UNIVERSITY OF CAPE COAST

THE USE OF MOBILE PHONE TECHNOLOGY AS AN INSTRUCTIONAL TOOL FOR LESSON DELIVERY AT ABURA ASEBU KWAMANKESE DISTRICT

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BY

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DISSERTATION SUBMITTED TO THE DEPARTMENT OF MATHEMATICS AND ICT, OF THE COLLEGE OF DISTANCE EDUCATION, UNIVERSITY OF CAPE COAST, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR AWARD OF MASTER OF EDUCATION DEGREE IN INFORMATION TECHNOLOGY.

AUGUST 2019

DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature..... Date.....

Name: Melchizedek Atidaa Akurigo

Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on supervision of dissertation laid down by the University of Cape Coast.

Supervisor's Signature..... Date.....

Name: Dr. Mrs. Nelly Abaidoo

ABSTRACT

Technology has evolved over the years from being simple machines to complex ones which are making work easier and faster than usual. Despite the influx of the mobile technology with its functions into the Ghanaian society with about 38,305,078 (CIA Report, 2017), most people are still stuck to its voice and other basic functionalities neglecting the economic and productivity enhancement ones. It was for these reasons that this study was carried out to find out the educational benefits of teachers using their phone technology to teach, the cost benefits that major stakeholders stand to gain when teachers use their mobile phone technology to teach and last but not the least, streamline ways by which teachers can effectively use their mobile phone technology in their lesson delivery.

The study used the descriptive research design adopting the mixed-method approach. The research adopted the use of survey questionnaire and interview guide. Major findings made from the study showed that about 92% of teachers used smart mobile devices but just for personal reasons. The teachers did not use the functions of their mobile phone devices to support their teaching process. They, however, saw the educational and cost benefits of using their mobile phones technology to teach. They, therefore, needed training workshops to equip them to make adequate use of their mobile phone technology to enhance their teaching. The study however recommended to the government through the ministry of education to develop a basic school's mobile app to help arouse the interest of teachers coupled with reduced tariffs from telecommunication networks operators.

KEY WORDS

E-learning

E-textbooks

Mobile learning

Mobile phone applications

Mobile phone technology

Smartphones

Teaching and Learning Tool

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Finally my sincere gratitude to all participants who agreed to be selected to be part of this study, Rev. Isaac Owusu of the Abura Asebu Kwamankese District Education Directorate (Training Officer), all head teachers in Moree Circuit basic schools and their teacher and above all to my family members especially Coronata Atidaa and her two girls for their continuous support and prayers.

DEDICATION

To the memory of my Late Mother: Clare Atidaa

LIST OF ACRONYMS

AAK	Abura Asebu Kwamankese
SPSS	Statistical Package for the Social Sciences
thebft	The Business and Financial Times
CIA	Central Intelligence Agency
INSET	In-service Education and Training
Std	Standard Deviation
TLRs	Teaching and Learning Resources
ICT	Information and Communication Technology
DETO	District Education Training Officer
MOE	Ministry of Education
MOC	Ministry of Communication
GES	Ghana Education Service
ISP	Internet Service Providers
App	Application
PDF	Portable Digital File
R.Q.	Research Question
OS	Operating System
Telco's	Telecommunication
N.G.O.s	Non-Governmental Organisations
WiFi	Wireless Fidelity
GSM	Global System for Mobile Communication.
CDMA	Code Division Multiple Access

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CHAPTER ONE

INTRODUCTION

Background to the Study

The academic success at the foundation or basic level of the academic ladder is much dependent on how best the teacher prepares and delivers the lesson. A lesson which is not properly planned is most likely to end with no change in the learners' behaviour. A properly planned lesson which is well-delivered lesson under conducive atmosphere is guaranteed to lead to learning to taken place. At the planning and delivery stages, teaching and learning aids are pivotal to ensure success and learning to take place. These teaching aids range from real objects to abstract drawings or charts. Teachers are always quick to blame the poor performance of their students to lack of teaching and learning aids in our schools. The mobile phone can ease that burden by proving all the aids that they need at a little or no cost. The mobile phone could contain any relevant material needed to help the teacher plan and deliver a lesson that could cause a major improvement in learners' success. This study is going to expose teachers to how to effectively use the mobile phone as teaching and learning material in their everyday world of work.

Mobile phones (smartphones) have entered the Ghanaian market to the extent that almost every teacher in Ghana has at least one. A survey by one of Ghana's largest online mobile retail found that with a population of 26.35 million there were about 36.6 million mobile subscribers (The Business and Financial Times (thebft), April 10, 2017). With this survey, there is a 129% penetration of the device to Ghana. The Central Intelligence Agency (CIA, 2016) had estimated Ghana's total mobile subscription at 38,305,078 with a

population of 27,499,924. With this population, 9,389,737 are at the age of 25 and 54 that is mostly the working class who could afford to buy a mobile phone. Out of this figure, an average of 142 mobile subscriptions is in 100 inhabitants (CIA Statistics about Ghana, July 2016). With these statistics, one is tempted to believe that all other things being equal since teachers are seen as salary income earners they least users of mobile phones will be about 98%. A smartphone could be described as one that has an operating system to run applications (e.g. windows, OS, blackberry, android), allow for installation of new applications apart from the default (GPS locator, Wi-Fi locator), has the QWERTY keyboard, receive and send electronic mails as well as connect the World Wide Web which the ordinary phone did not have. The ordinary phone could make and receive calls, play audio, take images and videos. This study seeks to explore how these functionalities of the smartphone could help teachers plan and deliver lessons that would increase educational outcomes. Much emphases would be on the teacher and a few times would include the learner. This is because of the planning and delivering of lessons is done by the teacher.

Statement of the Problem

Mobile phones have come in with new built-in features in them. These features have made the banking and financial sector to take opportunities to grow in their area. The mobile phone has gotten almost all the functions of a computer. One can, therefore, say it is a computer in one's pocket. Teachers in the developed world tend to make use of this device to aid in their teaching process. Only a few teachers in the developing world try to use the functions to teach but not all. The issue now is what policy document is put in place in Ghana

to direct the few who use the devices to teach as well as the majority who do not even apply them in their field?

The policy will help to curb the abuse in the use of mobile phones by some teachers thus those who leave their tones on while teaching, receiving phone calls during lesson deliveries just to mention but a few. These end up disrupting the very lesson they are delivering. Others do not apply the full functionalities of the device may be due to unawareness of these functions or difficulty in using the functionality. One major cry of a typical Ghanaian teacher when blamed for the poor performance of their students is that there are no teaching and learning materials (instructional materials) at their disposal meanwhile almost all teachers own a mobile phone (smartphone). These reasons teachers give for the poor performance of their students have made most teachers not applying modern-day technology to improve their pedagogical skills and hence go to the class not fully prepared even sometimes not prepared. They end up teaching their students with abstract concepts (abstract teaching).

The rippling effects of these challenges are being transferred on to the next generational leaders who are their students whom they are imparting the knowledge to. The success or failure of students in their adult years will largely depend on the teacher's role in guiding them to acquire knowledge. If this situation is not addressed an average of 1,000,000 out of the 4,324,315 basic school pupils could leave school with no or little educational change due to abstract nature of teaching by teachers according to Education Sector Performance Report 2016 by the Ministry of Education (Sapghana.com, 2016). Mobile phone applications if used correctly by teachers in the school setting could make it possible to have every type of information at students and teachers

fingertips and could be used in the classroom to reinforce learning (Miller, 2015). Teachers need to be trained on how to use mobile technology at their disposal because it is almost certain that the students have a better grasp on the capabilities of mobile devices than classroom teachers (Miller, 2015). MLearning (mobile learning) allows a method of educational delivery that could be more cost-effective than eLearning (electronic learning) methods, not to mention that the ubiquity of mobile phones means that many people are already familiar with mobile phone applications (Motlik, 2008).

Purpose of the Study

The mobile phone is seen as a social technology, learning technology, and interactive technology (Koole, 2006). The purpose of this research work is meant to establish the educational benefits that will come out when teachers use their mobile phone technology in the teaching process. The study focuses on identifying some guidelines that will streamline how basic school teachers can use their mobile phone's technology to enhance their lesson delivery. Thus how to reduce the cost of printing and supplying teaching and learning materials such as syllabi and teachers' handbooks.

Research Objectives

This research study is aimed at identifying the educational benefits from teachers using their mobile phone technology in lesson delivery. The study is aimed at finding out the cost benefits from teachers using their mobile phone technology in teaching as compared to hard copies of textbooks and other tangible teaching and learning materials.

