PERCEPTION OF TEACHERS AND STUDENTS ON THE USE OF MOBILE APPLICATIONS IN TEACHING AND LEARNING OF MATHEMATICS

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Abstract
Mobile applications (m-Apps) have been recognized as a powerful tool in teaching and learning of Mathematics. Proper usage of m-Apps would enhance students' and teachers' effectiveness in the classroom setting. This study examined the acceptance and perception of students and teachers on the use of mobile application in teaching and learning of Mathematics. The study adopted descriptive research design of a survey type. The sample for this study consisted of three hundred (300) respondents consisting of fifty (50) Mathematics and science subject teachers and two hundred and fifty (250) Senior Secondary School year one (SSS1) students randomly selected from five (5) public secondary schools in three Local Government Areas of Ogun-East Senatorial District in Ogun-State, Nigeria. The sampling technique used in this study was a simple random sampling. The only instrument used for data collection was titled "Acceptance and Perception on Mobile-Apps Questionnaire". The reliability of the instrument was determined using Cronbach alpha and a reliability coefficient of 0.764 was computed. Four research questions were answered. Data collected were analyzed using the descriptive statistics of mean, standard deviation and percentages. The result of the study revealed that teachers are more perceptive than the students about the use of mobile-Apps in teaching and learning of Mathematics. Furthermore, the result of the study showed that there is a high-level acceptability of mobile-Apps by teachers and students in teaching and learning of Mathematics. It was recommended, among others, that teachers of Mathematics should be sent to seminars, workshops, and conferences to update their pedagogical skills and strategies for innovative and fruitful delivery in the classrooms.

Key words: *Acceptance, Perception, Teachers, Students, Mobile-Application.*

1. Introduction

In response to the needs of the 21st century skills acquisition, digital literacy is an important dimension that teachers and students should be equipped with. The students of this generation are passionate, willingly accept and ready to work with technology, especially mobile applications. In other words, they usually develop a conspicuous willingness to use mobile phone applications in learning. Recently, the use of mobile phones in communication has been on the increase as people use them to reinforce teaching and learning. UNESCO (2012) found that the spread of using mobile phones in African, Middle East, and globally has reinforced and supported teaching and learning within and outside the classroom.

Mobile learning, or m-learning, is part of a new learning landscape, which is created by the availability of emerging mobile technologies that make education to be flexible, accessible, and personalized (Mishra, 2013). Furthermore, the author viewed mobile learning as a useful component of the flexible learning model, which supports learners in taking advantage of the learning opportunities offered by the technologies. With the use of these technologies in education, online learning communities can unite students from different backgrounds with vastly diverse learning styles into an educational setting.

Several studies have suggested that mobile devices are important resources in the teaching and learning process as they can help learners and the facilitators to access information, acquire content, communicate, and collaborate (Helm, Guth, & Farrah, 2012; Huang & Chang, 2010; Kizito, 2012; Mtega, Bernard, Msungu, & Sanare (2012); Suwantarathip & Orawiwatnakul, 2015). There are numerous mobile technologies and internet services, such as Short Messaging Service (SMS), Global Positioning System (GPS), camera, Bluetooth, Wireless Fidelity (Wi-Fi), voice calls, gaming tools and file sharing services, that are currently incorporated into teaching and learning for educational purposes (Mtega et al, 2012; Kizito, 2012; Rana, 2014). In addition, students and teachers can share and store information resources via these mobile applications. Most successful teachers appreciate m-learning as a medium to impact their teaching on students' learning (Ferry, 2018). Thus, m-learning can bring positive revolution and meaningful development to education, if they are properly integrated and used in teaching and learning settings (Jimmy, 2013).

