriers to blended learning's adoption in Nigerian teacher training institutions is technological limitations. Adeoye and Adanikin (2019) identified several technological barriers, including inadequate ICT infrastructure, unreliable internet connectivity, and limited access to digital devices (Kumar et al., 2025; Newby et al., 2025; Rai & C, 2025). These challenges are particularly pronounced in rural areas, where many teacher training colleges are located. Kwara State College of Education Oro, situated in a rural part of Kwara State, exemplifies these challenges. The institution struggles with inconsistent electricity supply, which hampers the use of technology in teaching and learning. Additionally, the college's limited access to high-speed internet and modern digital devices further complicates the integration of online learning components into the curriculum.

In addition to technological constraints, institutional barriers also play a critical role in hindering the adoption of blended learning. Institutional support is essential for the successful implementation of blended learning, as it requires clear policies, adequate funding, and a commitment to ongoing professional development (Sangrà & Bates, 2011). However, many teacher training institutions in Nigeria, including Kwara State College of Education Oro, lack the necessary institutional framework to support blended learning. For instance, there is often an absence of dedicated e-learning units or departments responsible for overseeing the implementation and management of blended learning initiatives. Furthermore, insufficient budget allocation for ICT resources and the lack of clear guidelines for blended learning delivery are significant impediments.

Resistance to change is another institutional barrier that affects the adoption of blended learning in teacher training. In the study of (Fullan, 2015) it was posited that educational reforms, including the integration of ICT, often encounter resistance from educators who are accustomed to traditional teaching methods. At Kwara State College of Education Oro, this resistance may be driven by several factors, including a lack of understanding of the benefits of blended learning, concerns about the increased workload associated with online teaching, and fear of obsolescence among educators. Overcoming this resistance requires a comprehensive change management

strategy that includes awareness-raising, capacity-building, and incentives for adopting innovative teaching practices.

Moreover, the socio-economic context of the students at Kwara State College of Education Oro must be considered when discussing the barriers to blended learning adoption. The findings highlighted that many students in Nigerian teacher training institutions come from low-income backgrounds and may lack access to the necessary technology for participating in online learning activities (López-de-Dicastillo et al., 2025; Neger et al., 2025). This digital gap restricts blended learning's potential as a tool for improving educational results and exacerbates already-existing educational disparities. Targeted actions are needed to address this problem, such as giving financially disadvantaged students access to digital devices and internet connectivity at a reasonable cost and providing financial help.

Despite these challenges, the potential benefits of blended learning in teacher training are increasingly being recognized. Blended learning can enhance learning outcomes, boost student engagement, and better prepare future educators for the demands of modern classrooms, per Graham's (2013) research. The professional development of teachers who are skilled at incorporating ICT into their classes may be significantly impacted by the adoption of blended learning at Kwara State College of Education Oro.

Adopting a multifaceted strategy is crucial to overcoming the institutional and technological obstacles to blended learning implementation at Kwara State College of Education Oro. . This approach should include investment in ICT infrastructure, continuous professional development for educators, and establishing supportive institutional policies. Specifically, there is a need to improve access to reliable electricity, high-speed internet, and modern digital devices. Additionally, the college should establish a dedicated e-learning unit responsible for coordinating blended learning initiatives and provide clear guidelines for blended learning delivery. Capacity-building programs focused on digital literacy and the pedagogical use of ICT should also be prioritised to ensure that educators have the necessary skills to implement blended learning effectively.

Furthermore, addressing the digital divide among students by ensuring access to digital devices and internet connectivity is essential for the success of blended learning, by putting in place programs that give economically disadvantaged students access to reasonably priced technologies and financial aid, such as scholarships, Kwara State College of Education Oro can help with this. By conquering institutional and technological obstacles, the college can foster an environment conducive to effective blended learning. This approach will enhance teacher education in Nigeria, leading to a more effective and responsive training system.

Statement of the Problems: Blended learning is recognized as a powerful tool for improving education by combining traditional and digital instructional methods. The study (Garrison & Vaughan 2008) highlighted its potential to increase student engagement and enhance learning outcomes. In the context of teacher training, blended learning is particularly valuable as it equips future educators with the digital skills necessary for modern classrooms (Graham, 2013). However, despite its benefits, the adoption of blended learning in Nigerian teacher training institutions, especially in rural areas, faces significant challenges.

Research (Tanwar & Agarwal, 2025) pointed out the technological barriers such as inadequate ICT infrastructure and unreliable internet connectivity, which are prevalent in Nigerian educational institutions. In the findings of (Popescu & Fitch, 2025) emphasized that institutional support, including clear policies and adequate funding, is essential to the effective use of blended learning. Another major obstacle to the adoption of blended learning in Nigeria is the disparity in computer proficiency between teachers and students, according to Evarest & Laura (2011).