The study is aimed at establishing how mobile phone technology can be used by teachers to improve effective lesson delivery.

Research Questions

1. What are the educational benefits of teachers using their mobile phone technology in their lesson delivery?
2. What are the cost benefits involved when teachers use their mobile phone technology in their line of duty as compared to other systems?
3. How can teachers use their mobile phone technology to ensure effective lesson delivery?

Significance of the Study

This work seeks to save government`s budget through the Ministry of Education on the printing of syllabi, provision of teachers' guide, the supply of other science teaching and learning materials as well as an increase in the number of successful students that teachers build for the nation.

It is also meant to sensitise teachers on how they can use their mobile phone`s technology to improve upon their professionalism and mastery of their area of teaching.

Delimitations

The scope of the research study is delimited to teachers in the Moree circuit of the Abura Asebu Kwamankese District in the Central Region of Ghana. The study is also delimited to only public basic school teachers in the Moree circuit, not private school teachers and second cycle schools. This study focuses only on the use of mobile phone technology but not on other forms of technologies.

Limitations

The study used a mixed-method approach to collect data but the observation was not used at all due to the time frame and the number of researchers involved. The research was limited to only Moree circuit out of seven circuits in the district and this could be non-representative enough for the entire population. The researcher had to reschedule the interview session with the District Education Training Officer (DETO) for several occasions and ended up having the interview on mobile phone recording.

With respect to the questionnaire, it was distributed to teachers on different days which culminated to 13 visiting days. Another 13 days were used to gather the answered questionnaire. All teachers wanted to be part of the sample which was not possible hence the researcher had a difficult time selecting those to be part. Head teachers were also concerned about instructional time being used for the sampling process.

Definition of Terms

(Mobile phone applications, mobile learning, e-learning, e-textbooks, mobile phone technology, smartphone)

Organisation of the Study

The study is organized into five chapters. Chapter one is the introduction to the study and it includes Background to the study, Statement of the problem, Purpose of the study, Research objectives, Research questions, Significance of the study, Delimitations, Limitations and Organization of the study.

Chapter two reviewed the related literature on various conceptual frameworks on the topic of study. Chapter three is research methodology. This

encompasses the Research design, the Population and Sampling procedure, the Data collection instruments, data collection procedure, the Data processing and analysis as well as the summary of the chapter.

Chapter four focused on the results and findings from the study and a thorough discussion of the findings. The findings will be compared with the research questions stated earlier. Chapter five gave a summary of the whole study, conclusions drawn from the result findings and the researcher's recommendations based on findings observed.

CHAPTER TWO

LITERATURE REVIEW

This chapter seeks to bring to light some authors whose works have given a highlight to the issue of teachers using mobile phone applications in their lesson delivery processes. The chapter is broken into three parts which will include how teachers can use mobile phone applications effectively to enhance their lesson delivery. It will also review the educational benefits that could come out from teachers using mobile phone applications. Lastly, the chapter will review the cost benefits involved in the use of mobile phone applications in their lesson delivery. This review is focusing on how teachers could explore and use their mobile devices through their respective applications to improve their works at school. The review will be focused also on getting stakeholders to buy into the idea of integrating mobile phone application in the training of teachers.

This study is influenced by many theories from some renowned psychologist due to the multi-function nature of the mobile phone. These psychologists range from the behaviourist of B.F. Skinner, Ivan Pavlov who saw the mobile phone device as capable of making Drills and Feedbacks during learning; the constructivist learning by Piaget (1970), Bruner (1960) and others who saw the mobile phone device as capable of creating room for simulators as well as a means of creating a room for participatory learning in the class; to collaborative learning by Vygotsky (1978) who believes the mobile device could be used to support learning and collaborate learning.

For purposes of this study, a holistic framework of mobile learning will be used.

This comes with the FRAME model. It is an adaption of Koole's (2006) model. The FRAME model takes into consideration various aspects of mobile devices ranging from technical, social and learning characteristics of the device Koole (2006). This model refers to concepts similar to those as found in psychological theories such as Activity Theory (Kaptelinin & Nardi 2006) – as well as about Vygotsky's (1978) work on *mediation* and the *zone of proximal development*. The model uses the set theory laws which consists of a three-circle Venn diagram comprising the Learner aspect (L), the Social aspect (S) and the Device aspect (D). Figure 1 gives a pictorial description of the model.

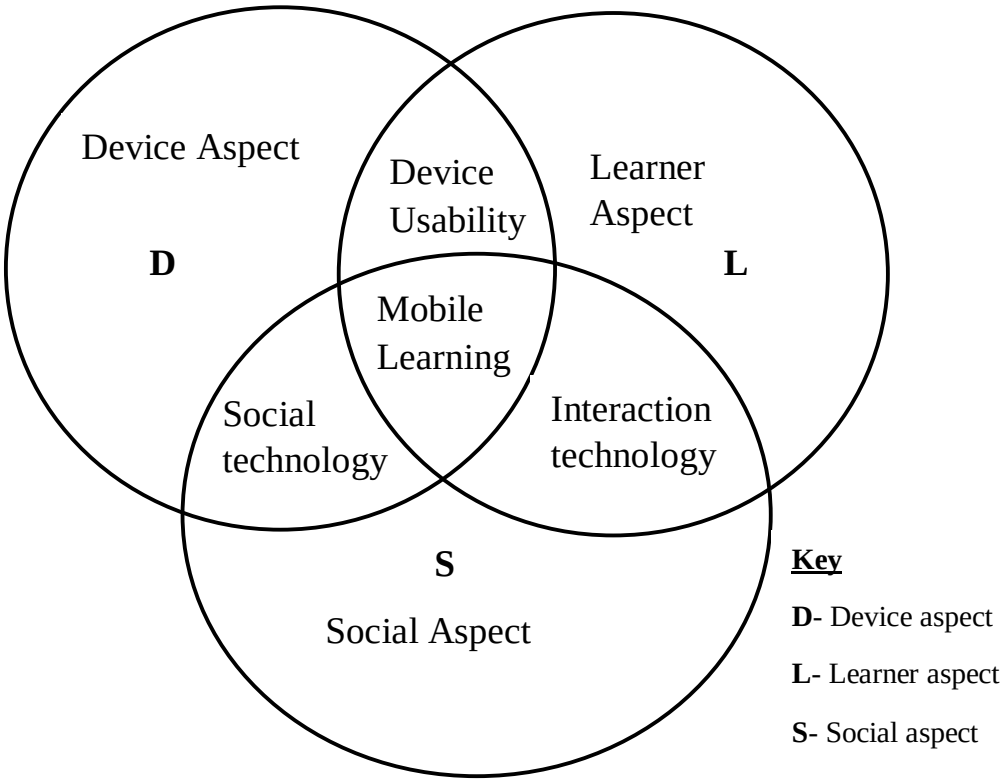

Figure 1: FRAME model of mobile learning using a Venn diagram

Source: Koole's (2006)

From figure 1, the Venn diagram (universal set) completely forms the model and it is made up of three subsets thus the three circles representing the aspects. They are the Device aspect denoted with (D), the Learner aspect denoted with (L) and the Social aspect denoted with (S). Where two circles overlap, they form a new attribute with the characteristics of the two aspects. The attributes formed are device usability from (D overlapping L), social technology from (D overlapping S) and interaction technology from (S overlapping L). The intersections describe the *affordances* of mobile technology as seen by Norman (1999). The three aspects all overlap in the middle thus D ∩ S ∩ L (using set theory) which is mobile learning, formed the basis of the FRAME model theory.

The device aspect of mobile learning is made of the physical components of the mobile phone. Thus the hardware components as well as the functions of each component. The functions range from storage capabilities, power, processor speed, compatibility, and expandability (Koole 2006). Shneiderman and Plaisant (2005) made a summary of the device aspect of the mobile phone on a table and it is presented in the Appendix.

The Learner aspect of the model indicated the mobile device as being able to invoke learners' prior knowledge as agreed by Ausubel (1968) he saw the mobile device to provide prior knowledge and experience will influence learning, so too will a learner's environment, task authenticity, and presentation of content in multiple formats. With regards to memory, the mobile device provides a form of stimuli to help student encode whatever they are learning. Tulving and Donaldson (1972) proposed that *semantic* memory is composed of general, non-contextually based concepts.

The social aspect sees the mobile device to enable users to be able to communicate with it. This aspect sees the mobile device as meant for conversation and cooperation as well as social interactions. With the device uses and in this case teachers will be able to learn rules of collaborative communication. Wardhaugh (1986) thinks that when a participant neglects to follow one or more of the rules, miscommunication may occur. Kearsley believes that it is through interaction that people receive feedback which, in turn, reinforces social and cultural beliefs and behaviours (Kearsley 1995).

