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Discovering Students Mobile Learning Experiences in Higher Education in Nigeria

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Abstract—M-learning plays a progressively significant role in the advancement of teaching and learning in higher education. However, the effective implementation of m-learning in higher education will be based on users' experiences and motivation to use this technology. Though m-learning has become global, developing countries such as Nigeria are yet to enjoy the full potential offered by m-learning. This study is focused on ascertaining students' experiences with m-learning, determining the influence of m-learning on students' motivations and interests, and identifying factors that are limiting m-learning adoption in Nigeria. We investigated these experiences by analysing questionnaires collected from undergraduate and postgraduate students of six universities in Nigeria. The results from our study show that the students own and use diverse mobile devices to engage in educational activities and other social networking purposes. Some of these learning activities are sending SMS messages, playing educational games, social learning, reading e-books/pdfs, and completing assignments and quizzes. Students expressed their satisfaction with m-learning especially for supporting them to learn anywhere, anytime. They further confirmed that m-learning motivates, interests, and inspires every aspect of learning. Furthermore, the students acknowledge that the interactivity, flexibility, convenience and engagement of m-learning were authentic learning experiences.

Keywords—M-learning; Mobile devices; Teaching; Learning; Learning experience; Mobile learning; Mobility; Mobile technology; Mobile learner; Higher education; Nigeria; Developing country; Mobile experience; University; Educational technology; E-learning; Information and communication technology; Computer science education

I. INTRODUCTION

Nowadays, there is a shift from traditional *electronic-learning* (e-learning) technologies to modern interactive *mobile-learning* (m-learning). M-learning is transforming the face of educational technology globally, since students at all levels of education can enjoy access to educational resources anytime anywhere. Mobile devices such as tablets, smartphones, and PDAs, plays vital role in higher education students' academic activities – supporting them to interact and collaborate with others, enjoying mobile device portability, affordability and flexibility, aiding their engagement with learning objects, motivating them and enhancing their interest. These are leveraged in both formal and informal learning contexts [1].

There has been a continuous surge in acceptance of m-learning among tertiary students in Nigeria. In [2], a survey was conducted of 170 higher education students and recorded

students' mobile activities and ownership of mobile devices – cell phone 97.5%, iPod 60%, 52.5% Pen Drive, 31.8% MP3 Player, 24.1% Smart Phone – and noted that 18.8% owned a PDA. Although mobile device ownership could form a basis for comparison, usage of these devices for m-learning is an important factor to be considered. As noble as the previous studies are, the studies have not been able to consider the learners' experiences with m-learning and those factors that influence adoption of m-learning in Nigeria [2], [3], [4], [5] and [6].

Student's motivation and interest are boosted with m-learning. In a study conducted to assess the impact of students' use of m-learning tools on motivation, 93% of students agreed that m-learning motivates their studies and consider it useful for learning [7]. Meanwhile, from our experience, many universities in Nigeria have no clear conception of how to adopt m-learning technologies. Moreover, learners' interests and views are not considered.

However, there is need to obtain up-to-date information about the population of students with mobile access, and their usage of mobile devices for learning activities, and to understand learners' experiences in order to aid the successful implementation and adoption of m-learning across universities in Nigeria. This study is therefore focused on students' access to devices that aid m-learning, identifying those learning activities that encourage students to learn through m-learning platforms, the impact of using mobile devices for learning, learner's experiences and factors that could affect m-learning adoption in Nigeria higher institutions. This research work is intended to:

- i. discover the mobile devices used by university students for accessing and engaging with learning contents;
- ii. determine the impact of using mobile devices for learning, and their influence on motivation and student interest;
- iii. ascertain students experiences with m-learning;
- iv. identify factors affecting m-learning adoption in Nigeria.

This paper is organized as follows: section II summarizes literature and previous research on m-learning and its influence across educational settings. Section III describes the research context, settings, research methods and procedures from the quantitative survey carried out in the study. An analysis of the findings reported in the study is performed in section IV. Interpretation of the results together with discussion of the significance of the results is presented in section V. Section VI concludes with a summary of the research results, contributions made and the future research plans.

