British Journal of Education
Vol.8, Issue 8, pp.57-70, September 2020
Published by *ECRTD- UK*
Print ISSN: ISSN 2054-6351: Online ISSN: ISSN 2054-636X

UTILIZATION OF MOBILE APPLICATIONS TO ENHANCE TEACHING OF MATHEMATICS AND SCIENCE IN BASIC SCHOOLS IN THE CAPE COAST METROPOLIS

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ABSTRACT: *Primarily, the study focused on finding out the type(s) of educational mobile apps often used by basic school teachers in the teaching of mathematics and science, how educational mobile apps can be utilized to enhance the teaching of mathematics and science and the challenges teachers face when using educational mobile applications in the teaching of mathematics and science in the basic schools. The study was conducted in the Cape Coast Metropolis in the Central Region of Ghana and a descriptive survey design was utilized in orderto explore the phenomenon in question. A total of 70 basic school mathematics and science teachers were sampled, using simple random sampling techniques. The study employed the use of questionnaires as the main means of data collection. The descriptive analytical techniques (frequencies and percentages) were applied to analyse the data collected. Findings revealed that educational games were often used by teachers in the teaching of mathematics and science. Also, it was revealed that majority of teachers used these educational mobile applications in lesson notes preparation and poor internet connectivity was a challenge to teachers in the utilization of these mobile applications in the teaching of mathematics and science. Conclusions, implications and recommendations were further discussed in the work.*
KEYWORDS: educational mobile apps, basic school, educational games, utilization

INTRODUCTION

The rapid advancement of mobile technologies along with rich mobile software applications make worldwide mobile learning possible (Johnson, Adams, & Cummins, 2012). These days, mobile technologies have become gradually ubiquitous and networked. Such technologies can be used creatively in different areas. The possibilities of mobile technologies for learning are numerous and includes user flexibility resulting from device portability, relatively strong computing power in small devices, and constant connectivity (Hsu & Ching, 2012). These possibilities lead to immense prospects for advanced uses of mobile technologies in teaching and learning. Furthermore, it should be realized that mobile devices such as smartphones are enormously advancing in recognition when it comes to education (Johnson, Levine, Smith, & Stone, 2010) because of the accessibility of different user-friendly mobile software applications. Interent-connected mobile technologies have created a platform for a new form of electronic learning, which is mobile learning (Fu, Su, & Yu, 2009). Internet-enabled mobile

technologies can help students in accessing educational materials in courses online, everywhere and at every time for academic expedience.

Background to the Study and Statement of the Problem

Mobile Application (M-apps) is also known as an app. It is a type of application software designed to run on a mobile device such as a smart phone or Tablet computer. Every day, academic scholars are searching for innovative techniques in imparting knowledge to students. Mobile applications assists in offering users with similar services to those accessed on personal computers (Pogue & David, 2009). A mobile application can be referred to as an app, web app, online app, smartphone app or even iPhone app (Roger, 2009). In changing times, teachers and students are more driven towards using mobile devices for every purpose. With the world at our fingertips, teachers and students can get access to information from anywhere at the easiest possible convenience. Since, teachers are significant in the learning process; it is necessary for them to explore the numerous affordances of utilizing mobile phones in teaching and learning as this will go a long way to encourage students to also use them enhancing their educational experiences. Ally (2009) asserted that mathematics and science education in basic schools is a must and mobile technology as a matter of fact opens an avenue for teaching mathematics and science in basic schools in the 21st century as a result of the presence of such technologies. In teaching, the m-apps are used to push information to students, in research, apps appear to be used to store information, share information, self-organize, collaborate with colleagues and so on and stay abreast with research done by the various educational practitioners worldwide to help teachers or instructors in the teaching and learning of mathematics and science at the desired levels of education.

Traxler (2009) defines m-learning, as a learning interaction between learners and the learning resources, which is made available from any location, using mobile technology. One challenge with mobile technologies is that it may be demanding to create a conducive environment that can support diverse kind of learning settings and activities, as well as ways to accept different cultures and traditions. As a result, many researchers and academicians are presently exploring the possibilities of mobile devices in supporting learning experiences. In this research, the educational mobile apps only refers to the application of mobile education.

