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**RESEARCH ARTICLE**

# Factors Associated with Effective Integration of Mobile Technology into Higher Education in Nigeria to Enhance Achievement of Learning Outcomes

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**ABSTRACT -** The advanced economies have recognized the educational usefulness of handheld devices and have resolutely integrated them into their educational settings at all levels to strengthen instruction and learning. The blending of mobile technology with education has advanced the conventional methods of instruction and learning activities by allowing access to educational possibilities at any time or location. This technology will inevitably be used in higher education if people must be suitably prepared for their duties and responsibilities in contemporary society, which places a high value on digital skills and teamwork, and the development of skills necessary for lifelong learning, among other abilities. However, the majority of African nations, including Nigeria, are having difficulty incorporating contemporary technology into their educational systems, while other countries on the continent have persisted in using antiquated techniques that put students in disadvantaged positions of learning that encourage memorization of facts and knowledge. The primary objective of this research is to examine the factors that enable efficient mobile technology incorporation into higher education in Nigeria, with the aim of promoting successful attainment of learning outcomes. 180 higher education instructors from institutions of higher education in four states in the country participated in a cross-sectional study that combined documentary and survey research. A validated questionnaire that was self-administered was used to collect data, and multiple regression was used to analyze the data. Out of the ten (10) factors identified for the experiment, the study found that educators' involvement in the choice to adopt innovation, internet connectivity, technological skills, mobile technology instructional material, orientation for mobile learning, and technical support are significantly associated with effective integration of mobile technology into higher education in Nigeria.

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## 1.0 INTRODUCTION

Globally, Information and Communication Technology (ICT), is progressively becoming more dominant in human activity. It is found in almost every endeavour undertaken by humans, including commerce, travel, healthcare, agriculture, and education. Advanced nations have heavily utilized and integrated the technology to promote the expansion of teaching and learning processes. ICT integration has been discussed extensively as a means of improving instruction, especially in the light of learner-centered education.

ICT gadgets become more powerful and compact as technology advances, making them more essential and user-friendly for gathering and disseminating information. Both industrialized and developing countries have experienced notable gains in the use and penetration of mobile devices, according to research on their use and adoption in higher education [1]. For example, 64% of individuals in South Africa and 97% of people in China and the USA, respectively, own these gadgets. Kenya and Uganda, two of the most undeveloped nations in Sub-Saharan Africa, have cell phone ownership rates of 83% and 65%, respectively, and as of June 2020, there are 196,039,869 functional mobile connections in Nigeria and with a teledensity of 102.88 [2]. Furthermore, the use of these portable gadgets by instructors and students in higher education in Nigeria is rapidly rising, and it is also making its way down to elementary and secondary schools. This trend has the ability to facilitate learning regardless of location or schedule, as well as to foster teamwork that lowers the accomplishment gaps between students. Since these gadgets have the potential to enhance instruction and gaining knowledge, they are now a part of many nations' educational systems. As mobile gadgets such as Personal Digital Assistants (PDAs), computer tablets, and cell phones support instruction and learning activities regardless of when and where they occur, stakeholders refer to this possibility as mobile learning or learning on the move [3]. Regardless of the different interpretations offered by academics, it is clear that these technologies can enhance learning processes. Using mobile technologies in the classroom has advantageous recommendations and benefits that increase students' motivation, leading to improved knowledge and increased academic performance [4,5].

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Many studies have examined how well handheld devices may be used to improve teaching methods and advance students' attainment of learning objectives [6,7]. With the help of mobile learning applications (software), students can easily study information effectively. Furthermore, they facilitate students' collaboration and teamwork at all times and locations, helping them to get past their learning obstacles and clear up any ambiguities.

While smart countries have continued to integrated mobile technology into their teaching and learning systems, developing countries are attempting to do the same [8]. In Nigeria, however, these initiatives have not yet yielded the desired results. This is where the study's relevance lies in identifying the variables linked to the successful integration of mobile technology into Nigerian higher education institutions to improve learning outcomes accomplishment.

The other parts of this paper show related works, methodology, results, discussion, and conclusion, as well as study limitations and future research.

## 2.0 RELATED WORKS

### 2.1 Mobile Learning

With every year that goes by, ICT devices, which include laptops, iPads, smartphones, and desktop and mobile computers, become more and more feature-rich and compact. Over the past two decades, technology has become more mobile, which has led to the emergence of mobile learning and a new dynamic for learning in many circumstances. The process of learning via portable electronic devices, like PDAs, cell phones, and tablets, is known as mobile learning [9]. It is the widespread usage of portable electronic devices with the goal of enhancing, making easier, and expanding access to educational opportunities.