II. LITERATURE REVIEW

The 21st century saw a boom in educational technology with e-learning. Educational technology is the study and practice of developing and applying technology in educational processes to achieve optimum results. The rapid development seen in computer-based instruction has affected positively the medium of teaching and learning over the years [8], [9] and [10]. The emergence of e-learning in the late 80's and the exponential growth in the processing capability of mobile devices has increased the applicability of these devices to educational processes [4]. Moreover, due to high demands from business sector, communication enterprises, sport and recreation, education, and gaming industry, mobile devices are increasingly becoming ubiquitous and affordable. There is also a reciprocal impact on the way learning takes place.

E-learning is the process of knowledge transmission via internet, electronic media, and technological devices [12]. Advantages of e-learning are enumerated as follows: flexibility in learning, reduction in travel cost and time, freedom of choice of learning materials, liberty to study anywhere anytime, increases self-paced learning, development of transferable skills, improve self-knowledge, self-confidence and motivation to learn. Conversely, e-learning has disadvantages: decline in teacher-to-learner relationships, limited ICT know-how and infrastructure, cultural limitation and absence of face-face interaction with teachers [11], [12], [13], [14]. E-learning creates an atmosphere of freedom for learners, thereby fostering enthusiasm, inspiration, motivation, and willingness to explore knowledge in-depth and allowing students to have direct interaction with learning materials. The remaining part of this literature review is about m-learning, student's acceptance of m-learning and impact of using mobile devices on learning.

Perhaps the history of m-learning studies could be traced to the early 1990s where a joint venture project named "Wireless Coyote" was undertaken [15]. M-learning is rather newer educational technology concept compared to e-learning. Students and teachers use portable, handheld computing devices either in formal or informal settings to accomplish some education activities [4]. M-learning is a form of e-learning that specifically employs wireless portable communications devices to deliver content and learning supports [1], [2], [4], [6], [16], [18], [19]. These portable mobile devices include cell phones, MP3 players, tablets, smartphones, PDA, and notebooks, are in continuous transformation. M-learning prospectively makes learning more commonly accessible and globally available compared to the e-learning scenario. The applications of mobile technologies in education are abundant: access to learning materials and objects, access to quizzes, tests, examination questions, participation in learning activities, live broadcast of lessons, video and audio slides, involvement in virtual learning communities and social interaction that aid learning [1], [19]. The advantages of m-learning are numerous: learning can be performed by anyone, in any location, at any time, support continuous interaction with peers and teachers, portability, lightweight and considerably less bulky, support collaborative work, information access and management, knowledge sharing, take advantage of device mobility and ubiquity

technology features to promote seamless engagement with learning and creation of individual learning experiences, combat digital divide and much more cheaper compared to laptops and personal computers [4], [20]. On the other hand, m-learning has its own limitations: small display areas limit the volume of information presented at a particular time, low battery/power capability, limited processing and storage capacity. These shortcomings tend to limit the device functionality, and reduce teacher involvement thereby reducing student motivation [4], [17]. M-learning has a promising future for changing completely the process of teaching and learning worldwide and incorporating innovations in educational technology and in particular computer science education.

Further discussion about m-learning was in early year 2000, where [21] proposed some new schemes in personal mobile technologies for lifelong learning. The scheme revealed the feasibility of hardware, software and mobile communication strategy suitable for m-learning. This new concept offers the opportunity for improved communication between teachers and learners around the globe and create avenue for sustained interaction with learning materials in a situated and virtual environment. Personal learning experiences are boosted for lifelong learning and these designs form the foundation on which m-learning is built.

Mobile devices are now common place. Vogel et al. in [22] noted the pervasiveness of mobile devices to be more than 100% in places like Hong Kong, thereby creating massive opportunities for students to obtain first-hand experience with m-learning. The performance of students is improved when they exhibit motivation to use mobile applications; learners' interest to develop mobile applications intended for learning purposes is also rekindled.

