Science Education International
33(3), 335-341
https://doi.org/10.33828/sei.v33.i3.9

International Council of Association for Science Education

ORIGINAL ARTICLE

Science Teachers' Perceptions of Integration of M-Learning into Class Instructions in Kwara State, Nigeria

Ganiyu Bello[1]*, Hafsat Imam Alabi[1], Zakariyau Adebayo Bello[2], Ilias Ayo Bello[3], Musa Mohammed Sulaiman[1]

[1]Department of Science Education, Faculty of Education, University of Ilorin, Ilorin, Nigeria, [2]Department of Integrated Science, School of Sciences, Kwara State College of Education, Ilorin, Nigeria, [3]Department of Information and Communication Technology, Nigeria Police Academy, Wudil, Kano, Nigeria

***Corresponding Author:** bello.g@unilorin.edu.ng

ABSTRACT

The mandate of the education system is for the advancement of knowledge, socioeconomic transformation, employment generation, and so forth**.** Literature is awash with arguments in favour of M-learning in the realization of the core mandate of the education system. This study, therefore, examines the perceptions of the science teachers on integration of M-Learning into science class instructions in Kwara State, Nigeria. One hundred and twenty-nine science teachers from 34 public and 27 private senior secondary schools participated in the study. Stratified and purposive sampling techniques were used to select the schools and the teachers, respectively. A researcher-designed questionnaire titled, "Teachers' Perceptions of M-learning" (TPML) with a reliability coefficient of 0.85, was used for gathering data. Data were analyzed using the t-test statistical tool, and findings from the study revealed that the participating teachers had high perceptions of M-learning and were at the preparation stage of integrating it into class lessons. It was concluded that teachers had favorable perceptions of M-learning and were in vantage position to use M-learning to leverage students' achievement. It is, therefore, recommended that science teachers should progress from the preparation Ssage to the action stage of integrating M-learning into science teaching.

KEY WORDS: M-learning; mobile devices; perceptions; science teachers; secondary schools

INTRODUCTION

Modern digital information and communication technology (ICT), an icon of the 21st century, is a revolutionary tool in the education sector like in all other spheres of post-modern society. Its application in education has led to the emergence of several innovative teaching and learning strategies that have profoundly transformed the education industry from the traditional four wall classroom setting and teacher-centered instructions to virtual class setting and student-centered instructions, respectively (Shuja et al., 2019). The list of ICT tools that has been integrated into the classroom is increasing rapidly due to their positive impacts on learning outcome. According to Koech (2021), examples of these modern digital ICT tools include Web boards, Smartphone, iPods, iPads, Tablets, Interactive white boards, Video games, and Audio books among others. Interestingly, more and more people are using these ICT tools daily. For instance, in Nigeria according to O'Dea (2020), there are between 25 and 40 million Smartphone users in Nigeria and around 170 million mobile subscribers. Smartphone penetration is projected to rise from the current 10% to 20% penetration to about 60% penetration in 2025. Android operating system has the largest (83.16%) of Smartphone market share in Nigeria followed by Apple iOS with 7.04% according to Statcounter (2020). As of May 2020, there were over 141 million active internet subscribers in Nigeria according to Okafor (2020).

According to UNESCO (n.d.), modern digital ICT devises are mainly use to "communicate, create, disseminate, store, and manage information" (para. 1) and it is now an integral component of teaching and learning. Digital ICT tools such as iPods, iPads, Tablets, and Smartphone provides flexibility in teaching and learning. These aforementioned ICT devices are handheld and can be easily used for teaching and learning while on the go. Learning through these portable modern digital ICT mobile devices when connected to the internet is referred to as Mobile Learning and sometimes shorten to M-learning. Sarrab et al. (2016) defined M-learning as the modifiable method of learning that encourage personalized and a learner-centered approach. M-learning is flexible because students can access education content anytime, anywhere, and whenever needed. It provides opportunities to network with other students and experts to share information on education. Students can easily interact with the teacher, submit assignments, and projects as well as participate in online class discussions as noted by Vangie (n.d.) and Ozdamil and Cavus (2011).