Technology-mediated learning, which makes learning possible anywhere and at any time, is powered by mobile technology. As a result of these devices' portability, users can access a wide range of platforms and services, including educational materials, wherever and whenever they choose [10]. They support students in gaining access to, evaluating, and sharing online learning materials, working together with classmates, and producing high-quality digital output that benefits both them and their teachers. In addition to providing students with access to instructional materials that may not be nearby, mobile learning helps them acquire the ICT knowledge and abilities needed to properly engage in contemporary society.

With these devices, students can satisfy their curiosity about knowledge at any time and from anywhere by accessing educational materials, interacting with instructors and other students, and connecting with anyone else. This removes the need that students must be present in person at a given place at a given time in order to learn [11]. They argue that the use of this technology in the classroom improves student participation in the learning process and strengthens the relationship between the teacher and the students. As a result of their portability and functionality, students can choose to use their downtime for learning instead of waiting to use a computer or library. While instructors—who are subject-matter experts in their fields—should pay close attention to how students interact with them on the platform, students must exhibit awareness and good self-control, in a setting for mobile learning.

### 2.2 Benefits of Mobile Learning in Higher Education

Numerous people who would not have been able to study due to their personalities or daily obligations can now access education because of the flexibility and self-paced nature associated with mobile learning. Self-paced learning can be implemented in a number of ways, such as following the instructor's instructions on smartphones or tablets to access particular course materials online, learning through pre-recorded class activities, and using online teaching resources. Through this kind of learning, virtual collaborative learning advances education [12]. The usage of mobile devices between students and teachers or among learners for synchronous or asynchronous communication encourages the enhancement of teamwork spirit. Students can connect with their teachers or peers in real-time during synchronous communications, but asynchronous interactions happen when they do so at different times. With mobile learning, students can receive the support they require while studying on the move by contacting their teachers or fellow students.

Additionally, in the global information society, mobile learning fosters the acquisition of digital competencies for lifetime education, which are becoming progressively important for both educators and students. Any educational system fails to adequately prepare its students for modern life, if it does not provide them with the resources for lifetime learning.

The traditional approaches to teaching and learning have undergone a paradigm shift as globalization has led to the creation of knowledge and information essential to the contemporary world. This growth has caused the emphasis of instruction to shift, with curricula that often demand access to a wide range of information and sources, programs, and techniques that assist skills and productivity being prioritized. Learner-centered tactics focused on authentic context and approaches where the teacher serves as a facilitator rather than an expert. Current and upcoming technologies, which are more important for teachers' continued education and for sharing new and improved practices with other groups, provide enough support for this new focus [12].

The removal of physical boundaries and improved access to information and resource networks for schooling are two benefits of mobile technology for higher education. One of the main educational benefits of mobile devices is that they allow students to study at their own pace and pick when and where to do so without causing other learners to fall behind

[13]. Students' ability to acquire, gather, arrange, provide and apply information, and communicate with classmates and teachers is enhanced when classroom restrictions are removed. The drive for mobile technology integration is an attempt to sufficiently prepare students for the ICT-dominated modern workplace, especially in higher education.

Today's learners are sometimes referred to as "digital natives" because of their greater exposure to technology. Consequently, higher learning education is swiftly switching from conventional to digital teaching techniques in order to more effectively address the demands of younger students [14] and adequately prepare them for a world that is always changing and where mastering digital skills is becoming ever more essential.

Students' acquisition of digital skills is facilitated by using mobile devices in their studies. Regular engagement with technology during teaching-learning processes improves student performance and fosters the development of digital skills. Digital literacy is vital for survival in the constantly evolving modern environment. There is an association between students' online time and level of digital literacy [15].