By the end of2014, the total number of education mobile- applications in China had increased to more than 70,000, this was about 10% of mobile apps market (Sina Education, 2014). Mobile apps popularity in the field of education has has had a huge influence on new learning style, use of smartphones, tablets and other mobile technologies that can be used to learn at anytime, anywhere. Currently, mobile-apps are mainly focused in the foreign language education, preschool class, test platform and grade12, etc. Smartphones are the most popular amongst students because it is easy to use and can be suited to fit personalized use and needs. In online education, ducational apps play a vital role. (Banchero & Simon, 2011). The development benefits of educational mobile apps are commonly good (Watlington, 2011). Mobile applications has, the most potential in the market and huge developmental space. This is due to the immense user base and stable education expenses. (Sina Education, 2014). With the reputation of smart phones, other mobile technologies, social capital investment in

research and development, educational mobile apps unquestionably steered a good chance for development.

Educational games are designed purposely for teaching and learning, or which have supplementary or secondary educational value (Shatz, 2015). All kinds of games could be utilized in an educational setting. Educational games are also designed to assist students to learn about certain subjects, develop concepts, reinforce progress, appreciate historical events or culture, or help them in learning a skill all the while playing (Shatz, 2015). The types of educational games are board, card, and video games. An educational game teach students about a specific subject and how to perform a skill.

Tutorials is a modality that is used in transferring knowledge. Tutorials are more interactive and specific than a book or lecture, as it seeks to educate through examples and supply the material in order to complete a certain task (Hagemans, van der Meij, & De Jong, 2012). Edmodo, us both a teacher and student's app which is used for educational purposes (Jarc, 2010). The Edmodo app enables teachers in distributing content, distributing tests, assignments on mathematicse and enhancing communication with students, colleagues and parents. It uses social learning platform makes an impact internationally thereby helping teachers who teach maths and science as well as students to communicate on topics relating to science and maths, and also collaborate with each another. It uses the social learning platform to allow students to respond to science and maths questions post on the learning platform. The medium helps members share ideas, files events and assignments in a virtual setting on the topics of science and maths (Jarc, 2010). Similarly, Using Evernote, science and maths teachers can share their projects with their students through shared notebooks, and all science and maths assignments can be posted on the Assignment shared notebook that is available for parents on teacher's website. Also, students can also post questions relating to topics on science and maths for their teachers to help them with. Traditionally, these handouts would be viewed by students then thrash. Now they can view them on Evernote and trees can be saved (Nelson, 2016).

Another type of app is drill-and-practice which is familiar to all educators. Drill-and-practice encourages the acquisition of knowledge or skill through continuous repetitive practice. Similar to rote learning, it includes continuously repeating specific skills, as this has become the building blocks for more meaningful knowledge (Tournaki, 2013). Drill-and-practice apps provide a structured reinforcement of concepts learned earlier. These apps are established on question and answer interactions and should always give the student immediate and appropriate feedback. Drill-and-practice packages may add games to encourage motivation (Byers, 2015).

GeoGebra involves a dynamic learning environment that supports its teachers or students in creating mathematical objects and interacting with them. , Teachers or students who use GeoGebra are able to use this environment to clarify, to explore, and to demonstrate mathematical concepts and the interactions between them, or mathematics in general (Hohenwarter & Jones, 2007). Botzer (2007) presented a project based on Math4Mobile, a cellular application for mathematics learning which includes Sketch2Go. This is an application that allows teachers or students to sketch graphs, increase and decrease

functions and also make graphical exploration of phenomena, and Graph2Go, a graphing calculator for dynamic transformation of functions. This mobile environment encouraged students to use the mathematical applications anytime and anywhere, which in turn boosted their performance of mathematical operations and improved experiential learning.

Roberts and Vanska (2011) presented the Nokia Mobile Learning for Mathematics which showed results that it was possible to use the networking platform for students' mathematics homework. Similarly, Kalloo and Mohan presented "Mobile Math", which was a mobile learning application designed to assist s students improve their performance in algebra. This application is only available on mobile phones which has acess to the internet. This app includes lessons, examples, tutorials, tests as well as games that assists students in practicing certain mathematical skills. From the results it indicated most of the students appreciated learning activities, especially the games and the application assisted them in improving their performance in algebra. Therefore, the learning app was seen to be effective.

Even though mobile apps certainly have a promising potential in the future, the prospects for mobile apps obviously do not come without challenges. Teachers perceive mobile phones as a disruptive technology if used in the teaching and learning process (O'Bannon &Thomas, 2013). The most common disruption in the classroom is a ringing phone and this is likely to negatively influence teacher delivery and student performance (O'Bannon & Thomas, 2013). Dahlstrom and Bichsel (2014) encouraged academics to explore instructional techniques that will assist educators to better support mobile technologies. It was emphasised by McGreal (2014) that to achieve this, mobile learning requires an effective integration between instructional content and technology to attain educational goals and to offer a positive teaching and learning environment. Alhazmi and Rahman (2012) reasoned that mobility and interactivity are technological features of mobile applications thatare important to effectively integrate this technology into wider educational settings. Most teachers find it difficult on how to effectively use technology to supplement their teaching.

