

## **Preparedness of Preservice and In-service Teachers' Towards the Use of Mobile Devices in Nigeria**

**Oluwafikayo E. Adewumi, Tataleni I. Asino & Kushal Jha**  
**Oklahoma State University, USA**

### **ABSTRACT**

The dramatic growth in the use of mobile devices across different environments and fields has contributed significantly to mobile learning (mLearning). Students have benefitted through the multimedia features of mobiles and can utilize emerging technologies with their mobile devices for learning purposes. Despite the relevance of mobile learning in formal and informal learning environments, it seems to be less explored in Nigeria. Research has shown that teachers play a significant role in adopting any technology in the classroom, so it is essential to probe into preparedness related to the adoption in the classroom. The paper examines the preparedness of preservice and in-service teachers to use mobile devices in their classrooms using an online survey on mobile learning readiness and technology adoption stages. Quantitative data revealed that teachers are willing to adopt mLearning, and rate themselves above average on the technology adoption stage; however, a few factors like an unsupportive curriculum and lack of infrastructure are causing its setback. The research recommends that more awareness be raised to promote its adoption, create a supportive curriculum and provide the needed infrastructure in the classroom to support its use.

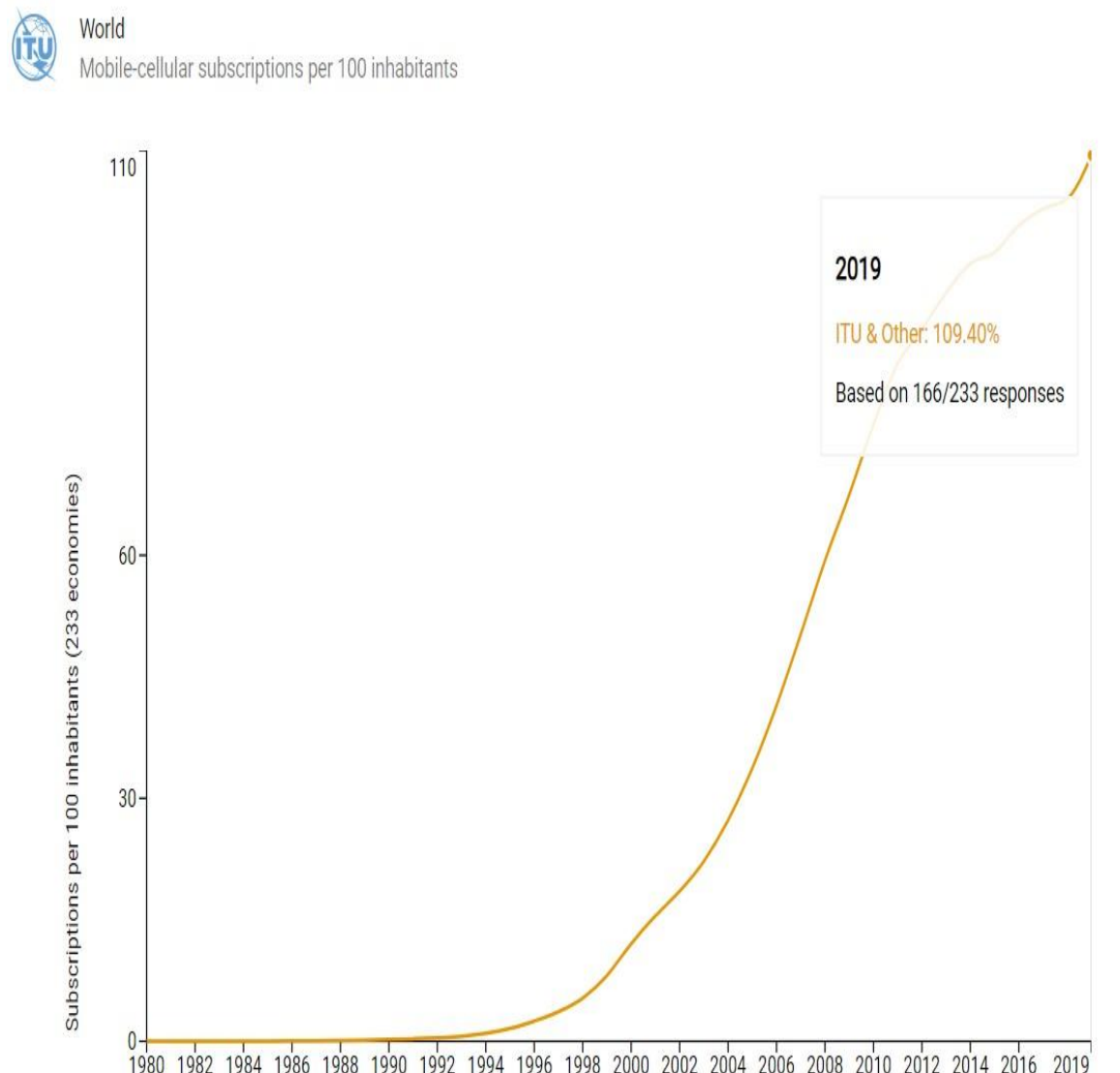
### **INTRODUCTION**

The use of technological devices in education has developed beyond large mainframe computers that took up half a room, to large brick size phones to smartphones, and now relatively affordable robots. These developments have impacted all sectors including education. The integration of technology in the classroom has shown that technology in education can enhance learning by creating a holistic learning environment (Rolle-Greenidge & Walcott 2020). Moreover, the impact of integrating technology has been felt globally and Nigeria is no exception. It is thus not surprising that teachers in Nigeria want to meet the educational needs of students in their classrooms by applying the best technologically informed strategies available.