Students with mobile devices that can access internet, often use them to extract information relating to their studies, as well as, search for definition of concepts and references (Katz, 2015). Regardless of their usefulness for academic purposes, mobile application appears to be disruptive devices in schools, due to improper use and limited supervision. In Nigeria for instance, most of the secondary schools banned the use of mobile devices by the students within the school environments. In line with this restriction, there are strict policies which are stipulated in school rules and regulations. These rules clearly prohibit students from accessing mobile phones during school hours. Primarily, most school authorities disallowed students from using mobile application, because they spend most of the time chatting, watching pornography and recording irrelevant activities and violent scenes (Ferry, 2018). Notably, the ban is aimed at improving students' moral behaviours and academic performances (Barkham & Moss, 2012). Even with the potential negative consequences of using mobile devices by students in secondary schools, it is important to explore the acceptance and perception of students and teachers on the use of mobile application as potential learning tools in Mathematics. The positive impact of m-learning to learning and teaching of Mathematics cannot be overemphasized. However, its integration into learning of Mathematics still confronts teachers, educators and researchers with many questions. The introduction of mobile learning technologies into teaching and learning has brought both new possibilities and challenges to teachers (Littlejohn & Pegler, 2017). Researches on the use of mobile technology with a particular focus on Mathematics education is rapidly growing as an area of interest. This interest is developing as mobile devices and applications become more easily accessible and popular amongst teachers and students. Studies have shown that there is an increase in the number of students and teachers using m-Apps in classroom. Hence, with the increase in use of devices and accompanying Apps in classrooms, teachers and educators need to consider their effectiveness in supporting learning, particularly in relation to Mathematics. Despite the rapid expansion of the use of mobile Apps in the

educational domain, there is a lack of empirical studies as to their effectiveness and acceptance in supporting learning particularly in relation to Mathematics (Larkin, 2013). Attentions must be given to the pattern of m-Apps usage especially, teachers and students in secondary schools. These may be in terms of purpose, usage and factors influencing m-Apps usage. This will develop healthy lifestyle practices among teachers and students in handling m-Apps. Hence, the main objective of this study is to assess the acceptance and perception of students and teachers on the use of mobile applications in teaching and learning of Mathematics. This study was anchored on Technology Acceptance Model (TAM). This model anticipate and clarify why user accept or reject a computer-based innovation (Katz, 2015).

2. Statement of the problem

The problem of Nigerian education is associated with several factors which include students' and teachers' perception on the use of mobile applications in teaching and learning. It has been observed that despite the importance and the impact of mathematics in the role of national growth and development, there seems to be problems in implementation of mobile application in teaching and learning. Hence, for proper implementation of mobile application in Nigeria schools, there is need to study the teachers' and students' perception on the use of mobile allocation in teaching and learning of mathematics at secondary school level.

3 Research Questions

(i) What is the general perception of mathematics teachers toward the use of mobile-Apps?
(ii) What is the general perception of students toward the use of mobile-Apps?
(iii) What is the level of acceptability of mobile-Apps by the mathematics teachers?
(iv) What is the level of acceptability of mobile-Apps by the students?

4 Methodology

4.1 Population

The population for this study comprised of all the Senior Secondary School year one (SSSI) students and teachers of Mathematics in Ogun-East senatorial district of Ogun-State, Nigeria.

4.2 Sample and sampling Technique

The study adopted descriptive research design of a survey type. The sample for this study consisted of three hundred (300) respondents consisting of fifty (50) Mathematics and science' teachers and two hundred and fifty (250) Senior Secondary School year one (SSS1) students randomly selected from five public secondary schools in three local government areas in Ogun-East senatorial district in Ogun-State. Simple Random Sampling technique was used to select the five (5) schools. Fifty (50) students and ten (10) Mathematics and science subject teachers were randomly selected from each school.

4.3 Instrumentation

Acceptance and Perception on Mobile Applications Questionnaire (APMAQ) used by Simon (2008) was adapted. APMAQ measures teachers' and students' perceptions, and their level of acceptability of mobile-Apps in teaching and learning of Mathematics. The original questionnaire consisted of 32 items, out of which 17 items were selected by the researchers due to their relevance to this study. The respondents on a four-point Likert scale completed the 17-items adapted questionnaire. Ten (10) items measured the perception on mobile-Apps and seven (7) items measured the acceptability of mobile-Apps. The instrument consisted two sections.