An investigation was carried out by [23] on the use of mobile technology by Finnish teachers. As at 2002, 98% of university students in Finland owned cell phones, suggesting that there is good future for learning via mobile devices, since students could extract learning materials at any given time. The study in [23] focused on text messaging via Short Messaging Service (SMS) and digital pictures. It is now clear that the advantages of m-learning cannot be overemphasized in future models of teaching and learning.

On the student's acceptance of using m-learning, [24] propose a model to study the factors that affect students' acceptance to use m-learning in higher education. Several significant determinant factors which affect behavioral intentions for adopting m-learning were enumerated. This model is intended to assist teachers adopt good strategies that will suit the student's learning interests.

In the same vein, [25], [26] discovered there is high level of acceptance of m-learning among higher education students in Saudi Arabia and Thailand respectively. Outcomes from these studies indicate that positive attitude is a direct pointer to the behavioral adoption of m-learning. These levels of acceptability cut-across most countries, it is therefore no surprise that students accept and are willing to adopt m-learning to supplement traditional e-learning systems.

In order to develop an effective m-learning application, consideration should be given to students and teachers on the one hand, as well as content, interaction and technology on the other [27]. These considerations can work together to expand traditional pedagogy and create learning environments capable of personalizing instructions and transforming educational content delivery, thus driving application development and technology in order to achieve high results.

Positive feedback had been obtained from studies about whether mobile device applications impact learning [28], [29]. In particular, [22] opined that student experiences with m-learning lead to performance enhancement and motivation. M-learning applications engage, interest and thrill the students, enhancing retention, as well as increasing enthusiasm, zeal and confidence. However, studies regarding students' learning experiences with m-learning are not common in Nigeria [2], [4], [7]. There is need to investigate and discover the expectation and anticipation of higher education students in Nigeria regarding m-learning so as to build an effective educational tool.

III. RESEARCH DESIGN AND METHOD

This study employed quantitative research methods. A survey questionnaire was administered through random sampling, as the instrument for collection of data. Questionnaire was adopted for the researcher to draw on a large sample of the population. Moreover, survey approach has been prominent in previous related literature [2], [7], [24], [25] and was regarded by [30] as a convenience sampling technique. The literatures mentioned above were consulted to design a well-structured questionnaire and validate the relevance of this study. The questionnaire was administered to solicit responses from the participants and obtaining information regarding students' m-learning experiences in Nigerian universities. The study was conducted during the first semester of the 2014/2015 academic year.

A. Research context

This research work was carried out in six universities across the North-Eastern region of Nigeria. The North-East region is one of the six geo-political regions of Nigeria. The universities covered by this study are namely: Modibbo Adama University of Technology Yola, American University of Nigeria Yola, Adamawa State University Mubi, Taraba State University Jalingo, Jubilee University Wukari, and Federal University Wukari. At these universities, the development and application of mobile devices for learning have been focused on providing flexible and ubiquitous learning. Even though the application of m-learning among university students in this region in Nigeria is still in its infancy, this research sought the experiences of students in order to proffer solutions that will support future implementation. Students from these universities interact socially and are busy with studies, moving from one place to another, which is a well-founded characteristic of m-learning.

B. Research population and sample

A total of 6000 questionnaires were distributed randomly to undergraduate students of the six universities covered by this study, 1000 questionnaires to each of the universities. The questionnaire was the only source of data because of the distance between the six universities. In all, 5450 questionnaires were returned which indicates a 90.8% response rate. Out of the returned questionnaires, 35 questionnaires (representing 0.6%) were disqualified due to incomplete responses, and multiple skipping of some questions. Overall a total of 5415 responses (representing 90.25%) were considered valid and usable for further data analysis. Knowing that m-learning is new in the context of Nigeria, this sampled population can be regarded as prospective early users of this novelty.

C. Research ethical issues

Privacy Issues: Since students' personal activities such as internet browsing, emails, mobility, and social undertakings are related to this study, it is therefore pertinent for the researcher to keep responses gathered confidential.

Cultural and Political Issues: Sensitive issues relating to cultural norms and practices as well as political undertones are completely disconnected from this research work in order to obtain an objective response from students. Quantitative research techniques are subsequently applied because of their objectivity, unbiasedness and detachment of the researcher's view.