Technical difficulties will definitely be an important aspect in the application and integration of m-learning technologies in education. (Qureshi, 2012) Qureshi enumerated a few technical challenges which included "installation, availability of modern technology, prompt and stable Internet connection, and uninterrupted supply of electricity, maintenance, administration, security and absence of technical support". These are technical challenges related to the infrastructure, type of mobile device, application development, technical support, security, and technical expertise of instructors, learners, and other stakeholders, which should be taken into account when engaging a m-learning project. These challenges developed because of the rapid modification in technologies, programs and devices. Bakari (2010) indicated that the majority of the developing countries are deficient in quality and expert in technical support and maintenance of Information and Communication Technologies (ICT).

Though mobile learning is quite new, studies have shown that it results in improved retention, decreases training times, and enhances productivity more than traditional

training models. Improved retention happens when mobile learning is present as a stand-alone teaching method or as part of a blended learning program. A recent study of mobile learning revealed how well learners retained information from training material. Some learners attended a live lecture whiles others listened to a podcast organised via a mobile device. The learners who listened to podcast presented significantly improved retention, showing a better score than the live lecture learners (McKinney, Dyck, & Luber, 2009). Interaction tendency in younger learners is improved by mobile applications (McCain, 2019). Some researchers and academics are in the opinion that apps in teaching and learning would make younger learners more interactive and activate increase in engagement between parents and learners. Unlike school, mobile applications can be available round the clock. Consequently, there is actually no reason to be concerned about schedules, because there can be a classroom anywhere. . Mobile learning is not restricted by time; it is a relaxed form of learning. Most of the apps promote user-friendly control. Learners should only reach out for the device when they feel like learning. Young learners can operate it without much effort.

Smartphones and tablets are mobile technologies among the six new growing developments that could considerably influence teaching, learning, and research in necessary training (Sung, Chang, & Liu, 2016). When it came to the area of mathematics, Ruthven and Hennessy (2002) compared the learning outcomes of computer-based teaching with mathematical teaching. With comparison to the traditional teaching method, results showed that computer-assisted learning could drastically increase the progress of scientific skills and the improvement of a greater insightful unfailing ability for the students (Jonassen & Grabowski, 2012; Jimoyiannis & Komis, 2007). This background supports the research to investigate the use of mobile applications in enhancing the teaching of mathematics in basic schools.

M-learning is observed as the current and familiarised type of learning, and its special capabilities have great prospects in enriching educational experience (Guy, 2010). The traditional approach of teaching includes the usage and carrying many books to and fro, it is stressful, time consuming and information required is not readily available which is the exception when it comes to the utilization of mobile applications in teaching. Currently, the most accessible electronic device in Ghana is the mobile phone. Therefore, it can be deduced that majority of teachers and students possess this device.

There is a need in the utilization of mobile applications to enhance teaching of mathematics and science in basic schools. The integration of mobile applications in teaching provides more opportunities for teachers to work better in this information age. Mobile technologies (m-apps) are an attractive and easy way to maintaining literacy skills and gain constant access to learning materials. Mathematics and science education in basic schools is compulsory for all students in the Ghanaian context and mobile technology creates an avenue for teaching mathematics and science in basic schools in the 21st century (Ally, 2009). Mathematics educationists are becoming more aware that mobile applications can have enormous prospects in learning mathematics at the basic level. It is therefore necessary to explore mobile applications that would make mathematics and science more interactive and easier to understand. Nonetheless, limited studies have been conducted in Ghana to explore the integration of these mobile

technologies in the teaching of mathematics at the basic school level. Although, there are some barriers that may discourage teachers from integrating m-apps in the classroom and prevent them in introducing support materials through m-apps usage, this study points out why there is a need for m-apps integration in the classroom setting.

Purpose of the Study

The main purpose of the study was to explore the utilisation of mobile applications (m-apps) to enhance the teaching of mathematics and science at the basic school levels in Cape Coast Metropolis. Specifically, the study sought to find out the educational mobile apps often used by basic school teachers in the teaching of mathematics and science, how educational mobile apps can be utilized to enhance the teaching of mathematics and science and the challenges teachers face when using educational mobile applications in the teaching of mathematics and science at the basic school level.