The first section obtained data about the demographic characteristics of the respondents and the second section contained items that elicit information about the importance, acceptance and perception of the respondents on the use of m-Apps in teaching and learning of Mathematics. The instrument was trial-tested on fifty (50) respondents which were randomly selected from a senior secondary school year one (SSSI) different from the selected schools for the purpose of reliability. The reliability of the instrument was determined using Cronbach alpha and a reliability coefficient of 0.764 was computed. Copies of the questionnaire were distributed to the respondents in schools within the area of the study by the researchers and a research assistant. The data collected from the respondents were analyzed according to the research questions. Descriptive statistics (mean, standard deviation and percentages) were used to answer the research questions. The validity of the questionnaire was determined through the face and content validation by experts in test and measurement, curriculum development and mathematics educator. It was confirmed that the instrument was relevant, unambiguous, detailed and capable of eliciting the needed responses from the target sample.

4.4 Collection of Data

Acceptance and Perception on Mobile Applications Questionnaire (APMAQ) was used to collect data from the respondents. The researchers visited the sampled schools for the administration of the instruments to the respondents.

5. Results

5.1 Research Questions

Research question one: What is the general perception of teachers toward the use of mobile-Apps?

Table 1: Teachers' perception toward the use of mobile-Apps in teaching and learning of Mathematics

Items	Statement	S.A	A	D	SD	N	Mean	S.D
1	I use one or more of these for activities in Mathematics: Opera Mini, Internet Explorer, Mozilla fire fox, Opera and Google chrome applications to browse online such as e-mail, real materials and lectures.	15 (30.0%)	18 (36.0%)	15 (30.0%)	2 (4.0%)	50	2.92	0.877
2	Using mobile Applica-tions makes me enjoy teaching and learning of Mathematics.	23 (46.0%)	12 (24.0%)	3 (6.0%)	12 (24.0%)	50	2.83	1.226
3	I use mobile phone applications That are related to Mathematics to contact my colleagues through Facebook,	27 (54.0%)	14 (28.0%)	6 (12.0%)	3 (6.0%)	50	3.30	0.909

	Twitter, and SMS and so on.							
4	Using mobile applications in learning of Mathematics is convenient.	12 (24.0%)	18 (36.0%)	14 (28.0%)	6 (12.0%)	50	2.72	0.970
5	Using mobile Applications in learning Mathematics helps students access the content of learning.	9 (18.0%)	16 (32.0%)	15 (30.0%)	10 (20.0%)	50	2.48	1.015
6	Using mobile Applications is a convenient tool for meaningful learning of Mathematics	17 (34.0%)	9 (18.0%)	12 (24.0%)	12 (24.0%)	50	2.62	1.193
7	Using mobile Applications in learning of Mathematics strengthens knowledge retention in Mathematics.	15 (30.0%)	23 (46.0%)	8 (16.0%)	4 (8.0%)	50	2.98	0.892
8	Using mobile Applications in teaching and learning of Mathematics is diversionary.	9 (18.0%)	25 (50.0%)	10 (20.0%)	6 (12.0%)	50	2.74	0.899
9	Though there are educational applications that are related to Mathematics in my phone, I download extra applications on my phone.	14 (28.0%)	19 (38.0%)	12 (24.0%)	5 (10.0%)	50	2.84	0.955
10	Using mobile Applications in learning of Mathematics reduces misconceptions.	16 (32.0%)	18 (36.0%)	5 (10.0%)	11 (22.0%)	50	2.78	1.130

Table 1 shows the results of teachers' perception toward the use of mobile-Apps in teaching and learning of Mathematics. From Table 1, the means of nine (9) items responded to are more than the mean bench mark.

Research question two: What is the general perception of students toward the use of mobile-Apps?