M-learning provides educational service delivery to all, does not discriminate against gender or disability, such education service sees every citizen as the same and as such supports equity in education. With quality education, one is able to understand the need for personal hygiene, that is, sustainable water management, and sanitation. Good job and economic growth sustenance can easily be achieved because an educated individual can easily create job to become self-employed and even become an employer of labor with a changed lifestyle. This was revealed by the Armeanu et al. (2017) study that

highlighted the drivers of gross domestic product growth rate as higher education business environment, infrastructure, technologies, communication, media population, lifestyle, and demographic changes.

Studies have indicated that integration of modern digital ICT devices often impact positively on students' academic achievement. For instance, Hussain et al. (2017) reported that the use of M-learning enhanced students' performances and retention in chemistry. Similarly, Alqahtani and Mohammed (2015) observed that when learning the Holy Quran using mobile ICT applications, a positive relationship existed between students' behavior perceived performance and satisfaction. The results of a study conducted by Elfeky and Masadeh, (2016) among 50 Najran University students also revealed that M-learning significantly improved students' academic achievement and conversational skills.

Yusri et al. (2014) conducted a survey study among 308 high school Indonesian teachers on their perceptions of M-learning. The results showed that the teacher had positive perceptions. Ishtaiwa et al. (2015) also conducted a study among faculty members in Al Ain University to determine their perceptions of the integration, affordances, and challenges of mobile learning. A semi-structured interview was used to gather data in the study. Findings of the study showed that faculty members' integration of M-learning varied and focuses on selected activities and that they recognized the importance of M-learning in enriching teaching and learning process. The results also revealed that challenges in adoption of M-learning include internet connectivity, poor ICT knowledge and skills, deficiencies in training, digital divide among students, and a lack of awareness about the usefulness of M-learning. Ramadhani and Vicent (2016) examined teachers' and students' perceptions of self-driven acceptance of mobile phone use as an ICT teaching tool. Results of their study showed that teachers and students were using mobile phone for teaching and learning process despite the ban of the use of mobile phone by students in school. The results also indicated lack of electricity, distractions by attractive social media, and increases spending by the students, among other are challenges facing the use of mobile phone for teaching and learning.

Kim et al. (2016) examined how the use of mobile devices affect teachers' perceptions on mobile learning. The use of mobile devices was reported to enhanced participants' self-confidence and professional development. Shraim and Crompton (2016) carried out a study among Palestinian tertiary educational institution lecturers to determine their perceptions of using smart mobile devices for teaching and learning. Their results indicated that the participants were not conscious of the potential of using mobile devices for teaching and learning and were at the experimentation stage of the use of mobile devices for non-pedagogical purposes. Chen (2017) conducted a survey study to investigate the perceived perceptions and acceptance on mobile learning by English as a Foreign Language instructors and students in Taiwanese universities. Two sets of questionnaires were administered to 52 instructors and 319 undergraduates in the study. Results showed that both the instructors and students had high levels of perceptions and acceptance of M-learning.

Miglani and Awadhiya (2017) carried out a survey study to determine university teachers' readiness and perceptions of M-learning. The study was conducted among 102 teachers selected across five Commonwealth Asian countries. The researchers reported that the teachers had M-learning devices and skills in addition to positive perceptions of M-learning. Similarly, Barnes (2018) carried out a casual comparative study to examine K-8 teachers' perceptions of M learning. A questionnaire based on an extended "Technology Acceptance Model" (TAM) and "Mobile Learning Readiness Survey" was administered to 39 teachers from two schools. Findings indicated that the teachers had high perceptions of M-learning adoption and were ready to implement it. Furthermore, the results indicated a non-statistical difference in the teachers' perceptions of M-learning.

Statement of the Problem

Mobile learning is one of the innovative means through which quality education could be disseminated to all for improving students' achievement. Teachers' perceptions of any innovative instructional strategy are a significant determinant of the adoption of the innovative strategy by the teachers. Indeed, Yusri et al. (2015) identified teachers' perceptions and readiness to adopt M-learning as a major factor towards its integration in their classrooms. Although the effects of using M-learning in classrooms especially in tertiary institutions have been studied extensively, less is known about science teachers'; perceptions of its integration in science classrooms at the secondary school level. Hence, in this study, the researchers investigated the senior secondary school science teachers' perceptions of M-learning integration into classroom instructions in Kwara State, Nigeria.