The device usability which is as a result of the intersection of device aspect and learner aspects, sees the mobile device as being portable, being able to make information available, ability to provide psychological comfort, and above all satisfaction. Nielsen (1993) believes that users should be able to learn the main functions quickly so they can accomplish desired tasks as soon as possible. (Shneiderman & Plaisant 2005) believes that sufficient training could increase user-friendliness as well as transparency.

The social technology which is an intersection of the device and social aspects respectively sees the mobile device to be networking device, a tool for collaboration as well as connecting systems. The networking functionality ranges from wired (Ethernet) to wireless technology (WiFi, infrared, Bluetooth, GSM, and CDMA). (Preece, Rogers, & Sharp 2002) believes that to ensure an effective mobile learning environment, there is a need for a media space to be provided.

The interaction technology is as a result of an intersection of social and learner aspects respectively. This attribute sees the mobile device as having the ability to create a learning community altogether, situated cognition as well as

create interaction for users. This makes it possible for teachers to be able to use it properly. Moore (1989) came out with three types of interaction in distance education: learner-content, learner-instructor, and learner-learner all of which are made possible with the mobile device.

The overall set theory revolves around the intersection of the three circles thus the three aspects made up of the device, the social and the learner makes the mobile learning. The mobile phone is seen to be a device that mediates, give access to information and used for knowledge navigation. Vygotsky (1978) thinks that the nature of the interaction itself changes as learners interact with each other, their contexts, tools, and information. Siemens (2005) thinks that "When knowledge is subject to paucity, the process of assessing worthiness is assumed to be intrinsic to learning. When knowledge is abundant, the rapid evaluation of knowledge is important". Details of the various aspects and attributes of the FRAME model are represented in tables at the appendix. For purposes of this work, learners are replaced with teachers as users. A remodel of the model was used but the core value remaining the same. Figure 2 gives the new model used in this study.

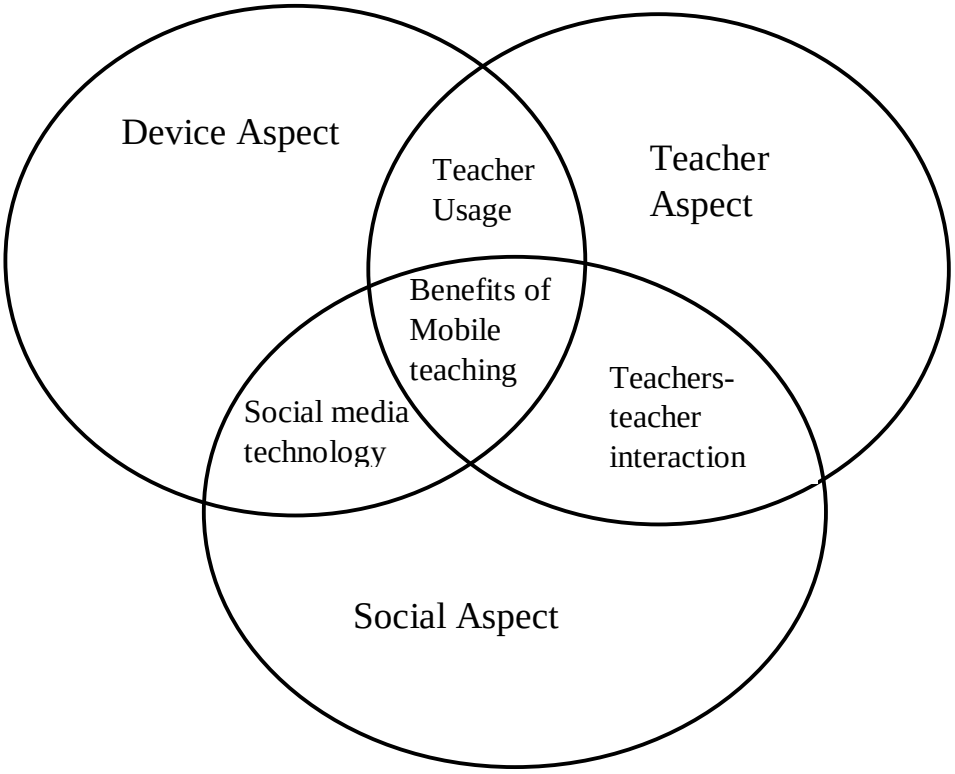

Figure 2: Remodel of FRAME model of Mobile Learning

Source: Author's construct, 2019

How Mobile Phone Applications can be used to enhance Lesson Delivery

Preparing for lesson delivery: Basic school teachers in Ghana must prepare a detailed lesson plan as a document which they will use to teach their respective lessons. This forms part of the professional competence of a Ghanaian teacher. Teachers write out a design on how they want their lesson to be delivered. This document could be used by a temporal teacher in the absence of the substantive teacher as a guide. Teachers usually rely on the textbooks given to them by the Ministry of Education through the Ghana Education Service. Some teachers do not have these books because of their location and those who have to rely solely on only those. It is for these that the mobile phone applications come in. There are applications on mobile phones (smartphones) that could help the teacher gather enough content or information relating to a

planned lesson at the preparatory part of the delivery process. (Aubusson et al., 2007) in their research titled *Mobile learning for teacher professional learning: benefits, obstacles and issues* echoed the fact that mobile learning is a potential process that could change the face of education but had their reservations on the timing not appropriate yet. They, however, support the fact and recommended that teachers could use mobile technology to construct knowledge and share with their students. (*Sung et al., 2016)* also, attest to the fact that mobile devices have certain features and these features may be able to enhance the effects of certain pedagogies, such as self-directed learning, inquiry learning, or formative assessment. The focus here is inquiry learning where teachers can do that to access certain information about their lessons. Teachers will be able to review other people's content from different jurisdictions to be able to get the best of content for their students.

During lesson deliveries: this is the point at which the teacher delivers the lesson to his students in the classroom after preparing. At this stage of the lesson, there is one main objective in the mind of the teacher which is to get his students to understand the concept he is reaching as well as apply the knowledge learned. Many factors do account for the teacher's main objective to be achieved. (Coe, Aloisi, et al., 2014) in the article defined effective teaching as "that which leads to high achievement by students in a valued outcome, other things being equal". Teachers sometimes have to use illustrations, charts, multimedia and others just to get their student to decode a mental picture of what is being taught. In a typical Ghanaian classroom, the readily available material that could enhance the lesson delivery is the student's textbooks. These books largely have text with few images which do not get a majority of students

understanding what is been learnt. This makes the learning process to appear rigid like a military commander issuing laid down instructions to his soldiers on the battlefield. There are mobile phone applications that could help the teacher download images and videos about the lesson for students to watch and give their views. Teachers could even use the sound technology of the mobile phone to produce sound of say musical instruments while teaching indigenous musical instrument instead of only showing them their pictures. This will help the student to identify them whenever they are used in a rhythm. (Thieman, 2008) in his research found out that teachers who use mobile technology normally show video recordings from DVDs and CDs, perfect as it may be, there are applications on the mobile phone capable of executing same with low cost.

Recording tool for review**:** teachers in a typical classroom only rely on exercises given at the end of a lesson to make reviews, self-assessment as well as methodology assessment. When students become used to the voices of their teachers over and over again, they become bored. It is for these reasons that teachers can take the opportunity of certain mobile phone applications to help them. Applications such as the audio recorders and podcast could be used to record a class session without students knowing what exactly is going on. These recordings could later be played by teachers in their free time for review purposes. (Rikala, 2013) in his study found out that most mobile devices and their applications are most used by teachers during field trip lessons, nature walks as well as games. Teachers especially those who teach language can rely on the advantage of their mobile phones to record and play out news bulleting to students later during a lesson in class for them to review and use that to develop their language skills. Just like (Rikala, 2013), the camera and video

functionality of the mobile phone can be used to take pictures and videos of student's craftwork which could be printed later for class magazines. In the case where students are aware that they are being recorded would try to pay attention which enhances learning.