Table 2: Students' perception toward the use of mobile-Apps in teaching and learning of mathematics

Items	Statement	S.A	A	D	SD	N	Mean	S.D
1	I use one or more of these for activities in Mathematics: Opera Mini, Internet Explorer, Mozilla fire fox, Opera and Google chrome applications to browse online such as e-mail, real materials and lectures.	29 (11.6%)	74 (29.6%)	97 (38.8%)	50 (20%)	250	2.33	0.925
2	Using mobile Applications makes me enjoy teaching and learning of Mathematics.	72 (28.8%)	14 (5.6%)	103 (41.2%)	61 (24.4%)	250	2.39	1.143
3	I use mobile phone applications that are related to Mathematics to contact my colleagues through Facebook, Twitter, and SMS and so on.	64 (25.6%)	96 (38.4%)	53 (21.2%)	37 (14.8%)	250	2.75	1.000
4	Using mobile applications in learning of Mathematics is convenient.	92 (36.8%)	58 (23.2%)	72 (28.8%)	28 (11.2%)	250	2.86	1.043
5	Using mobile Applications in learning Mathematics helps students access the content of learning.	25 (10.0%)	37 (14.8%)	63 (25.2%)	125 (50%)	250	1.85	1.014
6	Using mobile Applications is a convenient tool for meaningful learning of Mathematics.	42 (16.8%)	42 (16.8%)	102 (40.8%)	64 (25.6%)	250	2.25	1.019
7	Using mobile Applications in learning of Mathematics strengthens knowledge retention in Mathematics.	49 (19.6%)	45 (18.0%)	64 (25.6%)	92 (36.8%)	250	2.20	1.138
8	Using mobile Applications in teaching and learning of	48 (19.2%)	65 (26.0%)	84 (33.6%)	53 (21.2%)	250	2.43	1.028

	Mathematics is diversionary.							
9	Though there are educational applications that are related to Mathematics in my phone, I download extra applications on my phone.	84 (33.6%)	62 (24.8%)	72 (28.8%)	32 (12.8%)	250	2.79	1.047
10	Using mobile Applications in learning of Mathematics reduces misconceptions.	44 (17.6%)	42 (18.6%)	96 (38.4%)	68 (27.2%)	250	2.25	1.043

Table 2 shows the results of students' perception toward the use of mobile-Apps in teaching and learning of Mathematics. From Table 2, the means of six items responded to are less than the mean bench mark of 2.5 while means of four items are more than the mean bench mark.

Research question three: What is the level of acceptability of mobile-Apps by the teachers?

Table 3: Teachers' level of mobile-Apps' acceptance in teaching and learning of mathematics

Items	Statement	S.A	A	D	SD	N	Mean	S.D
11	Mobile Applications can improve the quality of teaching and learning of Mathematics.	25 (50.0%)	21 (42.0%)	2 (4.0%)	2 (4.0%)	50	3.38	0.753
12	It is interesting to use mobile Applications in teaching andlearning of Mathematics.	12 (24.0%)	18 (36.0%)	12 (24.0%)	8 (16.0%)	50	2.68	1.019
13	Mobile Applications can be used to assist teaching and learning of Mathematics.	14 (28.0%)	30 (60.0%)	4 (8.0%)	2 (4.0%)	50	3.12	0.718
14	Mobile Applications can be effective tools to learning of Mathematics in classrooms.	18 (36.0%)	20 (40.0%)	7 (14.0%)	6 (12.0%)	50	3.02	0.958
15	Mobile Applications can be used for administrative purposes (e.g. send SMS messages to parents)	22 (44.0%)	28 (56.0%)	0 (0.0%)	0 (0.0%)	50	3.44	0.501
16	It is advisable for secondary school students to bring their mobile	5 (10.0%)	9 (18.0%)	20 (40.0%)	16 (32.0%)	50	2.06	0.956

	phones to schools for learning of Mathematics.							
17	Mobile Learning should be part of secondary school Mathematics curriculum.	14 (28.0%)	21 (42.0%)	9 (18.0%)	6 (12.0%)	50	2.86	0.69

Table 3 shows the results of teachers' level of mobile-Apps' acceptance in teaching and learning of Mathematics. From Table 3, the mean of all the items responded to are more than the mean bench mark of 2.5.

Research question four: What is the level of acceptability of mobile-Apps by the students?