Underlying the interest in the use of technology in education is a question of preparedness (Darling-Hammond *et al.*, 2005). Preparedness can be manifested or be correlated with different factors. In the case of Nigeria, this can be related to a low level of knowledge about Information technology (Aremu & Adediran 2011), or what Agbatogun (2012) has referred to as low levels of computer literacy. While the question of preparedness can be addressed from varied perspectives, our paper focuses on the teachers. Specifically, we aim to explore the preparedness of preservice and in-service teachers towards the use of technology, particularly mobile technologies or what is broadly referred to as mobile learning.

Mobile learning (mLearning) has been around for many years and its impact in teaching and learning both from the teacher's and student's perspective has shown that it can improve teaching. In mLearning, teachers facilitate teaching by using the unique features of mobiles and students enjoy the learning materials, which are more and easily accessible to students. MLearning involves using portable devices such as tablets and mobile phones, which allows teaching and learning to stretch beyond the traditional classroom. The advantages of mobile learning include but are not limited to, flexibility, new opportunities for interaction, and feedback between teachers and learners (Güler *et al.*, 2022). Mobile devices are one of the most accessible devices in this century (see

Figure 1) in terms of affordability, accessibility, and user-friendliness. Smartphone users in Nigeria (2014-2025 | Statista (2022) forecasted the number of smartphone users in Nigeria to grow up to more than 140 million by 2025. This suggests that there would be an increase in access. Not only would teachers have access to mobile devices, but students would also have access to them. Considering its availability, we need to ask the question: are Nigerian pre-service and in-service teachers prepared to explore this kind of classroom?

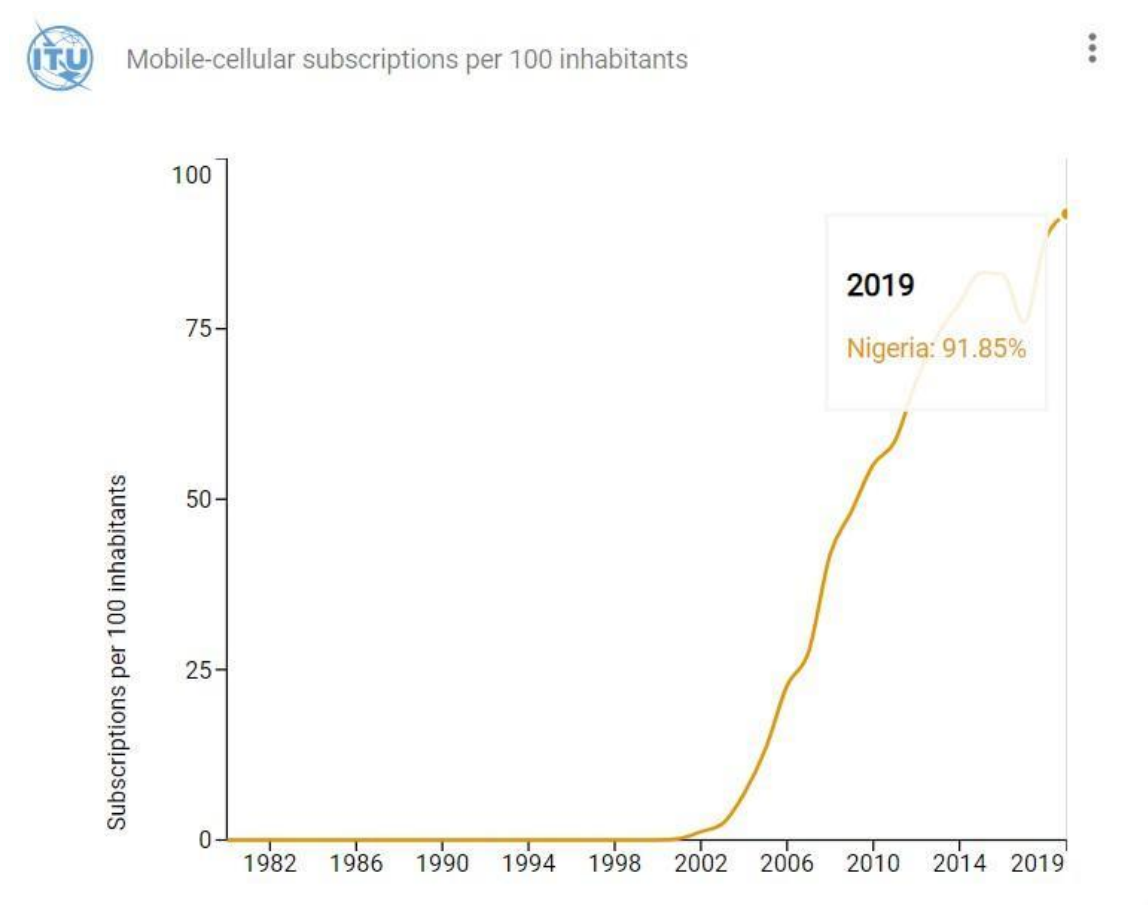


**Figure 1:** Mobile-Cellular Subscriptions per 100 inhabitants in the World (ITU, 2019)

Preservice teachers are often trained on using technology in the classroom but often the technologies that they are trained on, especially at university levels, may not exist at the school at which they are hired. Personal experiences from the first author for example, while studying education in Nigeria, included taking one stand-alone educational technology class all through the four years at the university. The class, which was on media in education, trained students on how to create videos and media content on topics or subjects being taught to the learners using