Meeting the needs of special Students**:** government and other educational stakeholders are working hard to get the All-Inclusive Educational Policy being fully enforce in the various schools. This is to ensure that all students despite their special challenge get access to equal opportunity to education. The policy will see those with special needs being integrated and taught in the same classroom as their colleagues in a regular classroom. Though teachers are trained at Colleges of Education on how to involve those students with special needs just as their regular counterparts, there has been the challenge with equipment. The challenge teachers have to go through to get the content delivered so that all manner of persons understand becomes enormous. The teacher can, however, rely on mobile phone applications to get their objectives achieved. In the case where there are visually impaired students in the class, teachers can record the lesson in audio form and play to the class where each member of the class will get the benefit of the lesson no matter their status. A procedure could also be filmed or downloaded from the internet in video format and used to teach a class that has a hearing-impaired student. A lesson could be recorded and sent electronically to the parents of those with multiple disabilities for the parents to continue the teachings at home to improve the learning needs of their wards. Those in a regular class could have their class participatory recorded and sent to the phones of their parents for them to see their improvement or otherwise. This makes students alert and attentive when they

are in class. (Hasselbring, Glaser et al., 2000) in their research on the use of technology to help students with special needs concludes in their findings that a lack of adequate training of teachers in technology has led to the exclusion of students with special needs in their classroom but could be changed if the teacher is trained on which technology to use in their classes. They, however, did not highlight the use of mobile technology in isolation for which the researcher sought to relate his study to. Sanchez-Gordon & Luján-Mora., 2016 assert that mobile technology could be retrofitted to meet the learning needs of all individuals. Their assertions were backed by (Bausch, Ault & Hasselbring., 2015) who say mobile technology could be created to meet the learning needs of students with special needs. (Puccini, Puccini, & Chang., 2013; Reid, Strnadova, & Cumming., 2013) think that mobile technology can provide multi-sensory learning opportunities for students with varying needs.

The mobile applications as interactive tools**:** The traditional classroom of a Ghanaian teacher makes the environment local champion situation where a teacher is the master of his class and that all he knows is what is regenerated for every year group of students. Teachers do not have an avenue where ideas are shared regarding their class activities. They are always in their comfort zones not ready to explore more challenging areas that could help in the style of delivering their lessons. (Clement & Vanden- Berghe 2000; Burbank & Kauchak 2003; Aubusson et al., 2007) explain this as collaborative learning which they say is critical to the professional learning of teachers. Their study saw teachers' collaboration as a way of making them active in the production of knowledge. The knowledge produced and shared by teachers with colleagues all contributes to the professional development of teachers as seen by (Noddings

& Witherell, 1991). For these reasons, the mobile phone application is a suitable tool that could enhance the collaborations among teachers which is a driving tool for teacher professional development. Mobile applications such as facebook, WhatsApp, Twitter, Viber just to mention but a few are common applications that when used properly could help teachers interact more often. These applications allow teachers to record and share their teaching, have conference calls during reflection times to try and share out their thoughts on contents posted on their platforms. (Aubusson, Schuck & Burden 2017) concluded in their study that learning with mobile phone applications provide the teachers with an unrealized opportunity for them to facilitate their observation, critique and sharing of activities in their respective classroom.

The Educational benefits of Teachers using Mobile Phone Applications in Lesson Delivery

The use of mobile phone applications has several educational benefits that could help stakeholders get value for their effort being made to improve the performance and standard of education. Some of the benefits are highlighted as follows:

General Improvement in the Academic Performance of Students*:* One of the benefits that come along with teachers using mobile phone applications in their lesson delivery is that they increase the performance of students. The educational mobile phone applications like text video players allow the teacher to download and play out videos relating to the content of study instead of trying every means to get the student to learn by rote means. The applications can get materials from different sources and will be able to build a mental picture of concepts which aids at retention and hence increase academic performance.

(Miller, 2015) in his study too found out the effects of the mobile phone usage by students about their performance showed a slight improvement probably because teachers were not in tuned with the technology. However, where the coach, in this case, the teacher has a better understanding and controls its usage the performance will increase more. (Coe, Aloisi, Higgins, & Major, 2014) share the idea that where the teacher spear-heads every new reformation it outcome is positive as compared to their neglect. During teaching, teachers can use the recording features of the mobile device to capture or record the works of students and could be sent to their parents whose majority are mobile phone users. A who knows that his or her works and activities in class are recorded and will be sent to their parents alone is a motivator that will arouse their interest in the learning process.

This creates collaboration between the school and home. This could evoke student to fully participate in in-class activities. The likelihood of understanding a lesson greatly rely on the readiness and involvement of students in classroom activities. Hara & Burke (1998) attributes children's academic performance at the early stage largely to the involvement of their parents. They said children whose parents take full interest and collaborate or complement the work of their wards' teachers perform better than those whose parents take little interest. Where mobile applications are integrated into teachers' delivery they can meet the need of every student the class. This includes those with special needs.

Improvement in the pedagogical and professional competencies of teachers using them**:** Another benefit that mobile phone applications bring to education is their ability to improve on the pedagogical skills of teachers as well

as their professional competencies. The methodology used by teachers can improve as well as decrease the performance of their students. The primary purpose of teaching at any level of education is to bring a fundamental change in the learner (Tebabal & Kahssay, 2011). They concluded in their study that, students are to be tasked for accomplishment rather than being asked to remember or memorize. The approach that the teacher will use is very key for them to accomplish those tasks. The mobile phone application is needed mostly to address this issue. The mobile phone can help the teacher access the appropriate teaching method to adopt for a particular lesson. The internet has a variety of information that can help the teacher some of which include the same lesson taught in different ways and all the teacher needs to do is to select the appropriate one that will suit their students. The internet application exposes teachers to new ways of solving existing challenges which include the approaches to teaching. Hudson-Ross, & McWhoter, (1996) said in their study that without new approaches to instructions that meet the changing needs of learners, their chances of poor performance is high so the need for teachers to explore for new ideas. The situation where teachers can teach with varying methods with a vast amount of content to deliver, they are building their professional competencies thus skills that they are learning from their job. The overall impact will be positive on educational outcomes which are key to a nation's development.

Increases in productivity of teachers*:* Aside from student performance and teachers professional development increase teacher work output is also a benefit that mobile phone application will bring to the educational system. Every employer expects the best from their employees thus the expect them to

put up their best for the overall goal of the organization to be met. For this to be realized there is the need to make materials readily available for the employees to work with. In an educational institution, the teacher has only the textbook, syllabus and charts as their primary source of content for their students. This affects their productivity which has an overall impact on the institution. The era of mobile phone applications means a teacher who owns a mobile device has the opportunity to get all forms of instructional media ranging from audio to video, text, multimedia and others all in in one device. The loving aspect is its portability nature, it means teachers can have access to any information they need before during and after a lesson. This is a motivator for teachers to improve on their output of work. However, this has not happened yet to a large extent. Kirschner and Selinger (2003) think in the same direction as they say technology which includes mobile devices are integral tools in the teaching field. Ferry & Ferry, (2009) think that mobile phone technology is providing the professional growth of teachers. This is to say for teachers to be able to put up much effort in the field of work, there will be a need for teachers to integrate mobile phone applications to their teaching.

Give teachers access to a variety of information and content: Mobile phone applications when properly used could give teachers access to a variety of content needed for a particular lesson. Teachers in the classroom as said earlier rely only on the textbooks given as their instructional materials which they rely on to teach their students. The coming of the mobile device comes with various features which could help individuals explore to solve challenges of life. An application could be specially designed for all basic school teachers to download and install onto their phones which will boost them to give up their

best given the availability of resources. Apart from building a whole application for basic schools, all the information needed is on the internet and you need to do is access the information needed using your mobile phone be it content, materials or methodology. Valk, Rashid, & Elder, (2014) said in their work that mobile phone application helps to improve access to education while maintaining the quality being delivered. They added that mobile phone devices have made learning to occur at any place at any time. (Pouezevara & Khan, 2007) thinks the use of mobile applications is best suited for English language teachers since they are mostly used to the words of the language. Teachers who leave in the remotest parts of the country and may not be privileged to get access to new materials when released need not worry because the mobile applications that could keep them up to date with information and content without the need to travel.

Cost benefits of using Mobile Phone Technology as compared to other Educational Interventions by Stakeholders

The use of mobile phone applications has a lot of benefits to stakeholders of education as it saves cost. More elaborations will throw more light on the issue.

Printing of teacher's textbooks and syllabi versus mobile applications**:** all teaching textbooks in Ghana has to be printed and sent to the regions who intend sent them further to the districts who then goes for the materials for teachers to use. Mobile phones have applications such as Portable Document Format (PDF), office suite just to mention a few. The PDF is a way of storing the file such that they not easily edited. The textbooks and syllabi could be saved as PDF and sent to teachers via an interactive mobile application. Comparing

that to the cost of printing for the total number of teachers. The monies from these could be channeled to different projects all in the name of developing the educational sector in Ghana. Valk, Rashid, & Elder, (2014) in a conclusion to their study think the opportunity cost of investing in mobile learning as compared to other educational technology has cost-benefits stakeholders. They, therefore, recommended that instead of government investing in one-laptop per teacher, they could channel those funds to developing other aspects by building classroom blocks for those lacking infrastructure. (Choi et al., 2011 & Lee et al. 2012) all recommend the use of electronic textbooks instead of printed ones due to the ability to include multimedia resources which the printed textbooks lack.