Optional Participation: Participants' responses were sought voluntarily and would be kept strictly confidential in order to obtain their unbiased and impartial opinions.

D. Research sample demography profile

The demographic results indicate that 52% of the sampled respondents were male while 48% were female. This shows that there is no significant gender disparity among the university students. The largest age group that responded falls within 16 – 20 years which represents 46% of the sampled population whilst respondents aged between 21-25 years represented 29% of the sampled respondents. Similarly, 16% of the respondents aged between 26-30 years. Respondents aged between 31-35 years represented only 7% of the total sample. Lastly, 2% of the respondents were aged above 36 years.

IV. RESULTS

In order to justify the purpose of this research clearly, we present the outcome according to research questions, the findings are further ordered into four parts.

A. Types, how and where university students used mobile devices for accessing and engaging with learning contents

This aspect explores the availability and kinds of mobile devices used by students to engage in learning. From Fig. 1, it is obvious that students own and use diverse mobile devices to engage in educational activities and other social networking purposes.

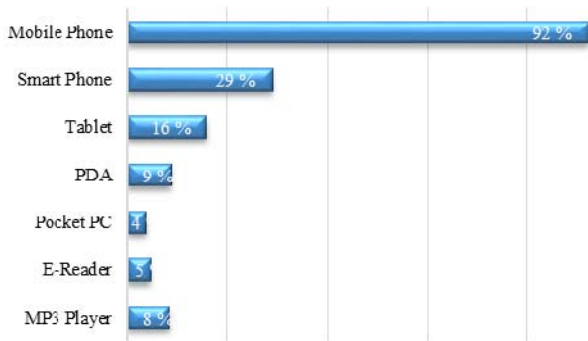


Fig. 1: Types of mobile devices owned by students

Table 1. Device features and frequency of use

Item No.	Item Description
1	Send /receive emails
2	Social media and Chatting
3	Making Calls and Texting
4	Taking photos & videos
5	Play educational games
6	Browsing internet
7	Read e-books/pdf
8	Listen to recorded session
9	Complete homework and assignments
10	Practice online quizzes/exams

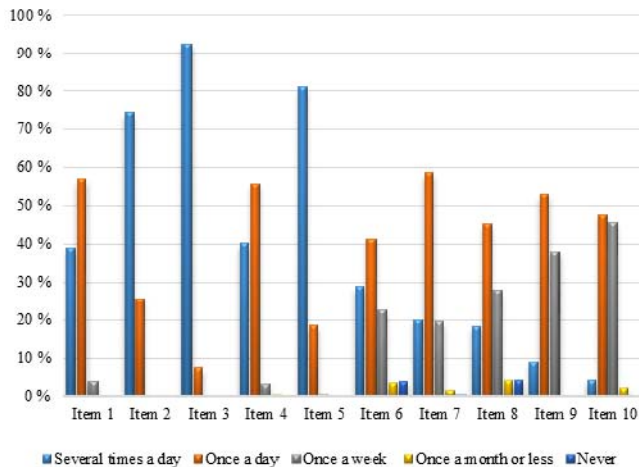


Fig. 2: Mobile devices features and frequency of use by students
Descriptions of item 1 – 10 are given in Table 1

Mobile phones are popularly used among university students because of affordability when compared to smartphone, and also because of their handiness. The university students are using their mobile device for educational activities such as SMS, playing educational games, social media, reading e-books/pdf, completing assignments and quizzes as presented in Fig. 2. The aspect that identified strategic positions and places where students make use of their mobile devices is presented in Fig. 3. The university campus, home, and during transit, are especially important for students for accessing learning because students spend substantial parts of their daily time in these places. Fewer respondents use the playground and working environment for learning.