smartboards. However, an average Nigerian government owned school has one or no smartboards or projectors for the whole school, hence making it difficult for every teacher to make use of the technology. Educational leaders in Nigeria understand that there is a need to integrate technology in our education system, however, can this desire be met given how expensive resources are? Given the foreseen growth in use and its prevalence in Nigerian society for smart mobile devices such as smartphones (Android and IOS), and tablets, can they conveniently serve as instructional resources and be integrated into teaching and learning?

According to the latest available data from the ITU, as at 2019, a large percentage of Nigeria's 203 million population (91.85%) were mobile literate (see Figure 2). This means that a significant percentage of the population can successfully perform basic tasks like calling and texting on their mobiles. Although, the stages at which they can operate might range from basic to advance, according to Asino, Jha & Oluwafikayo (2020) mobile digital literacy can be defined relative to the ability to identify, understand, interpret, create and communicate using the features and functionality of a mobile device.



**Figure 2:** Mobile Cellular Subscriptions per one hundred inhabitants in Nigeria (ITU, 2019)

The purpose of this study is to compare and discuss any significant differences in the use of mobile learning by in-service and preservice teachers in Nigeria. The research questions that guide this study are:

- What is the difference in the preparedness of preservice teachers and in-service teachers to teach with mobile devices?
- Is there a significant difference in the level of technology adoption stage between preservice and in-service teachers?

## LITERATURE REVIEW

A review of literature for this paper led to an emergence of a few themes regarding the use of mobile devices for teaching and learning. Specifically, from the articles reviewed, the findings indicate that mobile learning is most prevalent in undergraduate courses, Mlearning promotes active learning, and for a successful mlearning practice, training should be provided for teachers to increase their readiness.

### **Mobile Learning**

Mobile learning involves using portable devices such as tablet devices such as iPads, and smartphones, allowing teaching and learning to stretch beyond the traditional classroom, that is, learning any time and place (Huang & Chiu, 2015; Klimova, 2019). It is defined as "A learning paradigm which takes place in a ubiquitous computing environment that enables learning the right thing at the right place and time in the right way" (Yahya, Ahmad & Abd Jalil, 2010, p.4). Since the adoption of Mobile learning in education, it has been proven to improve active learning in the classroom, and the Nigeria context is no exception. Research has shown that students' learning can advance beyond what is available in the textbook if exposed to a series of applications embedded in mobile devices for their learning. Song (2014) conducted research using the Bring Your Own Device (BYOD) model. This research investigated (a) What advancement the model will bring to students' learning, (b) How students advanced in their learning using the model, and (c) Students' perception towards that style of learning. The findings of this study indicated that BYOD technology model implementation in a learning environment develops the content knowledge of young learners (Song 2014) that is, it makes the learning more authentic by making learners active participants of knowledge creation. The advantage of owning a mobile device goes beyond active learning, its personalized feature gives room for learning activities that take place at student's own will, by their own choices and own responsibilities (Suprianto, Ahmadi & Suminar 2019). Mobile learning gives room for authentic learning, which is a key feature for a successful teaching and learning process. Authentic learning is composed of three essential elements, namely collaboration, reflection, and multiple roles and perspectives (Kola & Sunday 2018). All these three elements are in line with the constructivist point of view that encourages moving from teacher-centered learning to a more student-centered learning, where students own their learning.

### **Teacher's Mobile learning Perception**

The exploration of mobile learning is more common in higher education because college students have more improved skills in operating mobile devices (Gambari *et al.*, 2021). The idea of improving students' learning through mobile technologies has been in the educational system for decades; however, it is completely new in the average Nigerian classroom with low awareness amongst students (Obiefuna & Offorma 2014; Okai-Ugbaje *et al.*, 2020). Iroriteraye-Adjekpovu (2013) surveyed undergraduate students at Delta State University in Nigeria on their perception of the integration of Mobile Learning Technologies (MLT) in the classroom for active learning. The findings of the study revealed that 85.1% of the students were willing to use their mobile devices to prepare for their day's lectures, 90.8% to make findings as well as complete assignments, and 93.6% to conduct self-assignment of their work in class. This means students supported the integration of MLT in the classroom, to become active participants of their learning. The increased active participation of learners in and out (formal and informal) of the classroom through mobile

technologies has further encouraged embracing mobile technologies in educational settings. Similarly, Okai-Ugbaje *et al.*, (2020) identified stakeholders (students, academics, IT personnel, and administrative management) willingness to adopt mobile learning in higher education in Nigeria, however, redundancy and engagement seem to be concerns.