Cost of transporting printed materials to their destination**:** printed hard copies of textbooks are done at the national level and later distributed among the regions who later dispatch the to the various district directorate for onward distributions. District directors of education sometimes complain of lack of funds to further transport the materials to the various schools and hence the cost is left upon the shoulders of heads of schools. These heads sometimes have to fund the bills by levying the parents of students. This is a challenge hindering the achievement of the Free Compulsory Universal Basic Education enshrined the constitution of the Republic of Ghana. To resolve these researchers have proposed that textbooks be stored in the form of electronic materials where teachers can access using their mobile devices. (Motlik, 2008; Sharples, Taylor, & Vavoula, 2007; Traxler & Dearden, 2005) in their study pointed to the fact that students and teachers in the remotest parts of the state stand an equal chance of benefiting from mobile learning as they will not have to pay for their materials to be delivered.

Time of accessing new materials**:** just as the cost of transportation, time of accessibility is another hindrance which will need mobile applications to solve. With materials being delivered at the various district for onwards distributions, certain school are unable to pick them up in time and by they are picked up some students elsewhere might have received and used the materials for their studies. This is unfair as they will all sit for common nation examination regardless of who received their materials in time.

Mobile phone applications as compared to government flagship program which is one laptop teacher in the past have seen most teachers not benefiting from it. Those who benefited some had the difficulty using them and others not seeing their value sold theirs out. But with mobile phones, teachers are comfortable using them. The only need is for policymakers to change toward the direction of new and innovative ways of doing things. The government would not need to purchase laptops since teachers already have their mobile devices. The government in collaboration with software developers could channel a fraction of that money to developing educational applications. All that teachers need to do is to be part of the process and they will be self-motivated to download the materials into their mobile devices and use.

CHAPTER THREE

RESEARCH METHODS

Introduction

The problem of inadequacy of teaching and learning materials at the basic level of education in Ghana has resulted in the falling standard of education. This has led to teachers delivering the lessons mostly in abstract and has caused most students to poorly perform at the end of their basic levels. The purpose of this study is to explore and find out to what extent mobile phone applications be used by basic school teachers as a tool to solve the problem of inadequate instructional materials. The chapter is divided into sections which include the research design, population, sample and sample technique, research instrument, data collection technique and data analysis technique.

Research Design

The research is descriptive in nature thus it is descriptive research which involved the use of the Mixed Method approach to collect data for analysis. Descriptive research is explained as a research method that describes the characteristics of a population which is being studied. Descriptive research as described by Adi (2019) is a method that focuses more on the "what" of a research subject rather than the "why". In brief, descriptive answers the question "what". This research covers "to what extent can mobile phone technology be used by teachers for teaching and learning".

Descriptive research is chosen over other research designs because this research involved the use of a mixed-method approach that encompasses both quantitative and qualitative approaches. Thus it gathers data from a variety of

methods which include surveys, case studies and observations all of which are used in this research. Other advantages of descriptive research are their ability to give a holistic understanding of a research topic due to the variety of data gathered. The data is gathered from the natural environment of the sampled population in descriptive research. This ensures that the data gathered is honest and highly relied on. Conducting descriptive research saves time as well as being economical. This is because the data can be gathered from any of the three methods or a combination of any. The survey, for instance, can reach a large number of participants even electronically and received the same without having to travel. To add up to the advantages, descriptive research can serve as the basis for further research as it seeks to find out "what" and upon finding out one takes up another research to find out the “why” and “how”. One shortcoming of the descriptive research is participants may give false responses to protect a wrong they may be doing.

This research employs a mixed-method approach. Mixed method research according to (Cameron, 2015) is a research approach that involves collecting, analyzing, and interpreting quantitative and qualitative data in a single study or in a series of studies that investigate the same underlying phenomenon. This approach focuses on the use of both quantitative and qualitative approaches to give a more comprehensive understanding of the research work. The mixed-method approach comes in various types, key of which include the following four by Creswell et al (2003). They are presented in Table 1.

Table 1: Advanced Mixed Methods Research Designs

Creswell et al. (2003)	Stage of integration	Implementation	Priority / Status
Sequential designs	Interpretation	QUAN→qual	Usually QUAN,
*Sequential explanatory			can be QUAL or
			equal
*Sequential exploratory	Interpretation	QUAL→quan	Usually QUAL,
			can be QUAN
			or equal
*Sequential	Interpretation	QUAL→QUAN	Either dominant
transformative		QUAN→QUAL	or both equal
Concurrent designs	Interpretation or	QUAL+QUAN	Equal
*Triangulation	analysis		
*Nested	Analysis	Qual within	Either dominant
		QUAN Quan	
		within QUAL	
*Transformative	Usually,	QUAL+QUAN	Either dominant
	analysis, can be		or both equal
	interpretation		

Source: Creswell et al (2003).

For this research, the sequential explanation design was adopted. This is because the quantitative data were collected and analyzed first and the result triggered the need for qualitative follow up. This ensured that there was corroboration of the results from the quantitative. Its implementation is easy and clear as well as the result of being easy to report.

The strength of adopting the mixed method over other methods is because, when the project is made of multiple phases, various approaches are required to be able to complete the task. The mixed-method is also used when the researcher wants to generalize the findings made for the quantitative research work. Furthermore, mixed-method research is chosen over either of the other two methods because it eliminates the weaknesses of quantitative and qualitative research. Their strength is rather combined to be able to come out with a comprehensive result.

One of the shortcomings of the mixed-method research is that it is complex thus it involves the use of more resources and time as compared to other methods. This is because the researcher has to perform two different research approaches which could have to be two separate research works.

A survey questionnaire was administered to a sample group to be able to answer the research question; what are the benefits of using mobile phone applications by teachers in lesson delivery if any? The researcher had control over the mobile phone application but wanted to find out how beneficial the applications was to teachers of basic schools. Survey research is defined as "the collection of information from a sample of individuals through their responses to questions" (Check & Schutt, 2012, p. 160). Singleton & Straits (2009) think surveys are frequently used in social and psychological research. The descriptive survey was used since data was needed from teachers from the basic schools. They are the custodians of students at the foundation of the academic ladder and have a greater share of the causes of the poor performance of students. Again the research is geared on how the teachers can use their phones as a supplement for instructional materials. The researcher opted for a

descriptive survey, as a result, its ability to make inferential from a sample to the whole population. As compared to the exploratory research, descriptive research is preplanned and structured in design so the information collected can be statistically inferred on a population. A pilot test was done by administering the questionnaire from the research questions to thirty-five (35) teachers from the various schools in the circuit who were curriculum leads and two kindergarten teachers each. The purpose was for them to check spelling, grammar errors and good construction of sentences as a way of validate the questions. The corrected version was then administered to the target respondent.

Population

The population can be described as a well-defined collection of individuals or objects that are known to have similar characteristics. Population can also be explained as an aggregate or totality of all the objects, subjects or members that conform to a set of specifications (Polit & Hungler 1999, p37). The research targeted all public basic school teachers in Abura Asebu Kwamankese. This includes teachers from the kindergarten, lower primary, upper primary and the junior high levels respectively. The research could have covered all basic school teachers from both public and private school but the researcher wanted to get teachers who have at least a Diploma in Basic Education.

The population included teachers of both sexes as well as ages ranging from 20 to 59 who are in active service. The accessible population was basic school teachers from the Moree Circuit in the AAK district in the central region of Ghana. The AAK District Education Directorate has a total of 107 public basic schools and 1300 teachers in these schools. Moree circuit under the district

was the main focus. This is because the Moree circuit was closer to the researcher. The time limit and resources available can only make for the selected places to cover. The circuit also has a mix geographical areas thus from rural to urban. But the results stand a better chance of being generalized to the whole population. The accessible population of 184 teachers, 13 headteachers and one District Education Training Officer, the total population was 198 in all.

Sample and Sampling Procedures

Sampling is a process or technique of choosing a sub-group from a population to participate in the study; it is the process of selecting several individuals for a study in such a way that the individuals selected represent the large group from which they were selected (Ogula, 2005).