Purpose of the Study

The study assessed teachers' perceptions on the integration of M-learning in science lessons. Specifically, the study:

1. Assessed the science teachers' perceptions of the use of M-learning in their teaching
2. Examined the level of readiness of science teachers to integrate M-learning into class instruction
3. Identified obstacles perceived by science teachers in the use of M-learning for science teaching
4. Ascertain if science teachers have mobile devices that can be used for M-learning
5. Determined the perceptions of science teachers on the use of mobile device as an innovative strategy for science teaching based on their experience
6. Determined the perceptions of science teachers on the use of mobile device as an innovative strategy for science teaching based on school type.

Research Questions

The following research questions were derived from the research purposes:

Science Education International
33(3), 335-341
https://doi.org/10.33828/sei.v33.i3.9

- Question 1: What is the level of science teachers' perceptions of the integration of M-learning as an innovative strategy for science teaching and learning?
- Question 2: What stage of readiness are science teachers in the integration of M-learning as an innovative strategy for science teaching and learning?
- Question 3: What do science teachers perceived to be obstacles in the integration of M-learning in science teaching and learning?
- Question 4: Do science teachers have the types of mobile devices that can be used for M-learning?
- Question 5: Are the perceptions of the less experience science teachers of integration of M-learning in science teaching and learning different from their highly experience counterparts?
- Question 6: Is there any difference between public and private secondary school teachers' perceptions of the integration of M-learning in science teaching and learning?
- Question 7: Do science teachers in public and private secondary schools differ in their level of integration of mobile devices for science teaching and learning?

Research Hypotheses

Three hypotheses were generated from the research questions and were tested at 0.05 level of significance. The null hypotheses were as follow:

- H_{01}: The perceptions of the less experience science teachers of the integration of M-learning in science teaching and learning are not significantly different from their highly experience counterparts
- H_{02}: There is no statistically significant difference between public and private secondary school teachers' perceptions of the integration of M-learning in science teaching and learning
- H_{03}: There is no statistically significant difference between public and private secondary school teachers' level of integration of M-learning in science teaching and learning.

METHODOLOGY

Descriptive research of survey type was adopted in the study while the population comprised all senior secondary school science teachers in Ilorin, Kwara State, Nigeria. One hundred and twenty-nine of about 400 science teachers from 34 public and 27 private Senior Secondary Schools participated in the study.

Purposive sampling techniques were used to select the schools and the teachers, respectively. Only 129 science teachers that signified their willingness to participate in the study by signing the study's Informed Consent Form administered in the selected public and private secondary schools were purposively selected as representative sample of the population. All ethical issues such as non-disclosure of the personality of the respondents, non-exposure of the participants to any form or risks, and, not compelling or intimidating the participants in any form were strictly adhere to.

The "Mobile Learning Perceptions Questionnaire" designed by the researchers was used to gather data in the study. The face and content validity of the instrument was determined by two experienced secondary school teachers, and two Senior Lecturers in the field of Science Education, and one Senior Lecturer in the field of Educational Technology. The reliability coefficient of the final version of the instrument was determined using the test-retest technique and it was found to be 0.85. The researchers employed the service of researcher assistants to administer the informed consent form and the questionnaire.

RESULTS

Data gathered from the administration of the questionnaire were subjected to both descriptive and inferential statistical analyses using the SPSS version 21. The analyses were carried out in line with the research questions and hypotheses raised in the study. The results of the analyses are presented in Tables 1–7.

Question 1: What is the level of science teachers' perceptions of the use of mobile device as an innovative strategy for science teaching?

Descriptive statistical tools were used to analyze the science teachers' perceptions of the integration of M-learning as an innovative strategy for teaching science. The aggregate mean score of the science teachers' perceptions of integration of M-learning in science teaching and learning was found to be 2.40 which were within the range of high perceptions

Table 1: Descriptive Statistics of Science Teachers' Perception of the Integration of M-learning as an Innovative Strategy for Science Teaching and learning.