Bamidele and Olayinka (2012) examined teacher's perception on the integration of mobile phones into teaching in public senior secondary schools in Oyo and Lagos state Nigeria. This study revealed that teachers only wanted to use their mobile phones for personal use and were not willing to use them for teaching. In addition, one of the participants from a study by Handal *et al.*, (2019) recognized the efficiency of technology in the classroom, however, she stated that;

"I understand that ICT and devices can be used to only enhance student learning but make life easier for teachers as well, however it does intimidate me, so I tend to stick to the old fashion method. In saying this I really want to learn more about them because I know I will teach better using them" (as cited in Handal, *et al.*, 2019, p. 718)

There is a mindset that the teachers' role as facilitators might be eliminated since students can operate devices themselves. However, the integration of Mobile devices in learning is not to eliminate the role of in-service teachers but to make teachers use technology as a medium to improve learning.

### ***Preservice Teachers and Inservice Teachers Mobile Learning Acceptance***

Obiefuna & Offorma (2014) speculated that preservice teachers are trained competently in the use of mobile technologies in teaching primary school children. Their findings indicated that preservice teachers are incompetent in the use of mobile devices in the classroom even if they use their personal mobile devices in their day to day activities. In practice, teachers viewed technology as a far-off material in the classroom, unlike their students who enjoyed interacting with technology (Oguchinalu & Ozonuwe, 2018). Even with the rise in availability of educational technologies, Christensen & Knezek (2017) noted resistance to adopting technology in the classroom, because the adoption of technologies in the learning environment relies on the teacher's attitude towards technology or their technology adoption level.

Teachers' attitudes toward some technology devices can determine how and if those devices are used in the classroom (Rolle-Greenidge & Walcott 2020). Educators need to always remember that for learning to take place, we need supportive and positive attitudes from teachers to promote active learning. Ertmer *et al.*, (2012) suggested that if teachers are trained in the context of their institution and classrooms, together with students, there would be greater opportunities for concepts, methods, and principles of technology integration to be maintained. Similarly, Bas & Sarigöz (2018) noted a significant difference in the mobile technology readiness of students in different university programs as compared to Instructional Technology pre-service teachers. In contrast, Neumann, Alvarado-Albertorio & Ramírez-Salgado (2021) argued that there is a lack of connection between what preservice teachers are taught in standalone educational technology courses and the realities of teaching with technology in today's classrooms. The pedagogical knowledge to apply technology in the classroom, especially mobile technologies, is understudied (Khaddage *et al.*, 2015), which makes the transference of mobile skills more challenging. This is why it is important to investigate the difference between the perceptions of both teachers in and out of the field. Thus, a better comprehension of the adoption process in the education system would better inform its adoption and integration.

It is imperative to note that due to the more active role preservice teacher's play as college students using their devices, Thomas & O'Bannon (2013) stated that preservice teachers would be more comfortable using technology and would be inclined to use mobile technology in their classrooms in the future. Preservice teachers play a significant role in mobile device acceptance because they would play important roles in significant future changes in the educational system (Tondeur *et al.*, 2017). Lofty, Olufemi & Ama (2015) notably stated in their work that Nigerian students are highly immersed in their mobile devices and could channel the mobile skills into mobile learning.

Kafyulilo (2014) conducted a study on the perceptions of teachers and students towards mobile phones as a tool for teaching and learning in Tanzania. Findings from the study identified poor acceptance from both in-service and preservice teachers in integrating mobile learning in the classroom. Factors such as minimal knowledge about its integration, low self-efficacy and misuse of mobile devices by the students, were the concerns of the teachers (both preservice and in-service teachers) regarding its integration. In contrast, Akhigbe, Ogonnaya & Owolabi (2021) conducted a study post COVID-19 to determine Nigerian preservice teachers' perception of a collaborative mobile learning environment that embeds Google Classroom features. The participants of this study attended a class through Google Classroom, after which they completed a TAM questionnaire that assessed perceived usefulness, perceived ease of use and behavioral intentions to use Google Classroom. Results from the data showed that the preservice teachers perceived collaborative mobile learning as easy to navigate, comprehensive and ubiquitous. The perceived ease of use had a significant influence on behavioral intent, which shows evidence that the preservice teachers might adopt mobile learning in their practice in the future. It is important to note that with the shift in learning during the COVID-19 pandemic, it is now evident that "mobile learning can be introduced as a viable pedagogical alternative to face-to-face classroom instruction if blended with appropriate learning strategies" (Akhigbe, Ogonnaya & Owolabi 2021, p.62).

## METHOD

This descriptive quantitative research study investigates Nigerian teacher's preparedness towards mobile learning in their classroom. The purpose of the study is to compare the preparedness of preservice teachers and in-service teachers in Nigeria to use mobile learning. The researchers used *Qualtrics* online surveys to collect data from preservice student teachers whose major is in education and in-service teachers whose significant studies were in education. This study's participants include second year to final year students and in-service teachers majoring in education in Nigeria's urban areas. The study adopts the Christensen and Knezek (2017) online survey on mobile learning readiness and technology adoption stages. Some items from the survey were modified (see Table 1) to align with the research purpose and population. An additional section for comments was included in the survey for comments from participants.