### 2.3 Situation of Mobile Education in Higher Education in Nigeria

The campaign started on February 21, 2012, at the University of Ibadan. However, Nigerian tertiary education has not fully adopted this pedagogical innovation [16]. The mobile project administrators gathered student data from the remote learning centre's Management Information System (MIS) department to locate and register students for the innovation. At the beginning of the semester, a mobile learning induction program was presented to the students. After being divided into groups, the students were connected to online learning environments and teachers. For each course, the learners were provided with three online modules at the start of the actual implementation. A module consisted of frames, and within each frame were tests with either multiple-choice questions or text responses that were supposed to be very quick. These inquiries were made in order to determine the extent to which they comprehended a certain fact in a frame [17]. Furthermore, the courses had chat features that enabled students to engage in group learning using their portable devices. The three modules were evaluated utilizing a mobile platform after they were done. However, structural issues revealed that this innovation could not continue.

In 2012, a mobile learning initiative was also introduced at the University of Ibadan. It was developed by a team of scholars and funded by the Partnership for Higher Education in Africa Educational Technology Initiative (PHEA-ETI) [18]. The project's objective was to provide distance learners with continuous, location- and time-independent access to educational resources through portable devices. At the initial stage, 4 courses were developed on a mobile application that is reachable at any time and from any location using any handheld device that has an internet connection. Students could collaborate on educational projects and connect with teachers via the website.

Additionally, a mobile learning platform was developed in 2012 by Ogbuju, Mbanusi, Chukwu, and Onyesolu for Nnamdi Azikiwe University students. They asserted that the project improved students' collaboration, assignment delivery, and content access [19]. Scholars have also investigated whether learners' educational experiences might be enhanced by a full integration of the teaching tool. Oyelere, Suhonen, and Sutinen [20] came to the conclusion that students might actively use these devices to better their learning after researching how Nigerian tertiary students access and interact with educational resources on their portable devices. In an investigation on the mobile learning experiences of Nigerian university students, Shaibu, Mike, Solomon, and Jarkko [21] discovered that the use of technology enhanced their subjects' academic performance. Olaitan & Olusegun [22] also looked at the attitudes of Nigerian college students on using mobile phones and found that they had a positive outlook on using the devices.

To facilitate the transition from a traditional classroom to a technology-driven one, the Mobile Edu-puzzle application was created with Nigerian computer science education in mind. Developments in brainteaser learning, games, and program visualization made this endeavour easier [23,24]. Despite these pilot programs, mobile technology-mediated educational activities are still substantially absent from the majority of Nigerian higher education institutions.

### 2.4 Factors that Influence Successful Incorporation of ICT Into Teaching and Learning

The characteristics that facilitate or impede the successful integration of ICT into teaching and learning situations are referred to as "factors" in this context. Research indicates that both teachers and their students found it challenging to apply ICT to their various roles in education, despite government investments in ICT for education and the growing demand for its integration in institutions to provide students with the necessary training for sufficient engagement in modern society. [25,26]. Ten potential factors have been identified that may influence the successful integration of ICT in teaching and learning.

*1. Instructor*

The instructor's mindset is one important aspect impacting how technology is used in the teaching and learning processes [27,26]. If educators have a positive attitude about ICT, they might try to integrate it into their work; if not, they might take all the required safety measures to keep it out of their hands. They are more likely to accept the innovation if they are persuaded in a favourable way about the inclusion of ICT tools in education [27]. Teachers have a big say in how ICT is integrated in learning environments. They decide if something is usable or not.

*2. Technological Skills*

A crucial factor in deciding how much technology is used in education is ICT proficiency. Knowledge is necessary for innovative education to be effective and abilities of both students and teachers, making a deficiency of basic knowledge and practical abilities the major obstacle to the use of ICT in the classroom. According to Cox, Preston, and Cox [28], most ICT teacher training focuses more on the technical side of things than how teachers can incorporate it into their teaching plans, leaving teachers with little to no understanding of how to use these technologies in the classroom. Instructors with a strong basis in tools and skills will use technology in the classroom more frequently, according to Knezek and Christensen [29]. The degree of technology used in instruction is also influenced by the institutors' level of ICT proficiency, as found by Berner [30]. Teachers who are proficient in using technology to enhance teaching and learning will find it easy to incorporate it into their instructional plans.

*3. Culture of Schools*

A school's culture, according to Maslowski [31], is composed of the shared core values, norms, and cultural artefacts of its instructors and students. One of the biggest obstacles keeping poor countries from adopting technology as a necessary component of daily life is cultural customs. Prevailing cultures may make it challenging for new technology to be successfully incorporated into organizations. It is necessary to support educators who are required to integrate technology into their instruction [32]. School administrators are likely to continue using traditional procedures when they show no interest in implementing ICT and do not provide the required training. In sub-Saharan Africa, school leaders are apathetic about using technology in the classroom. The use of ICT tools to enhance teaching and learning processes is discouraged by this behaviour.