Items	n	Sum	Mean	SD
Do you think mobile learning should play an important role in the future of science teaching and learning?	129	361. 00	2.80	0.49
Do you think teachers should be responsible for helping students to use mobile devices as a tool for learning science?	129	349.00	2.71	0.56
Would you like your students to have and be able to use mobile devices in science class?	129	327.00	2.53	0.61
Would you prefer your science students to have digital text books?	129	292.00	2.26	0.71
Would you use free mobile content for your own teacher development?	129	280.00	2.17	0.40
Would you pay a reasonable price for good quality mobile learning content?	129	279.00	2.16	0.39
Would you encourage your colleagues to adopt the use of mobile devices for science teaching?	129	278.00	2.16	0.38
Aggregate Mean=2.40				

NB: Mean score<1.00=Low Perception level, Mean score 1.00–2.00=Moderate Perception level, Mean score>2.00=High Perception level

Science Education International
33(3), 335-341
https://doi.org/10.33828/sei.v33.i3.9

Table 2: Descriptive statistics of science teachers' level of integration of M-learning as an innovative strategy for science teaching

Items	n	Sum	Mean	Std. Deviation
Are you ready to integrate the use of M-learning to develop your own teaching?	129	249.00	1.93	0.26
Are you ready to encourage students to regularly use mobile devices to surf the internet for learning science topics?	129	236.00	1.83	0.38
Do you ever buy/install educational Apps on your mobile device to use in your teaching?	129	207.00	1.60	0.49
Do you sometimes use mobile device to surf the internet when updating your knowledge of a topic before teaching or use it as a learning tool with students?	129	191.00	1.48	0.50
Do you ever use e-books with your students?	129	163.00	1.26	0.44

Aggregate Mean=1.62, NB: Mean Score <1.00=Contemplation Stage, Mean Score 1.00–2.00=Preparation Stage, Mean Score >2.00=Action Stage

Table 3: Descriptive Statistics of Perceived Obstacles in Integration of M-learning in science teaching and learning.

Obstacles	n	Minimum	Maximum	Mean
Lack of Internet Connectivity	129	1.00	5.00	3.84
Lack of Pedagogical Justification	129	1.00	5.00	3.60
Student's Poor Attitudes	129	1.00	5.00	3.60
Lack of M-learning Devices	129	1.00	5.00	3.58
School Administration Reluctance	129	1.00	5.00	3.54
M-learning Devices Vary Widely	129	1.00	5.00	3.35
Lack of Training	129	1.00	5.00	2.69

(2.00–3.00) as shown in Table 1. This finding showed that the science teachers had high perceptions of the integration of M-learning in science teaching and learning.

Question 2: What stage of readiness are science teachers in the integration of M-learning as an innovative strategy for science teaching and learning?

The aggregate mean score of the science teachers' readiness stage to use M-learning devices as an innovative strategy for teaching science was found to be 1.62 as revealed in Table 2. This figure (1.62) was within the preparation stage. Hence, the result indicated that the science teachers were prepared to make use of mobile devices (M-learning) for teaching science.

Question 3: What do science teachers perceived to be obstacles in integration of M-learning in science teaching and learning?

Table 4: Frequency and percent count table of type of mobile devices use by science teachers

Devices	Frequency	Percent
Android phone	77	59.7
iPad	21	16.3
Internet capable phone	13	10.1
Tablets device	9	7.0
IPhone	2	1.6
I do not own a mobile device	7	5.4

Table 5: t-test table on science teachers' perceptions of the integration of M-learning in science teaching and learning

Experience Levels	n	Mean	Std	Df	t	Sig
Less experience	55	16.58	1.57	127	−1.65	0.10
High experience	74	17.02	1.45			

Table 6: t-test table of significant difference in public and private secondary schools science teachers' perceptions of use of mobile devices for teaching science

School Type	n	Mean	Std	Df	t	Sig
Private School	63	16.70	1.58	127	−0.67	0.504
Public School	66	16.88	1.47			

Table 7: t-test table of Significant Difference in the Levels of Use of Mobile Devices for Teaching Science by Teachers in Public and Private Secondary Schools.