Table 4: Students' level of mobile-Apps' acceptance in teaching and learning of mathematics

Items	Statement	S.A	A	D	SD	N	Mean	S.D
11	Mobile Applications can improve the quality of teaching and learning of Mathematics.	90 (36.0%)	72 (28.8%)	60 (24.0%)	28 (11.2%)	250	2.90	1.020
12	It is interesting to use mobile Applications in teaching and learning of Mathematics.	25 (10.0%)	48 (19.2%)	102 (40.8%)	75 (30.0%)	250	2.09	0.942
13	Mobile Applications can be used to assist teaching and learning of Mathematics.	121 (48.8%)	60 (24.0%)	23 (9.2%)	46 (18.4%)	250	3.02	1.147
14	Mobile Applications can be effective tools to learning of Mathematics in classrooms.	57 (22.8%)	48 (19.2%)	62 (24.8%)	83 (33.2%)	250	2.32	1.147
15	Mobile Applications can be used for administra-tive purposes (e.g. send SMS messages to parents)	73 (29.2%)	82 (32.8%)	48 (19.2%)	47 (18.8%)	250	2.72	1.079
16	It is advisable for secondary school students to bring their mobile phones to schools for learning of Mathematics.	93 (37.2%)	98 (39.2)	29 (11.6%)	30 (12.0%)	250	3.02	0.986
17	Mobile Learning should be part of secondary	72 (28.8%)	94 (37.6%)	52 (20.8%)	32 (12.8%)	250	2.82	0.990

	school Mathematics curriculum.

Table 4 shows the results of students' level of mobile-Apps' acceptance in teaching and learning of Mathematics. From Table 4, the means of four items responded to are more than the mean bench mark of 2.5 while means of three items are less than the mean bench mark. The implication of this result is that most of the students were disposed to usage of mobile-Apps.

6. Discussion of Findings

The result in table 1 indicates that teachers have positive perception about the usage of mobile-Apps in teaching and learning of Mathematics. The teachers' strong perception may not be unconnected to their experience, exposure and emotional stability. Also, teachers' avidity to catch up with 21st century of teaching and learning process may activate their perception toward the use of mobile-Apps in the classroom. Moreover, teachers' position in this regard is to avoid being redundant in the classroom in the future. On one hand the teachers whose perceptions are in line with the use of m-Apps learning might think that there is the need to cope with the technological changes in teaching and learning while those whose perceptions are in dissonance with the use of m-mobile learning can be attributed to the fact that, as pointed out by Means (2014), panicked that they would be replaced by computers**.**

Furthermore, result in Table 2 showed that students are less perceptive about usage of mobile-Apps in teaching and learning of Mathematics. Students' perceptions in this comportment indicate that students might think the mobile-Apps may not be a complete solution to their difficulties in learning of Mathematics. Another reason for this less perception of students toward the use of mobile-Apps is that they might not have adequate knowledge about the strengths and weaknesses of various instructional techniques and media (m-Apps). They might also not have sufficient exposure to the usage of mobile-Apps for effective teaching and learning and therefore, they cannot make any concrete decision on effective means of promoting good instruction through the usage of mobile-Apps. However, this result is in consonance with the propositions of some researchers (Clark 1999; Salomon, 2002) that instructional techniques designed by the teachers are more effective than media (mobile-Apps) in achieving better quality learning.

Results in Table 3 showed that Mathematics' teachers embrace mobile-Apps form of instructions as a valid platform for teaching and learning. More so, majority of the teachers believed that mobile-Apps can be used to improve the quality of teaching and learning of mathematics and that, mobile-Apps can also aid their administrative purposes. This result is in agreement with findings of (Simon, 2008) that mobile-Apps can be used to enhance teaching and learning. This finding is also in consonance with the studies of Kizito (2012), and Wang (2017) that asserted that using mobile phone applications in teaching and learning provides positive ideas and benefits that motivate teachers to understand better. Similarly, Wang (2017) reported that mobile phones make teaching and learning more convenient and successful.

7. Conclusions

This study examined the acceptance and perception of students and teachers on the use of mobile application in teaching and learning of Mathematics. The finding revealed that teachers are more perceptive than the students about the use of mobile-Apps in teaching and learning of Mathematics. Furthermore, the result of the study showed that there is a high-level acceptability of mobile-Apps by teachers and students in teaching and learning of Mathematics. Finding of

result in Table 4 is consistent with studies by Roselan (2003) which states that the effectiveness of the teaching and learning process depends on ICT equipment that is used as an intermediate platform between teachers and students.