Research on rural teacher preparation programs, such as Kwara State College of Education Oro, is lacking despite these studies. There is a knowledge gap about how these obstacles directly impact rural institutions because the majority of the material currently in publication focuses on issues in metropolitan or better-resourced contexts. By offering a thorough examination of the institutional and technological obstacles to blended learning adoption at Kwara State College of Education Oro, this study aims to close this gap. By addressing these unique challenges, the study aims to contribute to more effective strategies for implementing blended learning in rural teacher training institutions across Nigeria.

Purpose of the Study: The study examined technological constraints, institutional policies, and other barriers to the implementation of blended learning.

The study especially examined how technology constraints affect Kwara State College of Education Oro's adoption of blended learning.

Examine the effects of institutional policies on the blended learning implementation at Kwara State College of Education Oro.

Analyze the level of digital literacy among the instructors and students at Kwara State College of Education Oro.

Provide practical answers to the technological and institutional barriers that have been identified as preventing Kwara State College of Education Oro from implementing blended learning.

Research Questions: This study was guided by the following research questions:

What are the main technological barriers preventing Kwara State College of Education Oro from implementing blended learning?

What effects do Kwara State College of Education Oro's present institutional policies have on the use of blended learning?

How digitally literate are the faculty and students at Kwara State College of Education Oro right now?

What workable plans can be created and put out to get beyond the institutional and technological obstacles preventing Kwara State College of Education Oro from implementing blended learning?

Theoretical Framework: The theoretical framework of this study is based on the Technology Acceptance Model (TAM) and Institutional Theory, which provide a comprehensive lens through which to investigate the barriers to blended learning implementation at Kwara State College of Education Oro. According to Davis (1989), the TAM focuses on people's perceptions, particularly how beneficial and simple they believe technology to be. These factors are important in determining whether or not people would embrace blended learning. This model is instrumental in understanding how technological constraints, such as inadequate infrastructure and digital literacy, might influence educators' and students' acceptance of blended learning tools. Simultaneously, Institutional Theory sheds light on the broader organizational and policy-related factors that impact adoption. It examines how normative, coercive, and mimetic pressures within the institution either facilitate or impede the integration of blended learning into the curriculum (Olaniyi, 2020). The absence of supportive policies or resistance to change within the institution can significantly hinder adoption efforts.

The study is well-positioned to investigate both institutional and human barriers to blended learning by combining these two frameworks, providing a comprehensive understanding of the difficulties and opening the door for focused interventions to improve adoption within the college.

RESEARCH METHODOLOGY

This study adopts a mixed-design descriptive survey research approach to examine the institutional and technological barriers to adopting blended learning at Kwara State College of Education Oro (Ekayanthi et al., 2025; Fisher et al., 2025). The descriptive survey design was deemed appropriate as it facilitates the collection of both quantitative and qualitative data, enabling a detailed exploration of the current state of blended learning adoption, the challenges encountered by educators and students, and potential solutions.

The population for this study comprises 2,871 individuals, including students and lecturers. From this population, a sample size of 641 participants was selected for the quantitative aspect, while 90 participants were chosen for the qualitative component. This sample size was determined using the Research Advisors' (2006) sample size table, which recommends a sample of 641 for populations of 2,500–3,500 with a 95% confidence level and a margin of error of 3.5%. A simple random sampling technique was employed to ensure fairness, and the population was stratified into students and lecturers. Proportional sampling was further used to reflect the composition of each group within the population, ensuring adequate representation.

Data collection was facilitated through the use of structured and unstructured questionnaires. The structured questionnaire, administered online using Google Forms, underwent rigorous validation, achieving a content validity score of 0.82 and a reliability measure of 0.74. It was designed to gather quantitative data related to institutional and technological challenges. Meanwhile, the unstructured questionnaire was administered in person to 90 participants to capture qualitative insights and in-depth responses. Both instruments were developed to align with the study's objectives and to provide comprehensive data for analysis.

The data collection process was conducted in phases over six weeks. Initially, participants were identified and briefed on the study's purpose. Consent was obtained before distributing the questionnaires. The structured questionnaire allowed for broad participation, while the unstructured questionnaire facilitated detailed exploration through qualitative interviews.

The analysis of the data involved both quantitative and qualitative methods. Quantitative data were processed using the Statistical Package for the Social Sciences (SPSS) software, employing descriptive statistical tools such as frequencies, percentages, and means to summarize the findings. Qualitative data, on the other hand, were analyzed thematically using Atlas.ti software. This involved identifying recurring themes and patterns that provided deeper insights into the barriers to blended learning adoption.

To ensure the validity and reliability of the study, the instruments were subjected to expert review for content validation. Additionally, a pilot study was conducted with a small group of participants to test reliability, yielding a Cronbach's alpha score of 0.82, indicating high internal consistency. The triangulation of data from structured and unstructured questionnaires further enhanced the credibility of the findings.