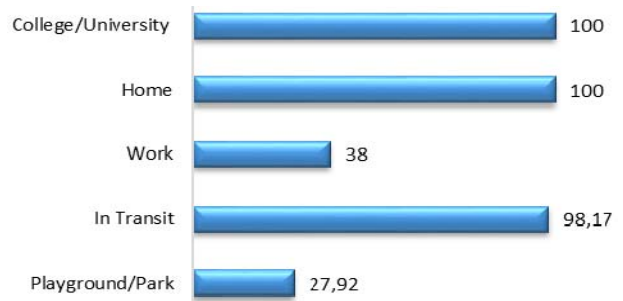


Fig. 3: Places covered by students for using mobile devices

B. Impact of mobile devices for learning: influence on motivation and interest

This part identifies the impact of using mobile devices for learning among university students in Nigeria. Several items were presented to respondents as presented in Fig. 4.

Table 2. Learning impacts of using mobile devices

Item No.	Item Description
1	I found it relevant to use mobile device for my home works and assignments
2	The learning activities on the mobile device helped to improve my skills
3	I prefer using mobile device such as smartphone as opposed to a textbook for learning
4	learning apps on the mobile device were easy to use
5	I found it useful that I can learn on a mobile device anywhere anytime

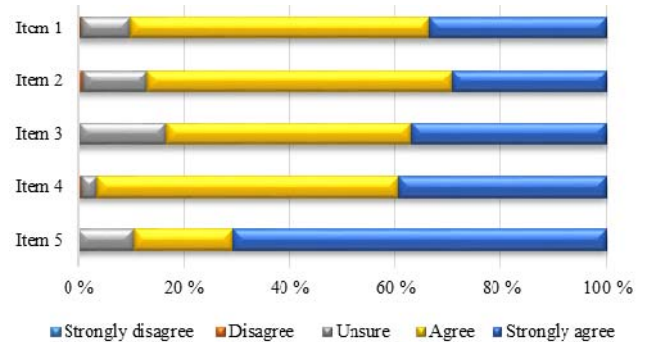


Fig. 4: Learning impacts of using mobile devices
Description of item 1 – 5 are given in Table 2

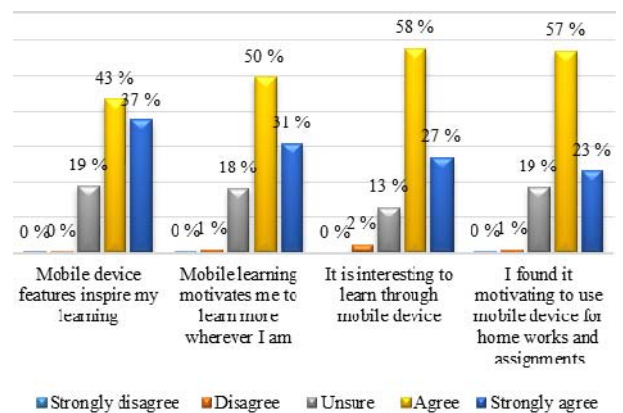


Fig. 5: Influence of m-learning on students' motivation and interest

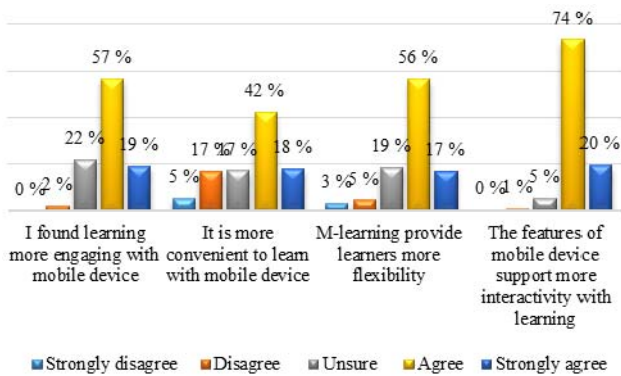


Fig. 6: Students' experiences with m-learning

To ascertain these impacts, the influence of m-learning on motivation and interest were explored. Fig. 5 identified the impact on motivation and interest. Students express their satisfaction with the effectiveness of m-learning to learn anywhere, anytime and for anyone. Besides, they confirmed that m-learning motivates, interests, and inspires students in every aspect of their learning.