This study made use of probability sampling. It is explained as a technique of selecting any sampling scheme in which the probability of choosing each individual is the same (or at least known, so it can be readjusted mathematically). This technique can also be called random sampling. They require more work but are much more accurate. There are four main types of techniques under the probability sampling which include; simple random sampling, systematic sampling, stratified sampling, and cluster sampling (Gaganpreet, 2017).

For purposes of this study, the stratified sampling procedure was adapted. This is a method of sampling that involves the division of a population into smaller groups known as the strata. In stratified random sampling, the strata are formed based on members that shared attributes or characteristics. A random sample from each stratum is taken in a number proportional to the

stratum's size when compared to the population. These subsets of the strata are then pooled from a random sample.

The stratified random sample aims to reduce the potential for human bias in the selection of cases to be included in the sample. As a result, the stratified random sample provides us with a sample that is highly representative of the population being studied, assuming that there is limited missing data. Since the units selected for inclusion in the sample are chosen using probabilistic methods, stratified random sampling allows us to make generalizations (i.e. statistical inferences) from the sample to the population. This is a major advantage because such generalizations are more likely to be considered to have external validity. When there is homogeneity within strata and heterogeneity between strata, the estimates can be as precise (or even more precise) as with the use of simple random sampling.

One of the challenges of the stratified technique is that Stratified Sampling is not useful when the population cannot be exhaustively partitioned into disjoint subgroups. It would be a misapplication of the technique to make subgroups sample sizes proportional to the amount of data available from the subgroups, rather than scaling sample sizes to subgroup sizes

There was a total number of 13 schools in the Moree Circuit which was made up the strata. Out of the number each stratum's size was determined by the population in the stratum divided by the total population and multiplied by total sample. Thus a formula used to get the size for each stratum.

$$\frac{stratum}{population} \times total\ sample$$

The formulae were entered in Microsoft Excel to determine the number to be selected from each stratum. Table 2 explains the details of the selection

procedure. At each stratum, the researcher used a simple random technique which involved talking to the use of yes or no. The researcher first explained to the staff of each school for them to agree that those who will choose yes will be considered for the survey whereas no will be left out. Pieces of paper with the number with the yes and no inscription was folded and placed on a table for the teachers to select. This gave equal opportunity to every teacher to be selected. The number of yes papers was determined based on the number expected from that stratum.

For the interview session, the researcher went in for the non-probability sampling and specifically the purposive or the judgmental sampling procedure. In purposive sampling procedure, the researcher chooses the sample based on who he/she thinks would be appropriate for the study. The main objective of purposive sampling is to arrive at a sample that can adequately answer the research objectives. The selection of a purposive sample is often accomplished by applying expert knowledge of the target population to select in a non-random manner a sample that represents a cross-section of the population (Henry, 1990). In this case, the District Education Training Officer (DETO) and the heads of the 13 schools were selected based on purpose thus the expertise and their supervision of teachers respectively.

The target group was all the public basic school teachers in Moree Circuit. Moree circuit is made up of three major towns namely Moree, Amosima, and Brafoyaw. It also has rural areas such as Abura Edukrom and Wiamoa. Moree being the urban community among them. The town is near the Cape Coast Metropolis in the central regional capital and a coastal town as well. It has the largest population in the district (Abura Asebu Kwamankese). The

town has four public schools and several private schools. The public basic schools are three mission schools thus Catholic Kindergarten, Primary A & B and JHS A & B; Methodist basic and Islamic basic schools respectively as well as a District Assembly School thus Moree D/A Kindergarten, Primary A & B and JHS A & B. Each of the public basic schools is made of two streams thus a double stream for each from the kindergarten through to junior high except the Islamic.

Brafoyaw is another urban community with mixed cultural groups since it serves as the residence to most workers coming to Cape Coast for their jobs. Brafoyaw had one public school which runs a double stream system for the primary and a single stream for the junior high school Brafoyaw Zion Kindergarten, Primary A, Primary B and JHS.

Amosima is about 8 kilometres from Eguase nearer the Cape Coast toll booth. Amosima has two public schools which run on single streams respectively. The nearest community to Amosima is Abura Edukrom which had only one public basic school. Wiamoa is the last community which also had one public basic school as well. The number of trained teachers for the entire public schools in the circuit to be one hundred and eighty-four (184). Out of the 184 teachers, 125 of them were chosen to be part of the study as the sampled group. All 13 headteachers were engaged in the interview as well as the District Training officer. A total of 139 made up the sampled size. The sample chosen from the 184 teachers to respond to the survey was based 95% confidence level with a 5% margin of error. A sample size calculator online was used to find the sample size (Hotjar, 2019) sample size calculator.

A summary of the sampling procedure is represented in table 1 showing the schools, the number of teachers and the percentage sampled from every school. It also shows the overall target for the research as participants.

Table 2: Summary of the Population and the Sampled Size

School	Population strata	Sampled size (stratum)	Sample Rounded
Moree D/A K.G. & primary	16	10.86	11
Moree D/A JHS	10	6.79	7
Moree Methodist basic	26	17.66	18
Moree Catholic K.G & Primary	16	10.86	11
Moree Catholic JHS	10	6.79	7
Moree Junction Islamic basic	12	8.15	8
Brafoyaw Zion K.G, Primary A & B and JHS	24	16.30	16
Amosima Methodist basic	18	12.22	12
Amosima Catholic basic	16	10.86	11
Abura Edukrom D/A basic	16	10.86	11
Wiamoa Catholic basic	20	13.58	14
Total teachers	184	125	125
Headteachers	13	13	13
District Training officer	1	1	1
Overall Total	198	139	139

Source: Field Survey, 2019

Data Collection Instruments

This study was a mixed-method approach to getting data. Thus it involved more than one form of data-gathering instruments. For this study, the survey questionnaire and the interview were used. The survey questionnaire was the primary source of data collected and formed the basis of the interview session. The survey questionnaire was meant for the teachers in the 13 public basic schools the Moree Circuit whereas the interview was for all the 13 headteachers of those schools together with the District Education Training Officer (DETO).

The researcher used a survey questionnaire to collect data from the teachers because, data needed for the study primarily came from teachers and since the teachers could read and understand, it was the convenient choice. The questionnaire was chosen over other instruments as the primary instrument because it could be answered concurrently by teachers and thus save time. There were certain questions that some respondents may not be comfortable giving out face to face with the researcher but could do so when they answer questions knowing their identity would remain anonymous. The questionnaire was able to get more respondents at that limited time to respond for the study as compared to observations and interviews. (Birmingham & Wilkinson, 2014) tipped the questionnaire to the other instruments because the questionnaire gave accurate data to the researcher. They also thought the questionnaire was cost-effective as compared to the other research instrument. (Birmingham & Wilkinson, 2014) grouped questionnaire into three broad types which included box mail survey, group-administered questionnaire and household drop-off survey.

The survey questionnaire was developed by the researcher and sent to the supervisor for editing. The survey was then administered on a pilot base for 35 teachers made up of the curriculum leaders for the participating schools and their kindergarten teachers who were attending a training workshop at the circuit centre. The purpose of the pilot was to get the teachers to answer the questions and check for further spelling errors that needed corrections. The questions set for respondents to respond to were crafted from the research questions being a guide. The objective is to find out how the independent variable being the mobile phone technology could be used to arrive at the dependent variables which include: teachers experience with their mobile phones in their line of duty; educational-benefits to stakeholders and cost-benefits to stakeholders.

The researcher used the scale item format in crafting the questions which were in statements form. There were different ways of crafting a questionnaire based on the scale item format but the researcher used the Likert scale. Questions were asked and a scale of options given for respondents to choose from. The options were in a rating scale of 1 to 5 and consisted of the positivity to low through to negativity of the response to the question. Rating scale items such as:

1 – Strongly disagree

2 - Disagree

3 – Undecided

4 – Agree

5 – Strongly agree

The questions were in four parts with part 1 being the bio-data of teachers and their experience with their mobile phones. Part 2 was about

whether they use their mobile phones to teach. Part 3 was about the educational benefits of using their mobile phones' technology to teach. Part 4 was about the cost benefits of using their mobile phone technology to teach. The questionnaire and the results of the pilot test are presented in tables at the appendices A and F respectively.

Reliability and Validity of the Questionnaire

As mentioned earlier, the questionnaire was submitted to the supervisor for scrutiny and then piloted for all errors to be corrected. The questionnaire was coded into SPSS and tested for reliability and the outcome of the *Cronbach's Alpha* was 0.817 with 39 items. The table of the Cronbach's Alpha is shown at appendix D.