While the statistical analyses focused on descriptive methods to summarize data trends, the thematic analysis provided a nuanced understanding of qualitative responses. Advanced statistical tests were not required as the study primarily sought to describe and analyze the challenges involved.

The scope of this study is confined to Kwara State College of Education Oro, making the findings most applicable to similar institutions in rural Nigeria. However, this focus also presents a limitation, as the results may not fully generalize to urban or well-resourced educational contexts. Furthermore, reliance on self-reported data introduces the potential for response bias. Despite these limitations, the mixed-methods approach provides a robust framework for understanding the

barriers to blended learning adoption, offering valuable insights for stakeholders in the education sector.

RESULT AND DISCUSSION

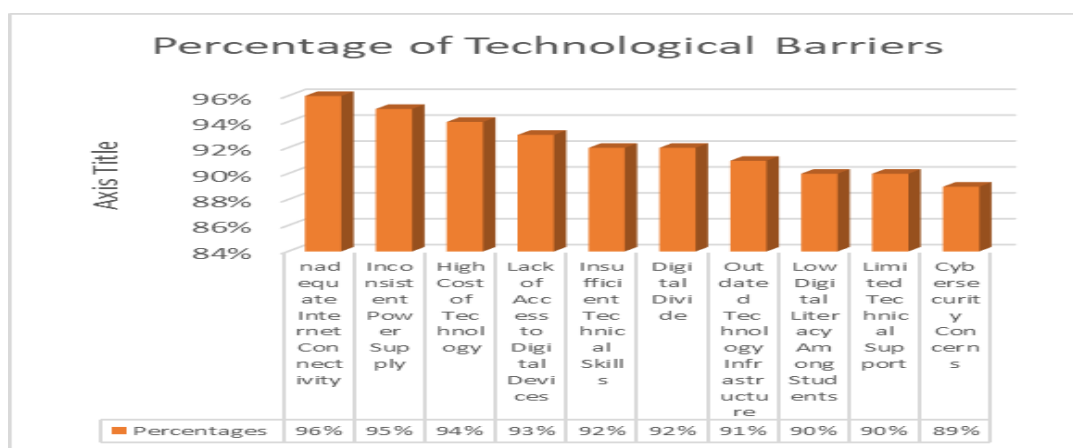
The research questions were answered in qualitative and quantitative approaches. A descriptive statistical tool of percentage, mean and thematic analysis of the analysis was presented in tables and charts, making it used to answer the qualitative part. The results are presented as follows:

Research question 1: What are the main technological barriers preventing Kwara State College of Education Oro from implementing blended learning?

Figure 1.

% of Technological Barriers

Mean % 92.2%

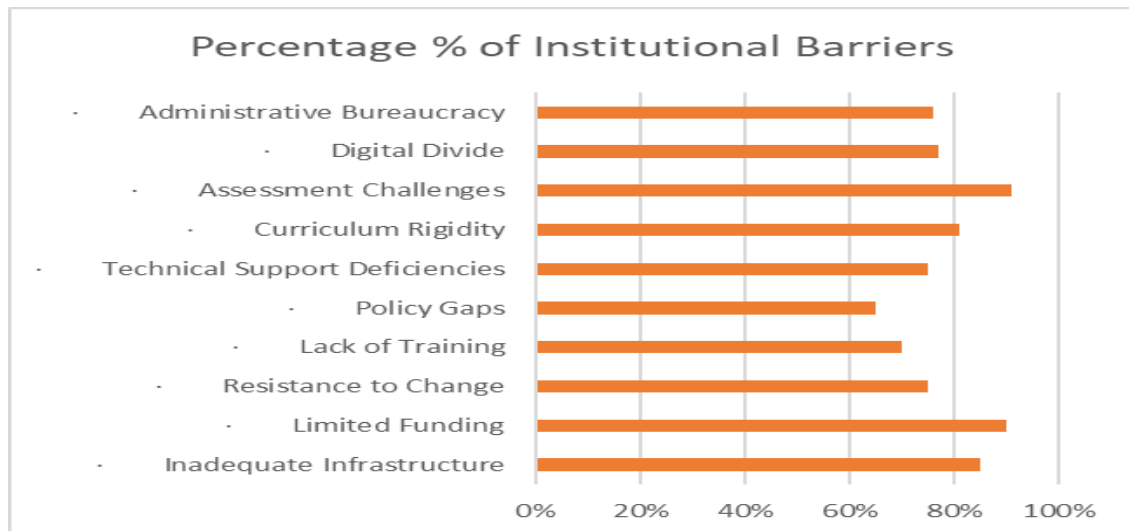


On average, 92.2 per cent of the 641 respondents at Kwara State College of Education Oro, according to the mean table shown in Figure 1. Identified the listed technological barriers as significant obstacles to adopting blended teaching and learning. This high percentage demonstrates a strong consensus among respondents regarding the impact of these barriers. With a mean frequency of 591.5, it is evident that a substantial number of respondents consistently recognized each barrier as a hindrance to the successful implementation of blended learning. This suggests that the challenges, such as inadequate internet connectivity, inconsistent power supply, and high costs of technology, are pervasive and widely acknowledged within the institution. The close range of agreement across different barriers (89% to 96%) further emphasizes the uniformity of opinion among the respondents, indicating that no single barrier stands out as significantly less important than others. Rather, the institution's implementation of blended learning is significantly hampered by these technological obstacles taken together. This broad acknowledgement emphasizes the necessity of all-encompassing approaches to deal with these problems to support the successful integration of blended learning and teaching techniques.