C. Learners' experiences with m-learning

In this part, learners' experiences with m-learning were explored. Several items were used to identify learning experiences, such as m-learning interactivity, flexibility, convenience and engagement, as presented in Fig. 6.

D. Factors Affecting m-learning Adoption

Lastly, a number of factors which are responsible for poor m-learning adoption were enumerated and confirmed by university students in Nigeria as presented in Fig. 7.

Table 3. Factors affecting m-learning adoption in Nigerian universities

Item No.	Item Description
1	Insecurity
2	Poor infrastructural development
3	Ownership
4	Affordability
5	Acceptability
6	Technical challenges such as different screen sizes, products etc.
7	Added complexity
8	Low computer literacy
9	Poor learning environment

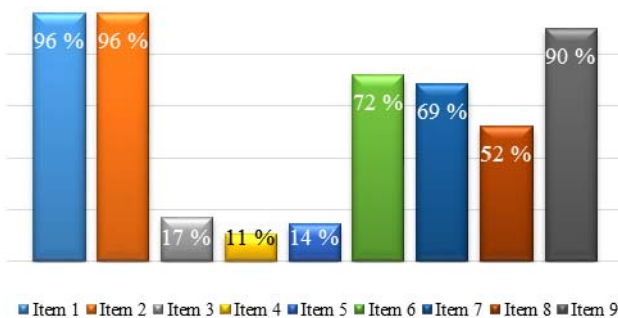


Fig. 7: Factors affecting m-learning adoption in Nigerian universities

The results obtained are discussed in the next section.

V. DISCUSSION

The purpose of this research work is to identify students' experiences with m-learning. The study also determined the perceived impacts of m-learning especially with regards to learners' motivation and interest, and identify possible factors limiting the adoption of m-learning in Nigeria higher education institutions. It is evident from the results presented in Fig. 1 that students possess the basic tools necessary for m-learning access. This particular finding support the research conducted earlier [2], [4], where ownership and mobile activities of students in higher education in Nigeria were presented. The affordability, popularity and handiness of mobile devices could be responsible for the ownership. The features of mobile devices that university students use frequently are presented in Fig. 2. Making calls and texting (SMS), playing educational games, social media and chatting, taking photos/videos, and emailing are major features used by students. The foremost places which students prefer for accessing m-learning are on the campus, at home and on the bus as presented in Fig. 3. The places identified by students are interesting, especially to help researchers to categorize students' pedagogical activities based on location and context. However, parks and offices were not frequently used by students, because the majority of respondents are within the undergraduate learning age thereby not having offices and mostly confined to campus during the academic semester.

Learning impacts of m-learning are presented in Fig. 4. Generally, most students support the intervention of learning on mobile devices anywhere anytime as opined in [4], [25], [26]. The ubiquitous nature of m-learning makes it preferred for pedagogical activities thereby influencing the overall output of learning. Our study does not enable us to determine the direct pedagogical effect of m-learning but when respondents were requested to provide information about items such as how easy the use of learning apps is on the mobile device, the majority of learners were positive. In fact, they prefer learning on mobile devices as opposed to textbooks. The respondents likewise favor completing learning activities on mobile devices which facilitated their knowledge acquisition and skills. Furthermore, learners support the use of mobile devices for off-campus learning activities and assignments. Our results also support the results obtained by [28] and [29] where encouraging responses were obtained from learners about the impact of mobile devices on learning.

To focus on the impacts of m-learning on university students in Nigeria, we examined further the influence of m-learning on motivation and interest of learners as shown in Fig. 5. Learners acknowledged on a large scale that mobile device features inspire them to learn more. According to [4], m-learning features such as blogs and social networking, assessment, push notifications, announcements, and posted lessons, are recommended for successful implementation of an m-learning system. Motivation, being an important variable

for measuring the effectiveness of m-learning, was evaluated from responses. The learners were keen to admit that m-learning motivates them to learn anywhere and interestingly, learning through mobile devices especially completing tasks, social networking, and collaborating. This result is consistent with [1], [22], which supports the idea that learners are motivated to learn, and experience a performance increase, through m-learning. The most likely explanation of the encouraging result is the combination of m-learning environment features, social networking and pedagogical objects which engross and captivate learners.