*4. Government Policies*

Due to insufficient information technology (IT) regulatory frameworks, it is challenging for teachers deploy ICT technologies into their instructional activities and are forced to rely on traditional techniques to fulfill their professional obligations. A national policy governing computer use in the classroom was one of the barriers to ICT use in the classroom cited by educators who took part in the 1998–1999 research evaluating the World Links schools program in emerging countries [33]. Although the Nigerian Policy for Information Technology included plans and goals, it lacked enough definition to address the ICT needs of the nation's educational system [34,35]. Oye, Salleh, and Iahad [36] revealed that over 90% of Nigeria's public schools lack computers in their classrooms due to the government's unsustainable policies.

*5. Technical Support*

When there is little or no technical support available in schools, teachers steer clear of utilizing technology for teaching reasons [37]. Teachers' confidence and readiness to use ICT in the classroom are greatly impeded by the lack of technical support in Nigerian schools. According to Ajadi, Salawu, and Adeoye [38], the National Open University of Nigeria is unable to use ICT because of a lack of technical support. Among the barriers impeding the use of ICT in a number of Nigerian schools is the dearth of staff members with the necessary training to offer users technical support.

*6. Inadequate Finance*

The lack of sufficient funding limits the amount of technology that can be integrated into schools because it is necessary for personnel development, ongoing facility maintenance, hiring and training new employees, and other expenses. In order for educators to effectively employ technology to enhance each student's learning, they must have adequate staff and financial support. This is just one additional significant issue that is having a detrimental influence on technology usage in Nigerian classrooms. Insufficient funding, according to Odia and Omofonmwan [39], has led to a deterioration in the system's standards, which has left laboratories, classrooms, and libraries in disrepair. Oye, Salleh, and Iahad [36] have indicated that the National Open University of Nigeria's (NOUN) inability to establish the infrastructure needed to effectively connect its students with online learning resources is largely due to a lack of funding.

*7. High Cost of Internet Access*

Effective mobile technology integration requires an internet connection. Most students in Nigeria are unable to pay for internet access on top of their already-increasing educational costs because of the high cost of access in the country. In underdeveloped nations such as Nigeria, the expense of internet connectivity makes it challenging for educators and learners to take full use of the opportunities and benefits that educational technology provides [40,41]. The current burden of unnecessary school fees and other associated charges in the nation is already too much for both parents and students to handle.

*8. Mobile Instructional Content*

Due to the smaller screen sizes of the devices and the different design and delivery of mobile learning materials compared to face-to-face instruction, there is a correlation between the type of online content and academic achievement levels in mobile learning contexts [42,43]. To aid in the internalization of the material, they recommended that the content be created in the proper format or formats and delivered to the students in manageable portions. This is to prevent them from being overtaken by the material. Shrain [44] proposed that a mobile learning platform's ease of use and functionality play a major role in helping students meet their learning objectives. Both synchronous and asynchronous access to the

content should be possible for the students [45]. Synchronous content delivery enables learners to reflect on the material in real time, work together, and engage in collaborative learning. Deeper knowledge is achieved by allowing learners to access, analyse, evaluate, and synthesize content in an asynchronous mode.

*9. Mobile Learning Orientation*

Competent resource persons can lead mobile learning orientations that are very beneficial because they give teachers and students the chance to help set up or configure their devices, and to practically demonstrate successful prototypes and procedures related to an effective mobile learning setting [46]. According to Antwi, Tampah-Naah, and Buame [45], to increase involvement and allay any fears, a thorough induction program should also be implemented to improve the confidence of the teachers and students who would subsequently join the innovation as it is being implemented. The management can also reassure teachers and students that it will help them in their creativity through the orientation program.

*10. Teachers' Participation in Decision Making Process*

Research has indicated that when educators are not included in the decision-making process about the implementation of novel teaching approaches, there is a likelihood that they will be hesitant to accept the change [41,45]. The involvement of educators in the decision-making process regarding the integration of technology into their professional activities is crucial as it enhances their readiness and commitment to its execution, ultimately resulting in the system's transformation [44]. Being the primary implementers of school policies, their participation in the decision-making process produces decisions that are feasible to carry out and motivates them to do so.