Research question 2: What effects do Kwara State College of Education Oro's present institutional policies have on the use of blended learning?

Figure 2.

Institutional Barriers Mean =77.9%



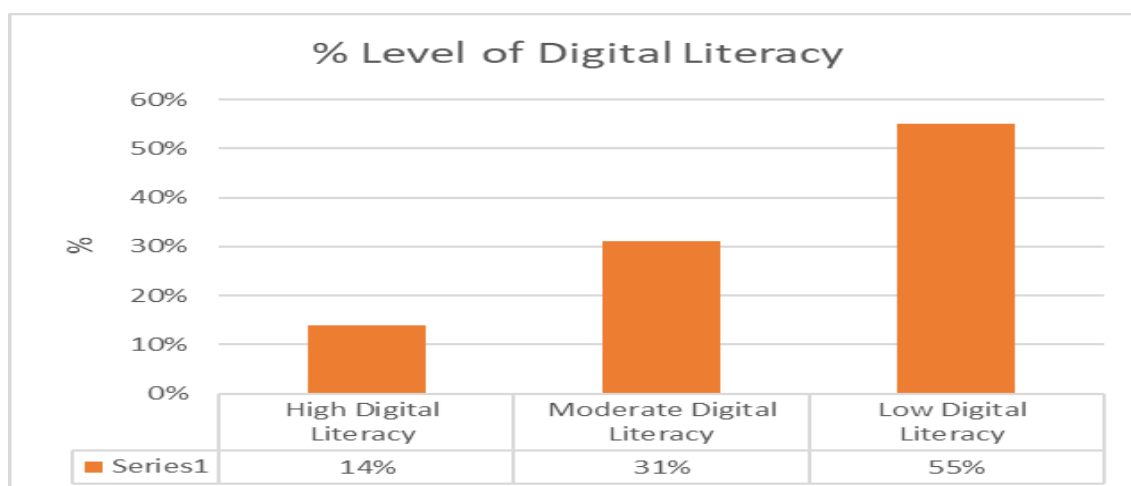
The mean percentage of agreement for all institutional impediments to blended learning adoption at the College of Education Oro shown in Figure 2, is approximately 77.9%. This indicates that, on average, a strong majority of respondents recognize these barriers as significant challenges to the effective implementation of blended learning. The high mean percentage underscores the pervasive nature of these obstacles, suggesting that comprehensive strategies are required to address them effectively. Overall, the data indicates that a wide range of institutional barriers are recognized by the respondents, with assessment, funding, infrastructure, and curriculum issues being the most prominent. Addressing these barriers will be essential for the successful implementation of blended learning at the college.

Research question 3: How digitally literate are the faculty and students at Kwara State College of Education Oro right now?

This is presented in the figure three :

Figure 3.

Revealed that 55%



Respondents have low digital literacy, indicating widespread difficulty with basic digital skills. Only 14% have high digital literacy, showing that very few are proficient with digital tools.

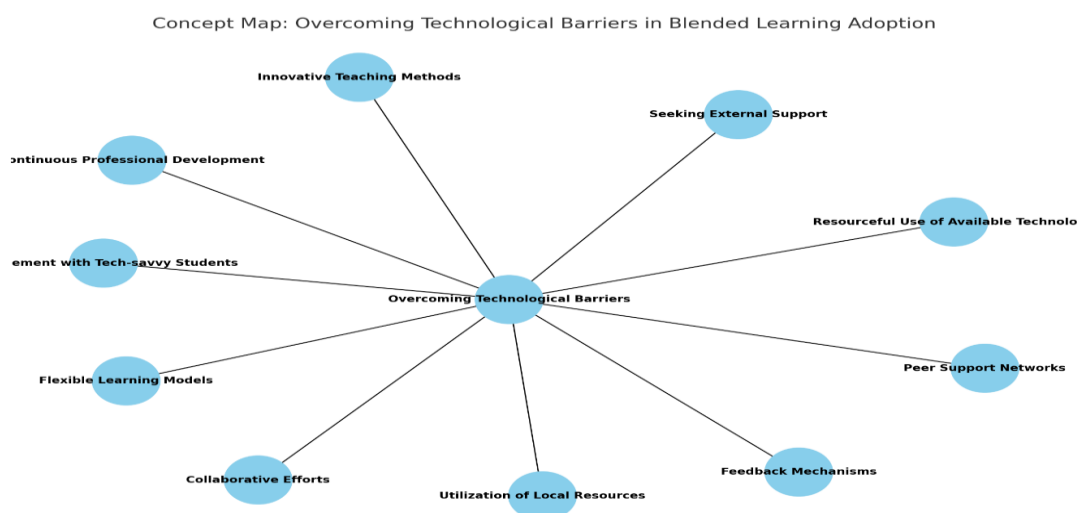
The remaining 31% have moderate digital literacy, capable of basic tasks but lacking advanced skills. This highlights an urgent need to improve digital literacy to support effective blended learning and digital initiatives at the college.