Research Questions/Hypothesis

The following research questions were formulated to aid achieve the purpose of the study:

1. What are the types of m-apps used often by teachers in teaching mathematics and science at the basic school level?
2. How are the identified educational mobile applications used to enhance the teaching of mathematics and science?
3. What challenges are encountered by teachers in using mobile applications for teaching mathematics and science?

Design and Instrumentation

The research adopted the descriptive research design to ascertain the primary purpose of the study. Whilst there are some valid concerns about the statistical validity, as long as the limitations are understood, this type of design is an invaluable scientific tool for the study (Shuttleworth, 2008). The main instrument for the study was a structured questionnaire A five-point Likert scale was used, and the agreement criteria were, strongly agree(SA), agree(A), neutral(N), disagree(D), and strongly disagree(SD) while other responses were in the form of 'Yes' or 'No'. The questionnaire was divided into three sections. The breakdown was made to conform to the research questions formulated to give focus to the study. Section I dealt with item that elicited information on the personal data of respondents; these included sex, age, subject taught, devices owned, type of educational apps on the device etc. Under Section II, the questions were based on how useful the educational app was to the teachers along with the challenges faced when using the educational mobile application in teaching. Section III dealt with the teacher's user experience with the educational mobile application. The questionnaire was chosen because of its numerous advantages. In the first place, it can be used to collect data from large group of people at the same time. It also enables the respondents take their time and answer the questions on the questionnaire.

Selection of Participants

The target population for the study were teachers who taught only science, only mathematics, or both mathematics and science in Cape Coast metropolis. The accessible population included science, mathematics, both mathematics and science teachers who taught in the various basic schools located in these localities; Ola, Abura, Diakor and

basic schools in and around the University of Cape Coast campus. A total of fifteen basic schools were sampled for the study through convenience sampling. The study also used the simple random sampling to select the teachers who were eventually involved in the study. According to Fraenkal and Wallen (2000) single random technique of sampling gives each and every member of the population an equal and independent chance of being selected. The sample size for the study consisted of 70 mathematics and science teachers selected for the study out of the targeted population of hundred (100) teachers.

Data Collection Procedure

Primarily, data gathered for this study was gathered through the use of questionnaire. In this study, the structured survey technique was therefore used. An initial visit was paid to all the schools from which data was collected and had a discussion with the heads of institution and came to an agreement as to when data collection was to start.

On the day of visit, permission was sought from heads of the schools and the mathematics and science teachers who were going to be involved in the study. At the meeting, the purpose of the study, its duration, and the likely benefits were explained to the participants involved for their consent to partake in the study and also allow the study to take place in their schools. Also, at these meetings, decisions about dates and times for the administration of the instrument were discussed. In all, fifteen schools were visited during the administration of the questionnaires which lasted for approximately one week. In each school, the participating teachers were brought together at one place after the close of classes so as not to disrupt normal class hours. On the day of the data collection, data was collected from one school after which the other school was visited for the same purpose of questionnaire administration. The consent of both teachers and students were sought to which a consensus was reached before administration of the instruments begun. The primary purpose of the study was once again explained to the respondents and they were assured of anonymity and confidentiality. Completion of the questionnaires took about 30 minutes after which the questionnaires were taken back by the researchers. All questionnaires administered were retrieved on the same day.

Data analysis and discussion

The data that were collected were coded, edited, and analysed. The analysis of the main results highlighted the actual research questions which were; the types of m-apps used often by teachers in the teaching of mathematics, the types of m-apps used often by teachers in the teaching of science, how these mobile applications are used to enhance teaching, some of the challenges encountered while using mobile applications. Descriptive statistics was the statistical tool used for analysing the data. In order to get the position of the respondents on the items that were given, percentages and frequencies were used for the analysis. The results are presented and discussed in the subsequent paragraphs.

Discussion of results regarding Research Questions/Hypothesis

Analysis of the background data of the respondents revealed that, 46 of the respondents which is 65.7% of the teachers who participated in the study are male, 24 which is 34.3% of the teachers who participated in the study are female. Also, 27 respondents representing (38.6%) teach mathematics, 27 respondents representing (38.6%) teach

science and 16 respondents representing (22.9%) teach both mathematics and science subjects at their various basic schools.

Research Question 1: What are the types of m-apps used often by teachers in teaching mathematics and science at the basic school level?

The first research question sought to investigate into the types of M-apps that mathematics and science teachers use at the basic school level. The results are presented in Table 1 and Table 2 below.