8. Recommendations

The following recommendations were made:

(i) Teachers of Mathematics should be sent to seminars, workshops, and conferences to update their pedagogical skills and strategies for innovative and fruitful delivery in the classroom.

(ii) Students must have regular access to technologies that support mobile learning to advance their mathematical thinking, reasoning, problem-solving, and communication skills.

(iii) Teachers and parents should work collaboratively in ensuring that students are using mobile phones appropriately as this could foster the development of value-based interactive mobile learning process.

References

Barkham, P. & Moss, S. (2012, November 27). Should Mobile Phones be banned in Schools? *The Guardian*, p. 8.

Clark, R.E. (1999). Media will never influence learning. *Educational Technology Research and Development*, 4(2), 21-29.

Ferry, B. (2018). Using Mobile Phones to Augment Teacher Learning in Environmental Education. *Proceedings of Oscillate Melbourne*, 295-298.

Huang, Y., & Chang, G. (2010). Guest editorial-innovations in designing mobile learning applications. *Educational Technology & Society*, 13(3), 1-12.

Helm, F., Guth, S., & Farrah, M. (2012). Promoting dialogue or hegemonic practice: Power issues in telecollaboration. *Language Learning & Technology*, 16(2), 103-127.

Jimmy, E. K (2013). The Perceptions of Teachers, Parents and Students on the Effects of Mobile Pnones use on students learning in Tanzania. *Journal of Education and Practice*, 4(25), 35-46.

Katz, J. E. (2015). Mobile Phones in Educational Setting. *Journal of Education and Practice*, 4(25), 305-317.

Kizito, N. (2012). Pre testing mathematical concepts with the mobile phone: implications for curriculum design. *The international review of research in open and distributed learning*, 13(1), 56-69.

Larkin, K. (2013). *Mathematics Education: Is there an App for that?* In V. Steinle, L. Ball & C. Bardini (Eds). Mathematics education: Yesterday, today and tomorrow. (Proceedings of the 36th annual conference of the Mathematics Education Research Group of Australasia). Melbourne, VIC: MERGA.

Littlejohn, A. & Pegler, C. (2017). *Preparing for Blended e-Learning*. 4th edition.

Means, B. (2014) (ed.). *The technology and education reform: The reality behind the promise*. 3rd edition.

Mishra, S. K. (2013). *Quality Education for Children, Youth, and Adults through Mobile Learning*. In J. Keengwe (Ed). Pedagogical Applications and Social Effects of Mobile Technology Integration (pp. 225-237). Hershey, PA: IGI Global.

Mtega, W., Bernard, R., Msungu, A., &Sanare, R. (2012).*Using mobile phones for teaching and learning purposes in higher learning institutions: the case of Sokoine University of agriculture in Tanzania.* Proceedings and report of the 5thUbuntuNet Alliance annual conference, 118-129.

Rana, S. (2014). A study of use of mobile phones for teaching & learning purpose. *International Journal of Science and Research, 3*(6), 2765-2767.

Salomon, G. (2002). Technology and pedagogy: why don't we see the promised revolution? *Educational technology. 52*(2), 71-75.

Simon, S. (2008). "A Study on the acceptance of mobile phones for teaching and learning with a group of pre-service teachers in Hong Kong". *Journal of Educational Technology Development and Exchange*, 1(1), 81-92.

Roselan, B. (2003). *Teaching and Learning Method.* Shah Alam: Karisma Publications Sdn. Bhd.

Suwantarathip, O., & Orawiwatnakul, W. (2015). Using mobile-assisted exercises to support students' vocabulary skill development. *TOJET: The Turkish Online Journal of Educational Technology*, 14(1), 163-171.

UNESCO. (2012). *Mobile learning for instructors in Africa and the Middle East: Exploring the potentials of mobile technologies to support instructors and improve practices.* United Nations Educational, Scientific and Cultural Organization, 1-40.

Wang, B. T. (2017). Designing mobile apps for English vocabulary learning. *International Journal of Information and Education Technology*, 7(4), 279-283.