Research question 4: What workable plans can be created and put out to get beyond the institutional and technological obstacles preventing Kwara State College of Education Oro from implementing blended learning?

This was presented in a qualitative form in Figure 4 and Table 1 as follows:

Figure 4.

Technological Barriers to Kwara State College of Education Oro Teacher Training's Adoption of Blended Learning



Finding and analyzing the technological barriers to blended learning implementation in Kwara State College of Education Oro's teacher training program was the primary goal of the study. The findings indicated that several major technology problems are impeding the institution's ability to successfully implement blended learning. Inadequate technology infrastructure was found to be the main obstacle. The college's inadequate internet connectivity, which is necessary for the effective fusion of online and in-person learning approaches, was discovered by the study. Participants reported frequent disruptions in internet service, making it difficult to maintain a consistent online learning environment (Gao et al., 2025; Khan et al., 2025; Vahdanjoo et al., 2025). This issue is not unique to Kwara State College of Education Oro, as the findings of note that unreliable internet infrastructure is a widespread problem in Nigerian educational institutions, significantly hindering the adoption of blended learning.

In addition to connectivity issues, the lack of access to digital devices emerged as a significant technological barrier. Many students and educators at the college do not have personal devices such as laptops, tablets, or smartphones, which are crucial for participating in and delivering blended learning. The study revealed that this digital divide is particularly pronounced among students from low-income backgrounds, who cannot afford the necessary technology. Thus, the finding of highlight that the limited access to digital devices among students in Nigeria is a major obstacle to their engagement with online learning platforms. This lack of access not only affects students but also limits the ability of educators to fully integrate digital tools into their teaching practices.

Another key finding was the insufficient technical skills among both educators and students. The study participants indicated that many educators lack the necessary training and expertise to effectively use digital tools and online platforms in their teaching. This skills gap leads to resistance or hesitation in adopting blended learning methods. Underscores that many educators in Nigerian institutions are not adequately equipped with the technical skills required for effective technology integration in the classroom. Similarly, students who are not digitally literate face challenges in navigating online learning environments, further complicating the adoption of blended learning.

The study also identified inconsistent power supply as a major technological barrier. Participants reported that frequent power outages disrupt online learning activities, making it difficult to maintain a consistent learning experience (Bhatia et al., 2025; Lam et al., 2025; Rhenals-Julio et al., 2025; Tahura et al., 2025; Yu et al., 2025). This issue is particularly problematic in regions like Kwara State, where electricity supply is often unreliable. Point out that the erratic power supply is a significant obstacle to the implementation of e-learning in developing countries, including Nigeria. The lack of reliable backup power solutions at Kwara State College of Education Oro exacerbates this challenge, leading to doubts about the feasibility and sustainability of blended learning initiatives.

Financial constraints were also highlighted as a technological barrier. The study found that the college's limited budget restricts its ability to invest in the necessary technological infrastructure and digital tools required for blended learning. Emphasize that financial constraints are a major impediment to the adoption of e-learning in Nigerian institutions, as the cost of acquiring and maintaining the necessary technology is often prohibitive. At Kwara State College of Education Oro, these financial limitations hinder the institution's ability to fully support blended learning, resulting in inadequate access to the tools and resources needed for its successful implementation.

The integration of blended learning into teacher training programs has increasingly gained prominence as educational institutions seek to enhance teaching effectiveness and learning outcomes (Kassa & Kegne, 2025; Leng et al., 2025; Parashar & Jaiswal, 2025; Pryce et al., 2025). Despite the promising potential of blended learning, various barriers have emerged that challenge its successful adoption. This discussion synthesizes findings from recent research conducted at Kwara State College of Education Oro, combining insights into the challenges faced and potential solutions for overcoming these obstacles.

A significant barrier identified in the study is inadequate infrastructure. Respondents highlighted issues such as unreliable internet connectivity and inconsistent power supply as major impediments to the effective use of blended learning tools. This concern is reflected in the study's data, which shows that 92.2% of participants consider these infrastructural deficiencies as substantial obstacles. These findings are consistent with the work of (Owen, White, Palekahelu, Sumakul, & Sedyono, 2020), who identify similar infrastructural issues in developing regions, noting that they severely impact the implementation of digital education tools.