An interview guide was administered to the heads of the schools in Moree circuit. The purpose for that interview was to get the heads to confirm or otherwise some of the questions answered by the teachers on the usage of mobile phone for teaching. The heads were in the best position to determine since they were the supervisors of the teachers and monitors their works at school. The interview guide was also made of (YES or NO) multiple choice for them to select for particular questions answered by the teachers. There was an opened ended question for them to access the independent variable with regards to whether teachers could use their mobile phone in the school for teaching.

Data Collection Procedures

Data was collected from two main sources that are from primary and secondary sources. The primary source of data was gathered from the immediate account of individuals who were directly connected with the information you need. The researcher gathered the primary data mainly from surveys (questionnaire), interviews were used to support the results of the questionnaire. The questionnaire was administered to the sampled teachers from Moree circuit in Abura Asebu Kwamankese (AAK) District in Central region of Ghana. Teachers were scheduled to answer the questionnaire at their schools. Each school was administered on a separate day. The questionnaire was given out and the researcher returned the following day for the results. The interview was held with the various headteachers after the questionnaire from the teachers were analysed. The interview with the District Education Training Officer (DETO) was the last data gathered and it was arranged through a phone conversation. The researcher had challenges meeting face to face with the DETO and so had to schedule for the session to be done through mobile phone recording. The recording was later played and transcribed for analysis.

However, the secondary data which refer to the data gathered from refined and processed data such as journals, articles and other research works related to this research work. Some of the secondary sources for this research work are newspapers (e.g. The Business and Financial Times thebft, April 10, 2017) on the influx of smart mobile phones in to the Ghanaian economy; the Central Intelligence Agency (CIA) statistics on Mobile phone subscriptions as compared to the population of Ghana as at July, 2016; The effectiveness of teachers during lesson delivery as echoed by (Coe, Aloisi, et al., 2014).

Data Processing and Analysis

The data collected from the survey questionnaire were analyzed using the SPSS software as a tool. The research questions were entered into the software and run to check for errors that might have to occur during the filling of the questionnaire. The descriptive test was run with a display of no error from the frequency tables presented.

As the study was descriptive, the study made use of the descriptive statics during the analysis stage. The tools that were reported included the mean, mode and standard deviations. The study also made use of percentages. The overall results of the analysis were represented on frequency tables.

Descriptive statistics helped to simplify large amounts of data sensibly. Each descriptive statistic reduces lots of data into a simpler summary. The graphs and charts are a pictorial representation of the results.

Descriptive statistics, therefore, enables researchers to present their data in a more meaningful way, which allows simpler interpretation of the data. It is useful to summarize our group of data using a combination of tabulated description.

For the research questions 1 and 2, the mean and standard deviations were reported respectively during the analysis. For research question 3, most of it was a content analysis of the interview guide. The interview session with the DETO was recorded electronically and later played for transcribing.

Results from the questionnaire formed the basis for the interview guide that was administered to the headteachers of the 13 basic schools of the survey participants as well as the District Education Training Officer of the Abura Asebu Kwamankese District.

Chapter Summary

This chapter was the research's methodology which saw the researcher adopted the descriptive study. The mixed-method approach was used in the primary data collection whereas article reviews formed the source of secondary data for the study. Though the mixed-method approach was used, the researcher made use of only the survey questionnaire and the interviews as the research instruments. A sample of 138 out of 198 target population was selected to be part of the study. One of the challenges faced with the research design was the approach used, the mixed method was supposed to include instruments such as survey questionnaire, interviews and observation. However, the study made away with the observation since the researcher couldn't have gone to the schools to observe individual participants.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

The purpose of this research was to establish the educational benefits of involving mobile phone technology by teachers in their lesson delivery. It was also to ascertain the cost benefits that came with the use of mobile phone technology by teachers of basic schools in their teaching processes as compared teachers using hard and tangible teaching and learning materials. The last purpose was to establish how teachers could use their mobile phones effectively in their lesson delivery to ensure improvement in the performance of their students.

This research was conducted at the Abura Asebu Kwamankese District in the Central Region of Ghana. The research targeted basic school teachers in the directorate and specific reference to those in the Moree Circuit. The research was focused on public basic schools only. Table 3 shows the details of the gender of the respondents.

Table 3: Gender

Category	Frequency	Percentage
Male	51	40.8
Female	74	59.2
Total	125	100.0

Source: Field Survey (2019)

A total of 125 teachers were selected from all the basic schools in the circuit to be part of the survey. All 13 headteachers of the various schools were also selected to respond to an interview session. One other official (The District

Training Officer) from the district was chosen to also respond to another interview. Amosima Methodist Basic School was chosen as an observed school. This made up a total sample of 139 participants. Out of the number, the majority were females, 55 were males whereas 84 were females. Table 4 was the details of the age categories of the respondents.

Table 4: Age of Respondents

Age	Frequency	Percentage
20 – 29	11	8.8
30 – 39	71	56.8
40 – 49	39	31.2
50 – 59	4	3.2
Total	125	100.0

Source: Field Survey (2019)

The ages of the teachers ranged from 20 to 59. Out of the number, 11 of them representing 8.8% age ranged 20 and 29; 71 of them representing 56.8% age ranged 30 and 39; 39 0f them representing 31.2% age ranged 40 and 49 and 4 of them representing 3.2 age ranged 50 and 59.

Table 5 showed the result of respondents with or without mobile phones.

Table 5: Ownership of Mobile Phone

Response	Frequency	Percentage
Yes	125	100.0
No	-	-
Total	125	100.0

Source: Field Survey, 2019

The first part of the questionnaire sought to find out the familiarity of teachers with the use of the mobile phone. Six questions that were made of "*Yes*" or "*No*" were posed to teachers. Question 1 wanted to know the number of teachers who owned a mobile phone. All the teachers representing 100% affirmed to indicate they had mobile phones. Thus all the teachers who took part in the survey owned mobile phones. This affirms The Business and financial Times publication in April 2017 on their observation of the penetration of mobile phones into Ghana.

Table 6 showed the result of respondents whose mobile phones are smart and those that were not.

Table 6: Smart Phone or Not

Response	Frequency	Percentage
Yes	120	96.0
No	5	4.0
Total	125	100.0

Source: Field Survey, 2019

The second question was to find out the number of mobile phones which teachers used was smartphones thus that run on *Android* and other mobile operating systems. The results as shown in table 6 indicated that 120 (96.0%) of the teachers had their mobile phones to be smartphones whereas only 5 (4.0%) of them were using phones which were not smartphones. This is in agreement with the assertion of the CIA's (July, 2016) statistics on Ghana about the number of Mobile subscriptions against the population of Ghana. Table 7 shows the results of the number of respondents who are able to download applications from their phone`s play store or apple store.

Table 7: Ability to download and install Applications from the Play Store.

Response	Frequency	Percentage
Yes	114	91.2
No	11	8.8
Total	125	100.0

Source: Field Survey, 2019

The next question was to find out teachers who were able to download and install applications from the play store of their phones. From Table 7, a total of 144 (91.2%) were able to download and install applications from the play store whereas 11 (8.8%) could not. This indicated that most of the teachers can install applications on their phones.

Table 8 shows the results of respondents on whether they use their mobile phone applications to teach.

Table 8: Mobile phone`s applications for teaching.

Response	Frequency	Percentage
Yes	73	58.4
No	52	41.6
Total	125	100.0

Source: Field Survey, 2019

The next question of the questionnaire wanted to know if the teachers used their mobile phone technology to teach and their responses and results were presented in Table 8. From the table, 73 (58.4%) responded yes to using applications on their phone to teach whereas 52 (41.6%) do not.

Table 9 presented the results of respondents who installed applications relating to their field of teaching.

Table 9: Installation of Applications Relating to Field of Teaching.

Response	Frequency	Percentage
Yes	81	64.8
No	44	35.2
Total	125	100.0

Source: Field Survey, 2019

Question 5 wanted to get the teachers to respond to whether they have installed any application related to their area of teaching. The results as shown in table 9 indicated that 81(64.8%) of the teachers responded positively to installing applications relating to their area of teaching whereas 44 (35.2%) responding otherwise.

Table 10 showed the results of the number of respondents who state the mobile phone as a learning resource in their lesson notes.

Table 10: Stating the Mobile Phone as a Teaching and Learning Resource

Response	Frequency	Percentage
Yes	35	28.0
No	90	72.0
Total	125	100.0

Source: Field Survey, 2019

The last question of this part wanted to know from teachers if they state the mobile phone as part of the Teaching and Learning Resources (TLRs) aspect of their lesson notes. The results as presented in Table 10 showed that only 35 (28.0%) do state the mobile phone as part of their TLMs whereas 90 (72.0%) do not do so. This is in contrast with the 64.8% who said they have applications related to their area of teaching. They are either not effectively using it or they

do not have the opportunity to be enlightened more on the use of the mobile phone.