School Type	n	Mean	Std	df	t	Sig
Public School	63	8.16	1.05	127	0.49	0.63
Private School	66	8.06	1.23			

Table 3 revealed that science teachers perceived seven obstacles to the integration of M-learning as an innovative strategy for science teaching. The obstacles in descending order of their magnitude (mean score) were: (a) Lack of internet connectivity, (b) lack of pedagogical justification for using the M-learning devices (c) students' poor attitudes, (d) lack of M-learning devices, (e) school administration Reluctance, (f) M-learning devices vary widely, and (g) lack of training.

Question 4: Do science teachers have the types of mobile devices that can be used for integration of M-learning in science teaching and learning?

It can be seen from Table 4, that almost all the science teachers had mobile devices that can be used for M-learning. Only 7 (5.4%) of the teachers had no mobile devices. The majority of the science teachers (59.7%) had Smartphones with Android Operation system. Other types of mobile devices that can be used for m-learning possessed by the science teachers were iPad, Internet capable phone, Tablets, and iPhone.

Hypotheses Testing

Research hypotheses 1, 2, and 3 were generated from research questions 5, 6, and 7, respectively. The three hypotheses were tested using the t-test statistical tool at 0.05 alpha level.

H_{01}: The perceptions of the less experience science teachers of the integration of M-learning in science teaching and learning are not significantly different from their highly experience counterparts.

The result of the t-test indicated that a significant difference does not exist in the perceptions the less experience and highly experience science teachers of integration of M-learning in science teaching and learning as shown in Table 5. The calculated t-value ($t_{(127)}= -1.65$) was greater than p-value ($p > 0.05$); hence, hypothesis H_{01} was not rejected.

H_{02}: There is no statistically significant difference between public and private secondary school teachers' perceptions of integration of M-learning in science teaching and learning.

Table 6 shows that the calculated t-value ($t_{(127)} = -0.67$) was greater than p-value ($p > 0.05$). Hence, the researchers failed to reject hypothesis H_{02}. This result means that significant difference does not exist in the science teachers' perceptions of integration of M-learning in science teaching and learning irrespective of their school type.

H_{03}: There is no statistically significant difference between public and private secondary school teachers' level of integration of M-learning in science teaching and learning.

This hypothesis was also tested at 0.05 level of significance using the t-test statistical tool as shown in Table7. The calculated t-value ($t_{(127)}= 0.49$) was greater than p-value ($p > 0.05$). Hence, hypothesis H_{03} was also not rejected. This result means that statistically significant difference does not exist in the public and private secondary school science teachers' level of integration of M-learning in science teaching and learning.

DISCUSSION

Findings of the study showed that the participating science teachers had high perceptions of integration of M-learning in science teaching and learning, indicating that they were positively predisposed to integrate M-learning into their class lessons. This finding could be attributed to the influence of the digital literacy acquired by the science teachers during their teacher education programs. Furthermore, knowledge and skills that the teachers probably learnt from professional colleagues, seminars, conferences, and workshops on the integration of modern digital ICT tools into teaching and learning probably influenced their perceptions of the use of mobile devices for science teaching. This result implies that the use of modern digital ICT tools may soon become an integral part of science teaching and learning process in Ilorin, Nigeria to leverage students' achievement in science. The result is in accord with Yusri et al. (2015), and Barnes (2018), it is, however, in contrast to the finding of Shraim and Crompton (2016).

Result of this study indicated that science teachers were at the preparation stage of readiness to integrate M-learning into science teaching. This may be a reflection of the teachers' level of awareness of the need to integrate ICTs into teaching and learning. This result seems to suggest that the teachers were about to take practical actions to fully integrate M-learning into science teaching and learning if not for the perceived major hindrances. This finding is similar to the report of the study carried out by Barnes (2018).

As revealed in this study, the lack of internet connectivity was perceived to be the major obstacle. This may be due to the fact that most secondary schools do not provide internet access to teachers and students in addition to the general poor internet coverage and the relatively high cost of internet connectivity in the nation. Lack of training was perceived by the science teachers to be a minor obstacle that hindered their readiness to integrate M-learning into science teaching. This may partially be due to the inclusion of General Studies courses on ICTs in Teacher Education program in Nigeria. These findings are similar to that of Ramadhani and Vicent (2016) and Ishtaiwa et al. (2015) who had earlier equally identified similar obstacles to the integration of M-learning into class instruction by teachers. It is, however, slightly different from the findings of Shraim and Crompton (2016). The general implication of the findings was that leveraging students' achievement in science through the integration of M-learning into class instructions may be a difficult task for the teachers under poor internet connectivity.