To address these technological barriers, solutions such as investing in reliable infrastructure and exploring partnerships with technology providers can be effective. Implementing community-based initiatives to improve internet connectivity and power supply could also play a crucial role. For instance, public-private partnerships have shown promise in enhancing infrastructure in various regions, as seen in projects by the World Bank and other international organizations focused on improving educational technology infrastructure (Kilinc, Tarman, & Aydin, 2018).

Another critical challenge highlighted by the study is the high cost of technology and the limited access to digital devices. The financial constraints faced by educators and students significantly hinder their ability to fully engage with blended learning. This observation aligns with

findings from the International Society for Technology in Education (2022), which emphasize the prohibitive costs associated with acquiring and maintaining technological resources. The study reveals that financial constraints are a major impediment at Kwara State College of Education Oro, limiting the availability of essential ICT resources.

Overcoming financial barriers requires a multi-faceted approach. One effective strategy is the development of targeted funding initiatives, such as grants or subsidies for educational technology. Institutions can also explore alternative funding sources, including partnerships with tech companies or non-governmental organizations that are willing to support educational advancements. For example, initiatives like the Google for Education programme offer grants and resources to schools in need. Additionally, implementing cost-sharing models where institutions collaborate on technology purchases can help alleviate financial burdens.

Institutional resistance to change poses another significant challenge. Educators who are accustomed to traditional teaching methods often express concerns about the increased workload and the potential obsolescence of their roles (Marcuzzo et al., 2025). The study reflects these concerns, mirroring observations about the resistance to educational reforms. To address this issue, it is crucial to implement comprehensive change management strategies. This includes conducting awareness-raising initiatives, providing capacity-building programs, and offering incentives for adopting new teaching practices.

Change management strategies should also involve the creation of support networks and communities of practice. These networks can provide educators with ongoing support and resources as they transition to blended learning environments. Successful examples of such support systems can be found in various educational reforms around the world, such as the SchoolNet Africa initiative, which has fostered communities of practice to support educators in adopting new technologies. Additionally, incorporating feedback mechanisms to address concerns and provide continuous support can help mitigate resistance.

Digital literacy is another crucial factor influencing the effectiveness of blended learning. The study found that a significant portion of respondents reported low levels of digital literacy, which impedes their ability to engage effectively with blended learning tools. This challenge is consistent with research by (Hwang et al, 2020), who stress the importance of digital literacy in successful technology-enhanced learning environments. To improve digital literacy, institutions should prioritize training and professional development programs.

Effective training programs should be designed to build both foundational and advanced digital skills. For instance, incorporating hands-on workshops and practical exercises into training can help educators and students develop the necessary competencies to navigate digital tools. The success of such programs can be observed in initiatives like the European Union's eTwinning project, which provides training and resources to educators across Europe to enhance their digital skills. Tailoring training programs to the specific needs of educators and students, and providing ongoing support, will enhance their ability to utilize blended learning effectively.

Institutional policies also play a pivotal role in shaping the adoption of blended learning. The absence of supportive policies can hinder efforts to integrate blended learning into the curriculum. The study highlights the need for clear guidelines and policies at Kwara State College of Education Oro, aligning with (Kaisara & Bivalya, 2021) who argue that institutional policies should foster a supportive environment for blended learning by addressing issues such as resource allocation, faculty training, and student support services.

Developing and implementing supportive policies involves creating a strategic framework that outlines the goals and objectives of blended learning initiatives. This framework should address

key areas such as resource allocation, faculty development, and student support. Successful examples of supportive policy frameworks can be found in the U.S. Department of Education's Office of Educational Technology, which provides guidance and resources for schools to develop and implement effective technology policies (U.S. Department of Education, 2022). Establishing clear guidelines and policies will create a conducive environment for the successful adoption of blended learning.

Thus, the integration of blended learning at Kwara State College of Education Oro is influenced by several challenges, including inadequate infrastructure, high technology costs, resistance to change, low digital literacy, and insufficient institutional policies. Addressing these barriers requires a comprehensive approach that includes investing in infrastructure, developing funding initiatives, implementing change management strategies, enhancing digital literacy through targeted training, and creating supportive institutional policies. By tackling these barriers effectively, institutions can create an environment that fosters the successful implementation of blended learning and ultimately enhances educational outcomes.

CONCLUSION

In conclusion, the study identifies significant barriers to blended learning adoption at Kwara State College of Education Oro, including inadequate infrastructure, unreliable internet, insufficient digital devices, low digital literacy, and resistance to change. To address these issues, the following steps are recommended:

Improve internet connectivity and collaborate with providers to ensure reliable access for all users. Partner with technology companies for discounted devices and establish a loan programme for low-income students. Implement continuous training programs to boost digital skills among educators and students.