Table 1: Downloading of Educational Mobile App by Respondent

Have Educational M-app	Frequency	Percent (%)
Yes	65	92.9
No	5	7.1
Total	**70**	**100.0**

As shown in Table 2, 65 teachers which constitute 92.9% have downloaded educational mobile applications on their devices whereas 5 teachers which constitute 7.1% have not downloaded educational mobile applications on their devices. This is a clear indication that a great deal of the respondents is exposed to M-apps. Furthermore, analysis was conducted to explore the type of educational M-apps that the respondents are previewed to.

Table 2: Types of Mobile Apps Downloaded by Respondents

Educational Mobile App	Frequency	Percent(%)
Drill and practice	13	18.6
Educational games	25	35.7
Simulations	7	10.0
Tutorial Apps	20	28.6
Total	65	92.9

Table 2 represents the various educational mobile applications downloaded and used by the teachers in teaching of mathematics and science. Educational games have the highest use with a frequency of 25 with a percentage of 35.7, followed by tutorial applications with a frequency of 20 and a percentage of 28.6. The least downloaded and used mobile apps by the teachers in teaching mathematics and science appeared to be apps on simulations. 7 teachers representing 10% have downloaded and used mobile apps on simulations. From Table 2 it is obvious that a total of 92.9% of the teachers have educational mobile apps downloaded on their mobile devices. The finding is in line with that of Zanchi, Presser, Vahey (2013) whose project disclosed that digital games for both individual and collaborative play and non-digital activities support students' learning. Also, Kalloo and Mohan (2012) revealed that most students enjoyed learning activities, especially games and they thought that the mobile application helped them improve their performance in algebra.

Research question 2: How are the identified educational mobile applications used to enhance teaching of mathematics and science?

The second research question sought to find out about the benefits of using educational mobile devices to enhance teaching of mathematics and science in basic schools. Teachers responded to the items in the questionnaire concerning the benefits derived in using these educational applications. The results are presented in Table 3.

Table 3: Uses of Educational Mobile Applications

STATEMENT	SA Freq (%)	A Freq (%)	N Freq (%)	D Freq (%)	SD Freq (%)
Aids teachers in lesson note preparation.	22(31.4)	34(48.6)	11(15.7)	3(4.3)	0(0.0)
Aids teacher teach effectively and efficiently.	18(25.7)	34(48.6)	13(18.6)	4(5.7)	1(1.4)
Guides teachers in delivering lessons on time.	11(15.7)	29(41.4)	16(22.9)	11(15.7)	3(4.3)
Aids teachers to respond to questions appropriately.	16(22.9)	28(40.0)	15(2.4)	9(12.9)	2(2.9)
Aids teachers set realistic and achievable lesson objectives	14(20.0)	27(38.6)	19(27.1)	7(10.0)	3(4.3)

From Table 4, 56(80%) of the respondents agreed that they indeed benefited greatly from using educational mobile applications, 11(15.7%) of the respondents were neutral whereas 3(4.3%) disagreed. Majority of teacher's 52(74.3%) agreed to the statement, 5(7.1%) disagreed while 13(18.6%) of the respondents being teachers remained neutral. Looking at the various percentages most of the teachers supported the statement "educational mobile applications aid in lesson note preparation" and "aids teacher to teach effectively and efficiently". To ascertain whether these educational mobile devices guide teachers in delivering lessons on time, Table 4 shows that, 40(57.1%) of the respondents agreed as compared to the 14(20%) of respondents that disagreed, 16(22.9%) of the respondents took the neutral stand to the statement "guides teachers in delivering lessons on time". In all, it shows that the majority of teachers agree that it aids in timely lesson delivery. As to whether educational mobile applications aids teachers to respond to questions appropriately, the responses gathered show that 34(62.9%) of the respondents agree to this statement "aids teachers to respond to questions appropriately". It can be inferred from the findings that majority of the teachers agree with the statements on the usefulness of mobile applications in the teaching and learning of mathematics and science. The finding is in line with what Stead (2014) indicated the mobile education is

full of exciting technologies and approaches that can help teachers transform how they teach, learn and work.

Research question 3: What challenges are encountered by teachers in using mobile applications for teaching mathematics and science at the basic school level?

The third research question sought to investigate the challenges teacher's face when using educational mobile applications to enhance the teaching of mathematics and science in basic schools, teachers responded to the items in the questionnaire concerning the challenges faced. The results are presented in Table 4.