Access to the use of mobile devices is the most important prerequisite for the integration of M-learning into science teaching by teachers. Findings of this study revealed that almost all the science teachers had mobile devices that can be used for M-learning. This finding could be attributed to the fact that most urban dwellers in Nigeria, especially civil servants including teachers have access to mobile phones. Indeed O'Dea (February 27, 2020) reported that between 10% and 20% of Nigerians are Smartphone users and the figure could rise to 60% by 2025. The popularity of android operation system phone among the science teachers may be due to the fact that this brand of Smartphone according to Statcounter.com (2020) has the largest market share of Smartphone market in Nigeria. It could equally be attributed to its relative popularity and cheap price compared with Apple iOS phones among others. This finding implies that science teachers are in prime position to integrate M-learning into science teaching. In other words, one of the most important prerequisites for the integration of M-learning in to science teaching already existed consequently; the possibility of using M-learning to leverage the achievement in science is high. This result is consistent with that of the study conducted by (Miglani and Awadhiya, 2017).

The results of this study indicated that there was no significant difference in the perceptions of the less experience and highly

experience science teachers on the use of mobile devices for teaching science. This result could be attributed to the popularity of mobile devices among all categories of teachers as civil servants. It could also be adduced to possible sharing of information on the usage of mobile devices for teaching between the less experience and highly experience science. The implication of this result is that years of teaching experience are not a hindrance to the integration of M-learning into class instruction and by extension, leveraging students' achievement in science.

Results of this study revealed that teaching in either public or private school does not significantly influence the science teachers' perceptions of the usage and stage of readiness to integrated M-learning into teaching and learning. These results suggest that the prevailing conditions of service in both public and private schools had no influence on the science teachers' perceptions and stage of readiness to integrate M-learning into class teaching. The results can partially be adduced to exposure of all the science teachers to similar teacher education program. In addition, as professionals, the science teachers might have been sharing information and skills on the integration of M-learning into science teaching and learning. Furthermore, their perceptions and stage of readiness to use M-learning might have been influenced through participation in seminars, workshops, and conferences on the integration of digital ICT tools into teaching organized by professional bodies, and governmental agencies. In general, the implication of these results is that integrating M-learning into class instruction and using it to leverage students' achievement in science is visible in both public and private schools.

CONCLUSION

In view of the foregoing, science teachers in Kwara State, Nigeria, had favorable perceptions of the integration of M-learning into class lessons and seemed primed to fully adopt M-learning in their lessons if poor internet connectivity among other obstacles were removed. Furthermore, it was concluded that the science teachers irrespective of their years of teaching experience and their school types were in vantage position to use M-learning to leverage students' achievement in science.

RECOMMENDATIONS

The following recommendations were made in line with the findings from this study:

- There is a need for further research on secondary school science students' perceptions of the integration of M-learning into class instructions
- It was recommended that science teachers should progress from the preparation
- Stage of readiness to the action stage of practical integration of M-learning into science teaching and learning
- Proprietors and school managements should provide regular internet access to teachers and students within the school compound
- Internet service providers should upgrade their service to ensure nationwide broadband internet connectivity
- Science teachers should regularly attend training workshops on the use of modern digital ICT tool to keep abreast developments in best practices in teaching and learning especially M-learning.

ETHICAL STATEMENT

Before the commencement of data collection for the study, ethical approval for this study was granted by the Department of Science by one of our institutions in the year 2021.

REFERENCES

Alqahtani, M., & Mohammed, H. (2015). Mobile applications' impact on student performance and satisfaction. *Turkish Online Journal of Educational Technology TOJET*, 14(4), 102-112.

Armeanu, D.S., Vintila, G., & Gherghina, S.C. (2017). Empirical studies towards the drivers of economic growth in EU-28 Countries. *Sustainability*, 10(1), 4.