Form a dedicated team to support blended learning implementation, offer technical assistance, and develop training resources. Formulate clear guidelines for technology use and support to address resistance and ensure successful integration. Establish a framework for regular feedback and continuous improvement.

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AUTHORS' CONTRIBUTION

Muhinat Bolanle Bello: Conceptualization; Project administration; Validation; Writing - review and editing; Conceptualization; Data curation; Investigation.

Alabelapo Kadir Akogun: Data curation; Investigation; Formal analysis; Methodology; Writing - original draft; Supervision; Validation; Other contribution; Resources; Visualization; Writing - original draft.

REFERENCES

- Barua, S., Golder, U., Chowdhury, R. S., & Sharmeen, K. (2025). Implications of NFT as a sustainable fintech innovation for sustainable development and entrepreneurship. *Sustainable Technology and Entrepreneurship*, 4(2). <https://doi.org/10.1016/j.stae.2025.100099>
- Bedenik, T., Cahir, C., & Bennett, K. E. (2025). I don't mind my information going to the Moon, but I don't want any letters from Mars: a qualitative exploration of the challenges with secondary use of health data in Ireland. *Archives of Public Health*, 83(1).

<https://doi.org/10.1186/s13690-025-01524-4>

- Bhatia, M., Gugnani, R., Yaqub, M. Z., Tripathi, P. M., & Broccardo, L. (2025). Emission reduction strategies and negative emission solutions-pathways, drivers, and challenges. *Journal of Cleaner Production*, 500. <https://doi.org/10.1016/j.jclepro.2025.145263>
- Ekayanthi, D., Lubis, D. P., & Sarwoprasodjo, S. (2025). Communication strategies to strengthen the resilience of micro, small and medium-sized enterprises during the COVID-19 pandemic: A systematic review. *Multidisciplinary Reviews*, 8(5). [1114-Article-Text-15683-1-11-20241015.doc](https://doi.org/10.1114/Article-Text-15683-1-11-20241015.doc)
- Fisher, O. J., Grogan, C., Barron, A., Kanagarajah, S., Smith, S.-E., Smith, I., & McGrath, K. (2025). Considerations for establishment of a private virtual hospital identified using an implementation science approach. *Scientific Reports*, 15(1). <https://doi.org/10.1038/s41598-025-85965-5>
- Gao, H., Wang, P., Yi, H., & Lv, C. (2025). Crowding out or Lock-in? Patent thickets and latecomers' Innovation policies. *Finance Research Letters*, 76. <https://doi.org/10.1016/j.frl.2025.106935>
- Guo, Y., Wang, B., Zhai, X., Liang, L., Hao, J., Pei, H., & Li, Y. (2025). Insights into improvement of the physicochemical and structural properties of wheat bran powder via combined effects of superfine grinding and glutenin. *Journal of Cereal Science*, 123. <https://doi.org/10.1016/j.jcs.2025.104140>
- Hasibuan, G. C. R., Al Fath, M. T., Yusof, N., Dewi, R. A., Syafridon, G. G. A., Jaya, I., & Anas, M. R. (2025). Integrating circular economy into construction and demolition waste management: A bibliometric review of sustainable engineering practices in the built environment. *Case Studies in Chemical and Environmental Engineering*, 11. <https://doi.org/10.1016/j.cscee.2025.101159>
- Kassa, T., & Kegne, M. (2025). Factors affecting innovativeness of small and medium enterprises in Benishangul Gumuz Regional State, Ethiopia. *Journal of Innovation and Entrepreneurship*, 14(1). <https://doi.org/10.1186/s13731-024-00458-5>
- Khan, A. A., Akbar, M. A., Lahtinen, V., Paavola, M., Niazi, M., Alatawi, M. N., & Alotaibi, S. D. (2025). Correction to: Agile meets quantum: a novel genetic algorithm model for predicting the success of quantum software development project (Automated Software Engineering, (2024), 31, 1, (34), 10.1007/s10515-024-00434-z). *Automated Software Engineering*, 32(1). <https://doi.org/10.1007/s10515-024-00474-5>
- Kumar, S., Walker, A., Leech, C., Powell, E., Varrall, R., Ramsay, S., Searle, R., & Jensen, S. (2025). Learnings From the Front Line: Early Implementation Experiences of the Central Queensland Foot Hub Virtual Multidisciplinary Team Model-of-Care. *Australian Journal of Rural Health*, 33(2). <https://doi.org/10.1111/ajr.70014>
- Lam, S.-T., Yap, K.-M., & Yeoh, K.-H. (2025). Driving sustainable energy transition: Understanding residential rooftop solar photovoltaic adoption in Malaysia through a behavioural analysis. *Renewable and Sustainable Energy Transition*, 7. <https://doi.org/10.1016/j.rset.2025.100103>
- Leng, J., Li, R., Xie, J., Zhou, X., Li, X., Liu, Q., Chen, X., Shen, W., & Wang, L. (2025). Federated learning-empowered smart manufacturing and product lifecycle management: A review. *Advanced Engineering Informatics*, 65. <https://doi.org/10.1016/j.aei.2025.103179>
- López-de-Dicastillo, C., Esteve-Redondo, P., Rojas, A., Gómez-Estaca, J., Gavara, R., & Hernández-Muñoz, P. (2025). Modifying the technological properties and the release of cocoa compounds of active gliadin films by increasing the temperature of processing. *Food and Bioprocess Processing*, 151, 54–63. <https://doi.org/10.1016/j.fbp.2025.03.003>
- Marcuzzo, R., Silberg, T. R., & Uriona-Maldonado, M. (2025). Growth of residential solar energy in Brazil: A system dynamics approach. *Renewable and Sustainable Energy Reviews*, 215. <https://doi.org/10.1016/j.rser.2025.115582>
- Neger, M., Rahid, A. O., & Alnour, M. (2025). Moderating effects of energy poverty for sustainable tourism, policy, innovation, and environmental resilience: evidence from SEM-ANN