**Table 1:** Modified Items

Original Question	Modified Question	Justification
Mobile devices can play an important role in K-12 education.	Mobile devices can play an important role in Early childhood - secondary school education.	Nigerian education uses the broad term Early childhood for K-6th and Secondary school for 7th - 12th grade.
My administration is supportive of students having their own device.	My administration is supportive or I am supportive of students having their own device.	Want to include a question that would assess the teacher's level of support.

The survey items used the Likert scale of strongly disagree (1) to strongly agree (5) that measured technology readiness. On the technology adoption stage, the items ranged from stage one to stage six.

Participants consisted of 70 teachers of whom 49.32% were in-service teachers and 26.03% were preservice teachers, with 67.12% in the age range of 25-34 years. Regarding gender, 59.90% of the participants were females, while 38.36% were males.

## RESULTS

The survey questions were sectioned into four factors. Factor 1 tested for future possibilities (Possibilities); Factor 2 tested for improving classroom instruction (Benefits); Factor 3 tested for mobile device preferences (Preferences); and Factor 4 tested for the environment/context (External Influences).

**Research Question 1:** What is the difference in the preparedness of pre-service teachers and in-service teachers to teach with mobile devices? Analysis of the data shows the following:

### T-Test

**Table 2:** Independent Sample t-test

	Factor 1 (Possibilities)	Factor 2 (Benefit)	Factor 3 (Preference)	Factor 4 (External Influence)
df	46	46	46	44
t	-0.033	0.476	-0.195	0.476
sig	0.974	0.636	0.846	0.637

Results for test of the following hypotheses:

H<sub>01</sub>: There is no significant difference in Factor 1 for in-service and pre-service teachers.

H<sub>11</sub>: There is a significant difference in Factor 1 for in-service and pre-service teachers

Since the p-value = 0.974 > 0.05, we fail to reject H<sub>0</sub>. Hence, we conclude that there is no significant difference in Factor 1 (Possibilities) for in-service and preservice teachers.

H<sub>02</sub>: There is no significant difference in Factor2 for in-service and pre-service teachers.

H<sub>12</sub>: There is a significant difference in Factor2 for in-service and pre-service teachers.

Since the p-value = 0.636 > 0.05, we fail to reject H<sub>0</sub>. Hence, there is no significant difference in Factor 2 (Benefit) for in-service and preservice teachers.

H<sub>03</sub>: There is no significant difference in Factor3 for in-service and pre-service teachers.

H<sub>13</sub>: There is a significant difference in Factor3 for in-service and pre-service teachers.



Since the  $p$ -value = 0.846 > 0.05, we fail to reject  $H_0$ . Hence, there is no significant difference in Factor 3 (Preference) for in-service and preservice teachers.

$H_{04}$ : There is no significant difference in Factor4 for in-service and pre-service teachers.

$H_{14}$ : There is a significant difference in Factor4 for in-service and pre-service teachers.

Since the  $p$ -value = 0.637 > 0.05, we fail to reject  $H_0$ . Hence, there is no significant difference in Factor 4 (External Influence) for in-service and preservice teachers.

**Research Question 2:** Is there a significant difference in the level of technology adoption stage between preservice and in-service teachers?

81.25% of the participants self-identified between stage 4 - stage 6 (Familiarity and confidence, Adaptation to recent contexts, and Creative application of new contexts). 20.83% identified as being familiar and confident in using technology, 16.67% Identified as being able to adapt to current contexts like transferring skills across different applications, and 43.75% identified as being able to create content using technologies.

A kruskal-wallis H test showed that there was no significant difference in the level of technology adoption stage between preservice and in-service teachers,  $\chi^2(2) = .001$ ,  $p = 1$  with an in-service teacher mean of 21.46 and a preservice teacher mean of 21.57.

## DISCUSSION

An innovation derives its usefulness from its uses. Hence, for mobile learning to have an impact, it must be put into practice and for that to happen teachers must attain a certain level of preparedness. This paper contributes to scholarship investigating teacher preparedness for mobile learning. Specifically, the current study aimed to examine the preparedness gap in the context of Nigeria and to reveal a deeper understanding of preservice and in-service teachers' intention and readiness to adopt mobile devices in their practice. This study aimed to answer two main questions: What is the difference between preservice teachers' preparedness and in-service teachers' teaching with mobile devices? Is there a significant difference in the level of technology adoption stage between preservice and in-service teachers? From the results, there was no significant difference in the level of preparedness for mobile devices adoption between preservice and in-service teachers. However, two themes emerged.

### Teachers Willingness to adopt mobile learning practices

One of the most important factors to consider in learning in the 21st century is the constructivist learning approach. The constructivist belief is that learners should construct knowledge themselves rather than being passive receivers of information. Results from the study indicate that teachers agree that mobile devices allow learners to play active roles in their learning and take ownership of their learning while using mobile devices. For example, two participants stated that it boosts students' creativity (taking pictures, making videos, participating in social interaction like creating educational content on Tiktok or Instagram, and collaborating with peers). In addition, it provides a sense of autonomy due to its individualized, personalized features and user-friendliness.