Barnes, J.A. (2018). Teachers' Perceptions of Implementing m-Learning Using Pedagogical Approaches (Doctoral Dissertation, The University of Memphis). Available from: https://www.proquest.com/openview/ef38c77ddb6a7a828087a26c6eb60a25/1?pq-origsite=gscholar&cbl=18750 [Last accessed on 2021 Nov 01].

Chen, K. (2017). Examining EFL instructors' and students' perceptions and acceptance toward M-learning in higher education. Universal Access in the Information Society, 16(4), 967-976.

Elfeky A.I.M., & Masadeh, T.S.Y. (2016). The effect of mobile learning on students' achievement and conversational skills. *International Journal of Higher Education*, 5(3), 20-31.

Hussain I., Suleman, Q., & Din, M. (2017). Effects of information and communication technology (ICT) on students' academic achievement and retention in chemistry at secondary level. *Journal of Education and Educational Development*, 4(1), 73-93.

Ishtaiwa, F.F., Khaled, A., & Dukmak, S. (2015). Faculty members' perceptions of the integration, affordances, and challenges of mobile learning. *International Journal of E-learning and Distance Education*, 30(2), 1-20.

Kim, D.J., Kim, D., & Choi, S.H (2016). How Does the Use of Mobile Devices Affect Teachers' Perceptions on Mobile Learning? *International Conferences ITS, ICEduTech and STEP*, pp. 297-300.

Koech, D. (2021). *List of ICT Tools for Teaching and Learning: Techinical Devices for Teachers and Students*. Available from: https://www.kenyayote.com/list-of-ict-tools-for-teaching-and-learning-tech-devices-for-teachers-and-students [Last accessed on 2021 Nov 01].

Miglani, A., & Awadhiya, A.K. (2017). Mobile learning: Readiness and perceptions of teachers of open Universities of Commonwealth Asia. *Journal of Learning for Development*, 4(1), 58-71.

O'Dea, S. (2020). *Smartphone users in Nigeria 2014-2025*. Tim Kröger: Statista. Avaialble from: https://www.statista.com/statistics/467187/forecast-of-smartphone-users-in-nigeria [Last accessed on 2021 Nov 01].

Okafor, E. (2020). *Nigeria Internet Users Surge 14% in Year to May 2020*. Business Day. Available from: https://businessday.ng/technology/article/nigerias-internet-users-surge-14-in-year-to-may-2020 [Last accessed on 2021 Nov 01].

Ozdamil, F., & Cavus, N. (2011). Basic elements and characteristics of mobile learning. *Procedia Social and Behavioural Sciences*, 28, 937-942.

Ramadhani, M., & Vicent, N.A. (2016). Teachers' and students' perceptions of self-driven acceptance of mobile phone use as an ICT teaching tool. *Journal of Emerging Trends in Educational Research and Policy Studies* (JETERAPS), 7(2), 91-106.

Sarrab, M., Al Shibli, I., & Badrusha, N. (2016). An empirical study on factors driving the adoption of mobile learning in Omani higher education. *International Review in Open and Distributed Learning*,

17(4), 331-349.

Shraim, K., & Crompton, H. (2016). Perceptions of using smart mobile devices in higher education teaching: A case study from Palestine. *Contemporary Educational Technology*, 6(4), 301-318.

Shuja, A., Qureshi, I.A., Schaeffer, D.M., & Zareen, M. (2019). Effect of m-learning on students' academic performance mediated by facilitation discourse and flexibility. *Knowledge Management and E-Learning*, 11(2), 158-200.

Statcounter. (2020). *Mobile Operating System Market Share in Nigeria*. Dublin: Statcounter. Available from: https://www.lite.gs.statcounter.com [Last accessed on 2021 Nov 01].

UNESCO. *Information and Communication Technology (ICT) in Education. Learning Portal.* Paris: UNESCO. Available from: https://www.portal.iiep.uneso.org

Vangie, B. *Mobile Learning (m-learning*). Available from: https://www.webopedia.com/definitions/mobile-learning-m-learning [Last accessed on 2021 Oct 29].

Yusri, I.K., Goodwin, R., & Mooney, C.H. (2015). Teachers and mobile learning perception; Towards a conceptual model of mobile learning for training. *Procedia Social and Behavioural Sciences*,176, 425-430.