In this paper we put forward some items to ascertain learners' experiences with m-learning as presented in Fig. 6. When asked about their experiences with m-learning during their pedagogical activities, the majority of learners agree that m-learning is more engaging, more convenient, more flexible and supports more interactivity. The results obtained are broadly consistent with related studies [2], [7] and [28]. As promising as these learning experiences could be, they are not completely conclusive because of certain challenges of mobile devices which were identified by [4]. Some of these challenges were categorized as technical, security, social, pedagogical, and typical challenges in developing country context [4].

While the entire learners' experiences and learning impacts were mostly positive, there is also the challenge of poor adoption of m-learning in Nigerian universities. Several factors were identified as possible reasons for this meagre m-learning adoption as presented in Fig. 7. The majority of the respondents (96%) confirmed insecurity and inadequate infrastructural development, while 90% identified deficient learning environment as factors responsible for low adoption of m-learning. Other m-learning adoption factors are technical challenges such as small screen sizes, battery life, bandwidth connectivity and small key size, low computer literacy, and added complexity. Items such as affordability, acceptability and ownership were identified by a small percentage of respondents because most of the learners could afford a mobile device, though few of them could have come from poor financial background. An important implication of these findings is that stakeholders can use these results to expedite action to implement m-learning systems for the pedagogical development of students in developing countries such as Nigeria.

A. Recommendations for improving m-learning adoption in Nigerian higher education context

We recommend the followings for improving m-learning adoption in Nigerian context:

- i. One of the prominent issues regarding the adoption of m-learning is insecurity. The insecurity is two-fold: physical insecurity as a result of terrorism and kidnapping; and cyber insecurity [5]. We hereby recommend that government should ensure preemptive steps are taken to secure universities from terrorists and kidnappers. The educational environment should be safe for learning. For every web-based system such as m-learning platform,

installation of protective mechanisms against web insecurity should be mandated.

- ii. Governments, policy implementers and decision makers should as a matter of urgency prioritise education funding, especially to meet global standard. Modern technology and infrastructure should be acquired to support m-learning implementation on national scale. There is need for improvement on the current learning environment.
- iii. Qualified teachers should be employed and those employed should be trained to adopt modern educational technology tools and methods. Teachers' welfare and training should be vital to government.
- iv. Computer literacy should be advocated at all levels of education. Awareness about the application and relevance of m-learning should be created to all education stakeholders especially teachers and students.

VI. CONCLUSION

This research work is a modest contribution to the ongoing discussions about students' m-learning experiences. The authors' attention was concentrated not only on discovering mobile devices used by university students for accessing and engaging with learning contents but also on determining the impacts of using mobile device for learning especially its influence on learners' interest and motivation. Furthermore, our study draw attention to the issues impeding the quick adoption of m-learning in developing countries especially Nigeria universities context.

From the research that has been undertaken, it is possible to conclude that undergraduate students in Nigerian universities possess mobile devices which could be used as mechanism for effective implementation of m-learning. Likewise, those pedagogical features of m-learning and preferred learning places were highlighted. Largely, the students support the intervention provided by m-learning. Like in developed countries, m-learning will increase the potential of broadening access to education in every part of Nigeria especially the rural areas. The handiness of mobile devices with improved capabilities to access learning materials, connect to internet, capture and store reasonable amount of data, are glaring evidence that both learners and instructors learning experiences are enhanced [2], [4], [7], [25], [26], and [28]. It has been demonstrated that m-learning enhances learners' interest, engagement, interactivity and motivation. Though, every technological innovation such as m-learning comes with inherent challenges, even as identified in our study, it is imperative to conclude that low adoption issues facing m-learning in Nigeria are surmountable especially when all stakeholders raise more awareness of its benefits [2], [4]. On the basis of the promising findings presented in this paper, work on the application of m-learning in particular course such as using indigenous games to teaching computer science are continuing and will be presented in future papers. The next stage of our research will be to implement m-learning applications [20] and explore their pedagogical attributes in real-life settings.

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