Overall, our results show that teachers are willing to participate in mobile learning and agree that mobile devices can improve student learning and practices. There is a realization that educators must recognize the possibilities of mobile devices in teaching and learning, which is the right attitude needed to influence its adoption positively. Teachers' perceived effectiveness of mobile devices strongly influences their adoption in their practice (Kalogiannakis & Papadakis, 2019). If



there is a high perceived effectiveness, there would be a high perceived usefulness, increasing its adoption. Peng (2022) indicated that the individual value attached to mobile devices could affect their perception and adoption by teachers. Furthermore, the research revealed that "For university teachers, the primary purpose of integrating information technology and teaching is to improve teaching performance and efficiency" (Peng, 2022, p. 68). Therefore, due to the flexibility mobile learning presents to teachers and learners, it is deemed valuable, practical, and useful.

In addition to the perceived effectiveness is the ease of use. Teachers self-identified as familiar with technological devices and able to create content using various devices. The ease of use is the ability to navigate on mobile devices with or without training. According to Davis (1989), ease of use is "the degree to which a person believes that using a particular system would be free of effort" (p. 320). However, ease of use does not equal usefulness. A device may be perceived as easy to use but might not meet the user's needs. Mohammadi *et al.*, (2020) conducted a study on mobile phone use by faculty members; participants rated ease of use and self-efficacy as above average; however, they rated usefulness as moderately average, that is, not efficient enough for learning. Albeit ease of use is still relevant for adopting mobile learning or mobile devices in teaching and learning. Gan & Balakrishnan (2014) stated that aside from the increase in the teacher-student relationship, the ease of use of mobile devices enhances the willingness to adopt in practice.

The willingness to adopt mobile learning practices can also be attributed to their accessibility level. Mobile devices are more accessible and affordable in Nigeria, and there is no need to wait for a perfect technology to augment learning. It is no surprise that teachers have realized that there will not be ideal technology, so they have to do with what is available and utilize the available resources as much as possible.

### **Factors Limiting the Adoption of Mobile Devices in the Classroom**

Due to some limitations attributed to m-learning, such as Internet issues, software and hardware issues, misuse, and distractions, the adoption of m-learning is less accepted in some educational systems than expected. In the case of Nigeria, inadequate resources in terms of the Internet and data connection (expensive data rates) and electricity can limit the adoption of mobile learning. One of the participants at the end of the survey commented,

*"In Nigeria, there are occasions when the network fails during the process of using mobile devices, or sometimes power outages affect the use of mobile appliances negatively."*

So, in the case of infrastructure, especially electricity, which controls other resources like charging devices and Internet supply, the Nigerian society is not ready and needs to provide the primary resources to make the teachers use the earned skills and willingness. "For M-learning to be successful in Nigeria today implies that the federal government must work on the erratic power supply to ensure electric power is stable" (Kola & Sunday, 2018, p.118). In line with that, students have also indicated that among the top four factors that would promote mlearning are: availability of solid Internet access, awareness of the benefits of m-learning, institutional and government support, and a constant electricity supply" (Okai-Ugbaje *et al.*, 2020, p. 11).

Mlearning limitations cut across different factors. Khaddage *et al.*, (2015) explained that the disconnect in pedagogy, technology, policy, and research are significant challenges with M-learning design and implementation. Limitations can be a lack of acceptance, implementation challenges, or teachers' poor learning experience and training. A study participant stated,

*"Just like traditional learning, using technology is not a straight jacket inclusion without properly equipping the teachers involved in the process."*

Although we have argued for ease of use of the devices, it is still relevant that teachers are trained on their implementation. M-learning implementation should be personalized/individualized, including collaboration with peers, and be authentic (Burden & Kearney, 2017), which would significantly affect how the learning is perceived. Finally, the implementation should have qualities that differentiate it from just another online learning event.

In addition, in-service teachers are concerned with the ownership of phones leading to distraction and cyber misuse (cyberbullying, visiting the wrong site). One of the teachers indicated in the survey that,

*"... mobiles should be specifically child-protective to ensure the effectiveness of such adoption"*

In the case of adopting mobile devices for learning in elementary - secondary school, measures to avoid misuse should be put in place. Despite all the limitations discussed, these claims should not eradicate the use of this potential learning platform. Instead, educators, curriculum designers, administrators, and policymakers should raise awareness about the importance of this learning platform, how to design learning, and best practices to promote the integration of mobile devices in practice.

## **CONCLUSION**

Globally, every country is trying to harness the power of technology for the benefit of improving teaching and learning practices and improving processes across industries. In the context of education, it is often teachers who are called upon to "champion the cause of technology integration in their classrooms in order to produce learners, future teachers and other professionals that fit the 21<sup>st</sup> century skills requirement of the workplace" (Ifinedo, *et al.*, 2019, p.46). One technology that is here to stay is mobile devices which are often the most accessible technology in technology rich and technology poor environments. Mobile devices are in constant advancement, providing benefits to users in a formal and informal context. Educators should make the best use of these devices because they are affordable, ubiquitous, and easy to navigate. The study identified the preparedness of Nigerian teachers. It recommends the urgent need to improve the available infrastructure (Internet, data, and technical support), redesign the curriculum to suit mobile and emerging technologies, and support teachers in implementing practices through professional development.