Table 1. Summary of the factors that influence successful incorporation of ICT into teaching and learning

| Factors | Summary | Authors |
|---|---|---|
| Instructor | The attitude of the instructors towards technology determines its usage in their educational activities. If their attitude is positive, there is the tendency that it will be deployed in their day-to-day professional activities, otherwise, they will be reluctant, owing to lack of passion and confidence. | [26-27] |
| Competencies | When both teachers and their students possess the required skills to proficiently manipulate technological devices, there is the likelihood that they will integrate them into teaching and learning respectively, to achieve the desired result. However, the device itself does not facilitate teaching and learning, but the skills to deploy it appropriately. | [28-30] |
| School culture | The level of technology usage in school is dependent on the support from the management of the school, because to effectively integrate technology into teaching and learning requires the support of the management of the school. If the management is not committed to innovation, it is nearly impossible to succeed. | [31-32] |
| Government policies | Just like the culture of schools, government policies can discourage or encourage the integration of technology in school activities through its legal framework and financial, as well as career development support. | [33-36] |
| Technical support | The presence of technical support not only ensures that the users of the technology have lifelines to explore when there are challenges in the innovation, but also ensures the maximum functionality of the devices. The provision of technical support unit empowers the teachers and their students to embrace the use of technology in their various educational roles, knowing that there are lifelines they can access to resolve any technical issues. | [37-38] |
| Finance | Every innovation requires adequate funds to be successful. When there is insufficient or absence of financial provision, such innovation will likely not yield the desired outcome. Training that will empower the teachers to appropriately deploy ICT tools to support and enhance their performance requires funding, as well as maintenance and transformation of the innovation. | [36,39] |
| High cost of internet connectivity | Unlike other nations across the world, there is high cost of internet access in Nigeria. Should the government or school administrators fail to offer the necessary incentives to allow instructors and students to have unfettered access to the internet to assist their educational activities, this could deter both educators and learners from adopting mobile learning. | [40-41] |
| Mobile instructional content | In a mobile learning environment, instructional content delivery and design are distinct from other contexts, and this to a great extent determines the level at which the students will understand the instructional content. The content should be either in the proper format or a mix of | [42-45] |

| | | |
|---|---|---|
| | formats, and delivered to learners in a user-friendly mobile platform to facilitate their understanding. | |
| Mobile learning orientation | Orientation helps to dispel any anxieties the participants (teachers and students) may have in adopting mobile devices in teaching and learning respectively. Induction also provides an opportunity where the school management can assure the participants of its support, regarding the innovation, as well as demonstrate the context-specific roles played by educators and learners. | [45-46] |
| Teachers' involvement in decision making process | Teachers ought to be included in the decision-making process when it comes to implementing innovations in the classroom. This practice makes them feel valued by the institution, and readily provide information relating to the likely challenges in the implementation of the innovation, this enable the management eliminate such challenges swiftly, to ensure hitch-free implementation. | [41,44-45] |

Table 1 above summarizes the factors associated with the successful integration of technology into teaching and learning processes, as revealed by previous related studies. These factors constitute the independent variables of this study.

## 3.0 METHODS AND MATERIAL

In this work, documentary research and a cross-sectional survey are combined. To facilitate the achievement of the objective of the study, the first helped the researchers to gather and evaluate literature pertinent to the subject of the study. During the process of looking for relevant resources for the study, articles that focus on using mobile learning to improve learning outcomes were selected, examined, assessed, and summarized. The latter was used to capture the participants' responses about the factors that might affect the successful integration of mobile learning into Nigerian higher education institutions. The population of this study consisted of all the teachers at Nigerian higher education institutions, and since studying the entire population would have been challenging, the researchers decided to focus on a sizable sample of the population to meet the study's objective.

Since the scope of the study was restricted to higher education institutions, the sample consisted of higher education institution instructors in four states in Nigeria. 180 instructors in higher education from the states of Edo, Akwa-Ibom, Kano, and Enugu were chosen at random to serve as a sample for the research. These respondents were chosen at random from an assortment of distinct age groups, genders, years of service, and educational backgrounds. Data were gathered via a paper questionnaire, with items developed through research, analysis, review, and synthesis of secondary sources of information relating to the objective of the study, including books, journal articles, conference papers, and other materials. To guarantee the validity and reliability of the questionnaire used to gather the data, three professionals in the fields of educational technology and evaluation individually assessed the items. A 5-point Likert scale was used as the instrument to allow research participants to indicate how much they agreed or disagreed with the parameters linked to the effective adoption of mobile learning in Nigerian tertiary education. Analysis of multiple regression was used to examine the data gathered. This is because it is typically used to estimate the association of two or more independent variables with one dependent variable, like in this study. The analysis showed that, of the ten (10) variables listed under "factors that influence successful incorporation of ICT into teaching and learning" in the related works, the following were found to be significantly related to the successful integration of mobile technology into Nigeria's higher education institutions: teachers' involvement in the decision-making process regarding the introduction of innovation (mobile learning), internet connectivity, technological skills, mobile instructional content, mobile learning orientation, and technical support.