Table 4: Challenges teachers face when using educational mobile applications to enhance teaching of math and science.

STATEMENT	SA Freq (%)	A Freq (%)	N Freq (%)	D Freq (%)	SD Freq (%)
Poor internet connectivity(speed)	20(28.6)	24(34.3)	16(22.9)	8(11.4)	2(2.9)
Frequent data loss	15(21.4)	24(34.3)	17(24.3)	8(11.4)	6(8.6)
Difficulty in searching and locating information	14(20.0)	17(24.3)	29(41.4)	9(12.9)	1(1.4)
Difficulty in learning to use the mobile application	7(10.0)	25(35.7)	16(22.9)	18(25.7)	4(5.7)
Mobile application freezes frequently	13(18.6)	23(32.9)	21(30.3)	9(12.9)	4(5.7)

From Table 4, it is clear that 44(62.9%) of the respondents agreed to the statement "poor internet connectivity". Moreover 10(14.3%) of the teachers disagreed that the challenge was poor internet connectivity. In all, 16(22.9%) of the respondents were neutral on the statement. Thus, teachers have a challenge with respect to poor internet connectivity while using M-apps for teaching and learning. The results further revealed that 39(55.7%) of the respondents agreed that frequent data loss was a challenge. 14(20%) of the respondents disagreed to the statement whereas 17(24.3%) which is greater than the percentage of respondents who disagreed, were neutral. This goes to show that data loss poses a challenge in teaching when using educational mobile applications. A cursory look at the results in Table 4 disclosed that mathematics and science teachers do not have much difficulty using M-apps in searching for information and learning with these apps. Also, more than half of the respondents indicated that M-apps freeze frequently while in use. This confirms the findings of the research conducted by Sandholtz, and Reilly (2004) when they stated that one of the challenges teachers faced in teaching was the frequent freezing of mobile applications during teaching.

Conclusions, Recommendations and Implications for teaching and learning mathematics and science

In the utilization of mobile applications to enhance teaching of mathematics, technology planning and policies should address three major areas: vision, access, and integration.

Vision pertains to what is expected from the mobile applications overall. Access refers to the acquisition, deployment, and availability of mobile applications to the target audiences. Integration of mobile applications to enhance teaching is the development and implementation of strategies that make mobile applications useful and capable of accomplishing the vision. Also, software packages such as those that support specific mathematics or science skills and knowledge can be gotten by the administrators of the basic schools or the teachers that teach the related topics.

It was evident from the study that majority of the mobile applications used by teachers in teaching mathematics and science are the educational games which makes teaching fun and entertaining. This presupposes that the use of these mobile apps make the teaching and learning of these subjects lively and get students more involved. Also, it can be said that the use of these mobile apps make both teachers and students more lively. It is however recommended efforts be made by school authorities, policy implementers as well as various governmental organisations support schools with these modern technological applications to enhance the teaching and learning of mathematics.

Also, it can be concluded that most mathematics and science teachers use mobile applications in preparing lesson notes because it is easy, cost effective and efficient. This simply means that mathematics and science teachers resort to using the mobile apps because in the preparation of lesson notes some content can be taken from educational games and other types of educational mobile applications thereby allowing lesson notes to be prepared from different sources since the information needed is readily available or easily accessible. Based on this finding, it is recommended that a research be conducted to find out how teachers use these mobile apps and its effects on their teaching and learning of their subject of interest. The implication of this finding is that those who do not use these mobile applications should be encouraged and motivated to do so to increase students' participation and performance in mathematics and science and as well as have impact on their teaching at the basic school level.

Further, it can be concluded that poor internet connectivity (speed) was a major challenge to teachers in the utilization of mobile applications in teaching of mathematics and science in basic schools. This means that, due to poor internet connectivity access to information via the various educational mobile applications, there may be a delay in teaching when the information needed does not arrive in time for use. It also implies that teachers' ability to complete the curriculum may be affected in a way since access is problematic. In light of this, it is recommended that in the utilization of mobile applications to enhance teaching of mathematics and science, it should be done in such a way that those using the educational mobile applications continue using it and blend the types of educational mobile applications together so they support each other when there is a weakness thus bring about the overall benefits of using the mobile applications.

In addition, the finding that more than half of the respondents indicated that M-apps freeze frequently while in use means that it would be problematic using the app for effective teaching. This implication of this is that using the app in teaching is most likely to create boredom, inefficiency and delays in lesson delivery. It is recommended

that research be conducted to find out apps that are free from or have less freezing point and its effects on teaching and learning mathematics and science.

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