Mobile learning goes beyond using mobiles for recreational purposes only. It has now become an indispensable tool across all learning contexts. Hence, there is a need for a structured mobile learning platform that is accessible not just for programmers but for educators at all levels. Accompanying this is also a need for instructional designers to consider the culture, population dynamics, and operating systems when designing for m-Learning.

## **FUTURE RESEARCH**

The present study is a component of a larger study. In the next phase, we intend to explore Nigerian teachers' and students' perspectives on using emerging mobile features like Mobile Augmented Reality in learning in the classroom.

## **REFERENCES**

- Agbatogun, A. (2012). 'Investigating Nigerian Primary School Teachers' Preparedness to Adopt Personal Response System in ESL Classroom' *International Electronic Journal of Elementary Education*, vol. 4, no.2, pp.377-394.

- Akhigbe, J, Ogbonnaya, U, & Owolabi, J. (2021). 'Nigerian preservice teachers' perceptions of collaborative mobile learning with Google Classroom: A pedagogical alternative in the era of COVID-19 pandemic' *Nigerian Online Journal of Educational Sciences and Technology*, vol. 3, no.1, pp.55-65.
- Aremu, A, & Adediran, E. (2011). 'Teacher readiness to integrate information technology into teaching and learning processes in Nigerian secondary schools: A case study' *African Research Review*, vol.5, no.4, pp.178-190.
- Asino, T, Jha, K, & Adewumi, O. (2020). Literacy in the Digital Age: 'From traditional to Digital to Mobile Digital Literacies(?)' In T. I. Asino (Eds), *Learning in the Digital Age*. Oklahoma State University Libraries: Stillwater. Viewed 21 April, 2021.  
[https://open.library.okstate.edu/learninginthedigitalage/chapter/literacy\\_in\\_the\\_digital\\_age/](https://open.library.okstate.edu/learninginthedigitalage/chapter/literacy_in_the_digital_age/)
- Bas, M, & Sarigöz, O. (2018). 'Determining the readiness levels of pre-service teachers towards mobile learning in classroom management' *Educational Research and Reviews*, vol. 13, no.10, pp.382-390.
- Bamidele, E, & Olayinka, T. (2012). 'Teachers' perception of integrating the use of mobile phones into teaching in public senior secondary schools of Oyo and Lagos State, Nigeria' *NAEMT International conference proceedings*, pp. 159-171.
- Burden, K, & Kearney, M. (2017). 'Investigating and critiquing teacher educators' mobile learning practices' *Interactive Technology and Smart Education*. DOI: 10.1108/ITSE-05-2017-0027
- Christensen, R, & Knezek, G. (2017). 'Readiness for integrating mobile learning in the classroom: Challenges, preferences and possibilities' *Computers in Human Behavior*, vol. 76, pp.112-121.
- Davis, F. (1989). 'Perceived usefulness, perceived ease of use, and user acceptance of information technology' *MIS Quarterly*, vol.13, no. 3, pp. 319-340.
- Darling-Hammond, L, Holtzman, D, Gatlin, S, & Heilig, J. (2005). 'Does teacher preparation matter? Evidence about teacher certification, Teach for America, and teacher effectiveness' *Education Policy Analysis Archives/Archivos Analíticos de Políticas Educativas*, vol.13, pp.1-48.
- EDUCAUSE. 2022, *Mobile Learning*. Viewed 9 May 2022
- Ertmer, P, Ottenbreit-Leftwich, A, Sadik, O, Sendurur, E, & Sendurur, P. (2012). 'Teacher beliefs and technology integration practices: A critical relationship' *Computers & Education*, vol. 59, no. 2, pp.423-435.
- Gambari, A, Abubakar, M, Yahaya, A, and Adamu, B. (2021). 'Acceptance of smartphone technology as a mobile learning tool among colleges of education students in Nigeria' *Kashere Journal of Education*, vol.2 no.1, pp. 89-95.
- Gan, C, & Balakrishnan, V. (2014). 'Determinants of mobile wireless technology for promoting interactivity in lecture sessions: An empirical analysis' *Journal of Computing in Higher Education*, vol. 26, no. 2, pp. 159-181.