## 4.0 RESULTS AND DISCUSSION

### 4.1 Results

Table 2. The sociodemographic attributes of the participants

| Variable | No | Percentage |
|---|---|---|
| Gender | | |
| *Male* | 127 | 70.6 |
| *Female* | 53 | 29.4 |
| **Total** | **180** | **100%** |
| Highest qualification | | |
| *Bachelor* | 48 | 26.7 |
| *Masters* | 67 | 37.2 |
| *PhD* | 65 | 36.1 |
| **Total** | **180** | **100%** |
| Teaching experience | | |
| *<10 years* | 36 | 20 |
| *10-19 years* | 41 | 22.8 |

| | | |
|---|---|---|
| *20-30 Years* | 64 | 35.5 |
| *>30 years* | 39 | 21.7 |
| **Total** | **180** | **100%** |

Of the 180 respondents who correctly completed and returned the questionnaire copies, 127 (70.6%) were men and 53 (29.4%) were women, as shown in Table 2. As of the time of this survey, 48 (26.7%) of them held bachelor's degrees, followed by 67 (37.2%) master's degrees and 65 (36.1%) doctoral degrees. In terms of how long they had been teachers, 36 of them (20%) had been in the profession for less than ten years, 41 (22.8%) for ten to nineteen years, 64 (35.5%) for twenty to thirty years, and 39 (21.7%) for more than thirty years.

Table 3. Multiple regression analysis of the variables linked to efficient use of mobile technology to improve achievement of learning objectives in Nigerian higher education (n = 180)

| Variables | Beta | SE | P-value |
|---|---|---|---|
| Teachers' involvement in the decision-making process about innovation | 0.29 | 0.27 | 0.012 |
| Technology skills | 0.29 | 0.25 | 0.006 |
| Internet access | 0.25 | 0.23 | 0.005 |
| Mobile content | 0.45 | 0.25 | <0.001 |
| Mobile learning orientation | 0.28 | 0.17 | 0.013 |
| Technical support | 0.26 | 0.23 | 0.005 |

Table 3 indicates a statistically significant relationship between the degree of teacher participation in the decision-making process regarding the integration of mobile learning into Nigerian higher education and the improvement of learning objectives attainment. As the Table shows, there is a relative change in the promotion of learning outcome accomplishment with a P-value of 0.012 for a unit shift in teachers' involvement in the procedures leading up to a choice to embrace mobile learning. Technology skills were significantly connected with the successful integration of mobile learning into Nigerian higher education to promote learning objective attainment. Table 3 above demonstrates that there is a similar increase in the use of mobile learning to improve the achievement of learning objectives for a unit change in technology competency, with a P-value of 0.006. Table 3 illustrates the relationship between internet accessibility and the effective integration of mobile learning in Nigerian tertiary education to improve achievement of learning outcomes. With a P-value of 0.005, an increase in internet accessibility leads to a corresponding rise in the use of mobile learning to improve learning outcomes accomplishment. Table 3 indicates a substantial positive link between mobile content and the effective use of mobile learning to enhance the attainment of learning objectives in Nigerian higher education. For each unit change in mobile instructional material, there is a corresponding significant rise in mobile learning integration to improve learning objectives achievement, with a P-value of less than 0.001. Table 3 above shows a substantial link between the orientation toward mobile learning and the successful integration of mobile learning to support the attainment of learning objectives, with a P-value of 0.013. Technical assistance was also shown to be substantially correlated with the incorporation of mobile learning into Nigerian tertiary education to improve learning outcome attainment, as shown in Table 3. Every unit adjustment in technological support results in a corresponding increase in learning objective achievement through mobile learning (P-value = 0.005).