- approaches. *Discover Sustainability*, 6(1). <https://doi.org/10.1007/s43621-025-00904-8>
- Newby, G., Chaki, P., Latham, M., Marrenjo, D., Ochomo, E., Nimmo, D., Thomsen, E., Tatarsky, A., Juma, E. O., & Macdonald, M. (2025). Larviciding for malaria control and elimination in Africa. *Malaria Journal*, 24(1). <https://doi.org/10.1186/s12936-024-05236-y>
- Pandey, S., & Thampi, G. (2025). Investigating efficacy of emerging ICTs for the Indian construction sector. In *Emerging Trends in Computer Science and Its Application* (pp. 33–40). CRC Press. <https://doi.org/10.1201/9781003606635-5>
- Parashar, M., & Jaiswal, R. (2025). Financial access, depth, and efficiency: The key pillars for enhancing energy equity, security, and sustainability. *Environmental Challenges*, 19. <https://doi.org/10.1016/j.envc.2025.101117>
- Popescu, T., & Fitch, W. T. (2025). Music and animal song follow a mode of extra-genomic evolution similar to that of language. *Physics of Life Reviews*, 53, 141–143. <https://doi.org/10.1016/j.plrev.2025.02.009>
- Pryce, H., Dhanda, N., & Straus, J. (2025). Exploring the purpose and stages of patient and public involvement and engagement (PPIE) in audiology research: a case study approach. *Research Involvement and Engagement*, 11(1). <https://doi.org/10.1186/s40900-025-00672-9>
- Rai, I., & C, S. (2025). Microgrid and grid synchronization: A critical analysis of challenges and opportunities. *Electric Power Systems Research*, 242. <https://doi.org/10.1016/j.epsr.2025.111434>
- Rhenals-Julio, J. D., Martínez, H. A., Oviedo, M. D., Arango, J. F., & Fandiño, J. M. M. (2025). Economic Assessment of the Potential for Renewable Based Microgrids Generation Systems: An Application in a University Building. *International Journal of Energy Economics and Policy*, 15(1), 206–212. <https://doi.org/10.32479/ijeep.17423>
- Tahura, S. S., Shabur, M. A., & Nuva, T. J. (2025). Evaluating the online and offline learning effectiveness in Bangladesh using Analytic Hierarchy Process. *Discover Sustainability*, 6(1). <https://doi.org/10.1007/s43621-025-00879-6>
- Tanwar, R., & Agarwal, P. K. (2025). Multimodal integration in India: Opportunities, challenges, and strategies for sustainable urban mobility. *Multimodal Transportation*, 4(2). <https://doi.org/10.1016/j.multra.2025.100210>
- Torroba, M., Sánchez, J. R., López, L., & Callejón, Á. (2025). Investigating the impacting factors for the audit professionals to adopt data analysis and artificial intelligence: Empirical evidence for Spain. *International Journal of Accounting Information Systems*, 56. <https://doi.org/10.1016/j.accinf.2025.100738>
- Vahdanjoo, M., Sørensen, C. G., & Nørremark, M. (2025). Digital transformation of the agri-food system. *Current Opinion in Food Science*, 63. <https://doi.org/10.1016/j.cofs.2025.101287>
- Wang, M., & Xie, Z. (2025). International trade barriers, export and industrial resilience: An empirical study based on the EU and USA antidumping and countervailing policies on photovoltaic products. *Energy Policy*, 201. <https://doi.org/10.1016/j.enpol.2025.114556>
- Yu, H., Yang, Y., Chen, Y., Zhao, H., Xie, Y., & Zhang, Q. (2025). Examining the universality of the EU's Integrated Pest Management (IPM) policy promotion in China: Asymmetric effects of farmer characteristics and cognitive factors on agricultural practices. *Crop Protection*, 192. <https://doi.org/10.1016/j.cropro.2025.107167>

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