- Güler, M., Bütüner, S. Ö., Danişman, Ş., & Gürsoy, K. (2022). A meta-analysis of the impact of mobile learning on mathematics achievement. *Education and Information Technologies*, 1-21.
- Handal, B, Campbell, C, & Perkins, T. (2019). 'Learning About Mobile Learning: Pre-Service Teachers' Perspectives' *TechTrends*, vol. 63, no. 6, pp.711-722.
- Huang, Y, & Chiu, P. (2015). 'The effectiveness of a meaningful learning-based evaluation model for context-aware mobile learning' *British Journal of Educational Technology*, vol. 46, no. 2, pp.437-447.
- Ifinedo, E, Saarela, M, & Hämäläinen, T. (2019). 'Analysing the Nigerian Teacher's Readiness for Technology Integration' *International Journal of Education and Development using Information and Communication Technology*, vol. 15, no. 3, pp. 34-52.
- Iroriteraye-Adjekpovu, J. (2013). 'Students' Perceptions of Integrating Mobile Learning Technologies Cell Phone in the Classroom for Improving Active Learning: A Case Study of Delta State University, Abraka, Nigeria' *Proceedings of the 2013, European Conference on Technology in the Classroom, The International Academic Forum*.
- ITU (International Telecommunication Union). (2009). ITU ICT Eye/ICT Statistics 2009, Internet: Users, Total Subscriptions, Broadband Subscriptions. Retrieved from <https://www.itu.int/net4/itu-d/icteye/>
- Kafyulilo, A. (2014). 'Access, use and perceptions of teachers and students towards mobile phones as a tool for teaching and learning in Tanzania' *Education and Information Technologies*, vol. 19, no. 1, pp.115-127.
- Kalogiannakis, M, & Papadakis, S. (2019). 'Evaluating pre-service kindergarten teachers' intention to adopt and use tablets into teaching practice for natural sciences' *International Journal of Mobile Learning and Organisation*, vol. 13, no.1 , pp.113-127.
- Khaddage, F, Christensen, R, Lai, W, Knezek, G, Norris, C, & Soloway, E. (2015). 'A model driven framework to address challenges in a mobile learning environment' *Education and Information Technologies*, vol. 20, no. 4, pp. 625-640.
- Kola, A, & Sunday, O. (2018). 'Mobile-learning (M-learning) through WhatsApp messaging, Facebook, and YouTube, Nigeria' *Education Journal*, vol. 1 no., pp.111-121, DOI: 10.31058/j.edu.2018.13008
- Klimova, B. (2019). 'Impact of mobile learning on students' achievement results' *Education Sciences*, vol. 9, no. 2, pp.90- 97, Doi:10.3390/educsci9020090
- Lofty, A, Olufemi, O, & Ama, I. (2015). 'Mobile collaboration learning technique on students in developing nations' *International Journal of Social, Behavioural, Educational, Economic, Business and Industrial Engineering*, vol. 9, no.10, pp. 3433-3438.
- Mohammadi, M, Sarvestani, M, & Nouroozi, S. (2020). 'Mobile phone use in education and learning by faculty members of technical-engineering groups: Concurrent mixed methods design' *Frontiers in Education*, vol. 5, pp .16- 24, Doi.org/10.3389/feduc.2020.00016
- Neumann, K., Alvarado-Albertorio, F, & Ramírez-Salgado, A. (2021). 'Aligning with Practice: Examining the Effects of a Practice-Based Educational Technology Course on Preservice Teachers' Potential to Teach with Technology' *TechTrends*, vol. 65, no. 6, pp.1027-1041.

- Obiefun-Obiefuna, C, & Offorma, G. (2014). 'Pre service Teachers Perception of using Mobile Devices in Teaching Climate Change in Primary Schools' arXiv preprint arXiv:1407.4450
- Oguchinalu, N, & Ozonuwe, O. (2018). 'Accessing the adoption of mobile learning in Nigeria: the library perspective: a case of Crawford University, faith city, igbesa ogun state, Nigeria' *Library Philosophy and Practice*, pp.1-25.
- Okai-Ugbaje, S., Ardzejewska, K, & Imran, A. (2020). 'Readiness, roles, and responsibilities of stakeholders for sustainable mobile learning adoption in higher education' *Education Sciences*, vol. 10, no. 3, pp.49- 68, Doi:10.3390/educsci10030049
- Peng, Z. (2022). 'An Empirical Study of Mobile Teaching: Applying the UTAUT Model to Study University Teachers' Mobile Teaching Behavior' *Curriculum and Teaching Methodology*, vol. 5, no. 5, pp. 55-70.
- Rolle-Greenidge, G., & Walcott, P. (2020). 'Assessing the Attitudes of Dominican Primary School Teachers toward the Integration of ICT in the Classroom' *International Journal of Education and Development using Information and Communication Technology*, vol. 16, no. 2, pp.84-96.
- Song, Y. (2014). 'Bring Your Own Device (BYOD) for seamless science inquiry in a primary school' *Computers & Education*, vol. 74, pp.50-60.
- Silva, P. (2015). 'Davis' technology acceptance model (TAM)(1989) Information seeking behavior and technology adoption' *Theories and trends*, pp. 205-219.
- Statista. (2022). Smartphone users in Nigeria 2014-2025 | Statista. Viewed 9 May 2022
- Suprianto, A, Ahmadi, F, & Suminar, T. (2019). 'The Development of Mathematics Mobile Learning Media to Improve Students Autonomous and Learning Outcomes' *Journal of Primary Education*, vol. 8, no.1, pp.84-91
- Thomas, K, & O'Bannon, B. (2013). 'Cell phones in the classroom: Preservice teachers' perceptions' *Journal of Digital Learning in Teacher Education*, vol. 30, no.1 , pp.11-20.
- Tondeur, J, Van Braak, J, Ertmer, P, & Ottenbreit-Leftwich, A. (2017). 'Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence' *Educational Technology Research and Development*, vol. 65, no.3, pp.555-575.
- Yahya, S, Ahmad, E, & Abd Jalil, K. (2010). 'The definition and characteristics of ubiquitous learning: A discussion' *International Journal of Education and Development using ICT*, vol. 6, no. 1, pp.117-127.