### 4.2 Discussion

The results of the statistical analysis technique revealed that, of the ten (10) variables found in the literature review component (documentary research) of this study, the following are significantly associated with the successful integration of mobile technology into higher education in Nigeria: teachers' participation in the decision-making process regarding the introduction of innovation (mobile learning), availability of stable internet connectivity, competency, mobile instructional content, mobile learning orientation, and technical support.

The practical integration of mobile learning into Nigerian tertiary education was found to be substantially connected with instructors' involvement in the process of making decisions to establish transformation in schools. Active participants in the educational decision-making process are more likely to embrace professional practice decisions, take responsibility for them, and vigorously defend them [47]. Engaging educators in determining how best to implement modernization in classroom enhances communication between them and the administration while also elevating the bar for these kinds of decisions [41]. Teachers make better decisions and ensure better implementation of those decisions since they are the ones who carry out and supervise school activities [48]. This enhances student performance.

Management should promote teacher participation in decision-making since it is crucial to the development and overall change of educational activities. Their engagement in decision-making exercise helps the management identify possible obstacles to the implementation and come up with plans to quickly get rid of them. When their involvement spans the entire decision-making process, from conception to application stage, it is easy for them to accept the innovation. They can effectively contribute to the integration in a variety of ways. However, if they are excluded from the decision-making process, the management may not be aware of their requirements concerning the innovation, which could lead to

bad decision-making and, eventually, unsuccessful execution. The absence of their participation may induce pressure and a reluctance to stand up for and accept accountability for the decision, impeding the accomplishment of the objectives.

To effectively incorporate mobile technology into higher education in Nigeria to enhance learning outcomes attainment, this study indicated that mobile learning proficiency is a vital aspect. Educators and learners alike must be able to use mobile devices to improve their respective roles and achieve the necessary outcomes. Teachers' technological proficiency and ability to deploy mobile technology to accomplish the intended objectives are key components of a successful mobile learning context [41]. Staff development should also train instructors on how to make optimal use of these devices in their official activities so that they can succeed in the mobile learning environment [49]. In a mobile learning scenario, instructors' skills and dispositions are critical to pointing students in the right direction toward achieving their goals [41]. Students' success is guaranteed when teachers are skilled in the mobile learning strategy; this outcome is not surprising since a basic use of mobile devices in educational settings does not provide an efficient integration that yields the desired consequence. The creation and distribution of information for mobile learning is quite different from conventional learning environments [50]. Most teachers are not proficient in using mobile technology as a teaching and learning tool, there is an inadequacy of the pedagogical skills required to deploy, disseminate, and maintain its usage in Nigerian higher education. Teachers need to be able to assess the needs of their students, develop mobile content in the right formats, and guide students effectively within the given context. The teachers should be equipped with these skills through staff development for a smooth integration.

It was also shown that the effective integration of mobile learning into Nigerian higher education to raise the accomplishment of learning outcomes was correlated with internet access. Compared to industrialized countries, where internet access is almost free for teachers and students in schools, internet connections are costly in Nigeria [51]. There is, for the most part, a significant ICT infrastructure disparity between schools in Nigeria's rural and urban areas [52]. Closing the gap and making it easier for educators and students to access the internet are necessary for successful integration.

Numerous scholars have demonstrated that there is a high correlation between mobile instructional material and efficient mobile learning integration [53,41]. The manner instructional information is designed and delivered for mobile learning differs greatly from traditional learning settings. Since mobile devices have small screens, learning materials should be designed to make full use of the multimedia features available on them and send to students in bite-sized morsels. Students should not find the amount of online content to be overwhelming [9,41], and as visual format is ideal for mobile learning, it should be used wherever possible [7,41]. If educators wish to reinforce their students' assimilation of the material, they must participate in the online environment frequently and in a meaningful way.

This study found a connection between good integration and the mobile learning orientation program. A comprehensive orientation program provides an opportunity to educate users' of their varied roles (teachers and students) and to give them suitable hardware/software sensitization prior to the implementation of mobile learning [54]. They affirmed that the training strengthened their learning and communication abilities. An orientation program greatly increases instructors' and students' adoption of innovative teaching practices and, eventually, the attainment of institutional objectives [45]. They claimed that reliance on technology, induction, and other factors is what leads to the expected effects being achieved. By establishing a connection between the teachers and their students and the hardware and software, orientation enhances the functionality of the innovation. Teachers and their students can set up their accounts and learn about the school's recommended policy of usage and guidelines for some apps that the teachers have deemed necessary for innovation through a well-managed orientation program, preferably led by an instructional technology specialist [55]. To allay concerns and increase comfort in the environment, educators and their students who will eventually adopt the innovation even as deployment is ongoing need a robust mobile learning orientation program.

To facilitate effective participation, the mobile learning induction provides users with information about where and how to get help. It also highlights the benefits for teachers who adopt and stick with the innovation. Without enough orientation prior to adoption, educators and students would not have the confidence or know-how to look for the various forms of assistance that are required for the project to be implemented successfully [56]. This could be significant because they might not have another chance to acquire answers to the questions they had before taking part in the innovation. Furthermore, the school administration would forfeit the opportunity to assess their readiness and express its readiness to assist them with the innovation.

Technical and instructional support were among the elements that led to successful mobile learning in schools, increasing instructors' confidence and allaying their fears about implementing this kind of innovation Han, Wang, and Jiang [57]. Having technical support is essential to integrating mobile learning. By working together with their peers, they can get technical support, and the more experienced members can mentor the less experienced ones. Technical support units are set up to guarantee that the devices work effectively and that the project is transformed [58,59]. To become more adept at using learning management systems and revising content for online distribution, teachers must undergo periodic training [41]. Such training support seeks to accomplish the intended result through an effective integration. In a similar vein, students are more likely to participate in and stick with online learning when their sense of community and social ties increase [60]. Colleagues and teachers' encouragement and support are vital for students studying online. Therefore, a mobile learning community should be created to promote interactive and collaborative online learning. When social engagement and teamwork are lacking in online learning platforms, students eventually stop studying mobile content

[61]. To maintain the sustainability of the constructivist approach to education and to encourage students to develop higher-order thinking skills, online instructor's support is crucial [62,63]. Furthermore, Aghaee and Keller [64] noted that undergraduate students considered online peer support to be highly helpful, confirming the effectiveness of online learning. Han, Wang, and Jiang [57] further underlined how crucial prompt assistance is to sustain and transform online learning. Research has indicated that in order to facilitate students' successful engagement with technology-mediated instructional resources, technical assistance is required. This is because it reduces students' apprehension about utilizing technology and bridges the gap in digital literacy across students [65,]. It is crucial to establish a dependable mobile learning lifeline for educators and students prior to implementation, as this can alleviate concerns and increase self-assurance in utilizing technology for educational purposes.

## 5.0 CONCLUSIONS

In this technologically advanced era, any teaching approach that is teacher-centered and inhibits student involvement is inadequate to sufficiently prepare students for the needs of today's society. Functional education requires significant theoretical shifts, knowledge reconceptualization, and the use of ICT tools to support the development of lifelong learning capacities.

This is a result of the changing needs of society. The needs of earlier generations were met by providing students with the resources they required through conventional teaching techniques. These outdated approaches, however, are unable to provide today's students with the abilities they need to adequately engage in and contribute to the advancements of the twenty-first century. Educational institutions must regularly employ new and innovative methods to better prepare their students for effective participation in social development and sustainability, as demanded by modern organizations.

Organizations today place a high value on collaboration, creativity, adaptability, and communication skills because they encourage innovation that increases operational effectiveness and efficiency. As a result, educational institutions need to reconsider their approaches to teaching and learning to encourage active learning that equips students with these competencies. Any instructional approach that encourages educators and learners to act as knowledge producers and receptors, independently, does not help students develop these skills.

Research has indicated that incorporating mobile technology into the educational process can aid in the development of these skills in students. This is because it gives teachers more time in the classroom to expose students to experiences that are relevant to the real world and foster their growth. Additionally, it encourages active learning.

This study identified mobile instructional content, induction, participation of teachers in the process of taking decision to integrate mobile technology and technical support, as well as uninterrupted internet connectivity as elements that facilitate successful integration of mobile technology into Nigerian institution of higher learning.

The only limitation of this study was that at the time of the survey, the majority of teachers thought mobile learning was unusual, this led to difficulty in getting more respondents. More studies with bigger samples of instructors in higher education are required in Nigeria.

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## AUTHORS CONTRIBUTION

A. Agbi Grant acquisition; Conceptualization; Methodology; Investigation; Data collection; Writing - original draft; Paper revision in collaboration with co-author)

S. Sengsri (Review and editing; Statistical analysis; Supervision)

## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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