Table 11 showed the results of a category of mobile phone applications that are often downloaded by the respondents.

Table 11: Mobile Phone Application Category often downloaded

Category	Frequency	Percentage
Games	12	9.6
Social media	23	18.4
Lifestyle	5	4.0
Education	70	56.0
Others	15	12.0
Total	125	100.0

Source: Field Survey 2019

The final statement of part 1 of the questionnaire asked to underline one mobile application they often download from a category provided. The results as shown in Table 11 indicated that 12 (9.6%) often downloaded games related applications, 23 (18.4%) underlined social media applications, 5 (4.0%) underlined lifestyle applications, 70 (56.0%) underlined educational related applications and 15 (12.0%) underlined other categories of applications.

Table 12 showed the results of responses to part 2 of the questionnaire.

Table 12: Usage of Mobile Phone's Technology in Lesson Delivery

S/n	Statement	No.	Mean	SD
1.	I Use my mobile phone for research during lesson note preparation	125	1.97	0.659
2.	I Use my mobile phone for downloading TLMs	125	1.72	0.590
3.	I Downloaded an education app to enhance my area of teaching	125	1.60	0.582
4.	I Downloaded the teaching syllabus onto my phone	125	1.70	0.638
5.	I Use the camera function as a motivator to students work	125	1.68	0.691
6.	I Use the recording function of my phone to record and play later for students during lessons	125	1.72	0.655
7.	I use my phone to support persons with disabilities	125	1.67	0.681
8.	I interact with colleagues about subject areas before teaching in class	125	1.68	0.590
9.	I share my lesson for the day on social media for friends to critique	125	1.64	0.677
10	I receive and use critique from friends for improvement	125	1.89	0.625
	Valid N (list wise)		1.727	0.639

Source: Field Survey, 2019

Part 2 of the questionnaire sought to find out from teachers whether they use their mobile phone for teaching and learning and thus before, during and

after a lesson. The results of their responses were presented in Table 12. The analysis of this part will involve the use of the mean and standard deviation (std). As explained in chapter three on the data collection instruments, this part involve the use of the Likert's Scale of which 1 represented respondents strongly disagreeing to a statement posed, 2 for disagreeing, 3 for respondents indecisiveness (undecided), 4 for agreeing and 5 for strongly agreeing to a statement presented in the question. Most of the results will be analyzed using the mean for each question.

Statement 1 suggested teachers use their mobile phone applications to access information from various sources during the preparation of their lesson notes. The results as presented in Table 12 indicated [mean = 1.97; std = 0.659]. A mean of 1.97 is approximately 2 which represented most of the teachers disagreeing with using their mobile phone applications to access information while planning for a lesson. This is in line with the researcher's view of teachers not using their mobile phones to aid their work professionally.

Statement 2 sought to find out if teachers use their mobile phones' internet technology to download learning aids such as charts from the internet. The results from Table 12 indicated [mean = 1.72; std = 0.590]. The mean of 1.72 is approximately 2 which represented that most of the teachers disagreed with the statement and thus do not use their phones internet technology to download charts. Their response corresponded to the findings made by (Clement & Vanden- Berghe 2000; Burbank & Kauchak 2003; Aubusson et al., 2007) that teachers were always in their comfort zone and were not ready to explore more areas that could help in their style of delivery.

Statement 3 wanted to get the teachers' view as to whether they had downloaded any educational application on to their mobile phones. The results as shown in Table 12 indicated [mean = 1.60; std = 0.582]. The mean for the responses of for statement 3 was 1.60 which could be classified as most teachers disagreed with the statement and thus most of them had not downloaded any educational application on to their mobile phones.

Statement 4 sought the views of teachers as to whether they have downloaded the teaching syllabus on to their phones from the internet. The results as shown in Table 12 indicated [mean = 1.70; std = 0.638]. The result showed most teachers disagreed with the statement of downloading the syllabus for personal use. This might be due to teachers comfortable using the hard copy of the syllabus as found by (Clement & Vanden- Berghe 2000; Burbank & Kauchak 2003; Aubusson et al., 2007).

Statement 5 sought to find out from the teachers whether they use the video camera function of their mobile phones. The results as shown as shown in Table 12 showed [mean = 1.68; std = 0.691]. This indicated that a mean of 2 which represented most teachers disagreed with the statement. This is to say that most teachers do not use the camera function to record their lessons as well as capture interesting moments of their students to serve as a motivation. This assertion is in sharp contrast with Rikala (2013) whose study found out that most mobile devices and their applications are mostly used by teachers during field trip lessons, nature walks as well as games during lessons. This is different in the case of respondents of this research work.

Statement 6 was about teachers using the sound recording function of their mobile phones during their lesson delivery. The results of their responses

were outlined in Table 12. The results showed [mean = 1.72; std = 0.655]. The mean of 1.72 is approximately 2 which meant most of the teachers do use the sound recording functions of their mobile phones during lesson deliveries. Teachers especially language teachers can take the opportunity of the mobile phones to record and a news bulleting and play to students later in class for them to review and use that to develop their language skills according to Rikala (2013). Thus recorded voices of students could be captured and later played to them.

Statement 7 wanted to know if teachers use their mobile phones' technology to help persons with special needs. This could range from learning disabilities to an impairment. The results as shown in Table 12 gave an outcome of [mean = 1.67; std = 0.681]. The results indicated that most teachers do use their mobile phone as an aid to help students with some form of disability. Their response contrasted with (Hasselbring, Glaser et al., 2000). In their research on the use of technology to help students with special needs, they concluded in their findings that a lack of adequate training of teachers in technology has led to the exclusion of students with special needs in their classroom but could be changed if the teachers were trained on which technology to use in their classes. Their response also contrasted with (Sanchez-Gordon & Luján-Mora., 2016) who asserted that mobile technology could be retrofitted to meet the learning needs of all individuals. Their assertions were backed by (Bausch, Ault & Hasselbring., 2015) who said mobile technology could be created to meet the learning needs of students with special needs.

Statement 8 of the questionnaire further wanted to know from teachers the few who uses their mobile phone whether they interact with colleagues on

social media platform about topics they are yet to teach. Their responses as shown in Table 12 indicated [mean = 1.68; std = 0.590]. Their responses showed that most teachers do make use of the social media technology of their mobile phones to prepare and get varied ideas about a topic they are about to teach. These results contrasted the views of (Aubusson, Schuck & Burden 2017) concluded in their study that learning with mobile phone applications provide the teachers with an unrealized opportunity for them to facilitate their observation, critique, and sharing of activities in their respective classroom.

Statement 9 of the part 2 questionnaire wanted to know if teachers use their mobile phone's social media function to perform post-lesson analysis. Thus if teachers share their experience of a lesson on their social media platform for friends to critique. Their responses as shown in Table 12 indicated [mean = 1.64; std = 0.677]. This result represented most teachers were not reviewing their lessons on social media platforms after teaching for their friends to critique.

Statement 10 sought to find out from teachers whether the few who put up their lesson reviews on their social media platforms do receive feedback from their friend. The results of the statement as represented in Table 12 indicated [mean = 1.89; std = 0.625]. The results showed that most teachers do not receive their feedback when they posted a review of their lessons on social platforms.

Overall, an average mean of 1.727 and a standard deviation of 0.639 was realized from the entire part 2 of the questionnaire. This may give an idea that teachers might not have realized they had such a powerful teaching and learning tool.

Table 13 showed the results of the educational benefits of teachers using their mobile phone technology in the lesson delivery.

Table 13: Educational Benefits of Teachers using their Mobile Phone applications in Lesson Delivery (Part 3)

S/N	Statement	N	Mean	Standard Deviation
1	Mobile phones used in class help students` understanding.	125	4.16	1.003
2	Internet content serves as a supplement to textbooks from GES	125	4.14	0.922
3	Variety of teaching materials helps in improving teacher professional competences	125	4.27	0.937
4	Collaboration between teachers on a platform before lessons helps develop teaching methods	125	3.79	1.117
5	Access to a variety of content increases productivity	125	4.31	1.011
6	The Internet provides more information as compared to textbooks	125	4.06	0.998
7	Mobile phone stores more information than textbooks	125	3.76	1.110
8	Mobile phones can be a tool for collaboration between teachers and parents	125	3.91	0.880
9	Mobile phones can be used to send students assignments to parents during holidays	125	3.72	1.082
10	Mobile phones can help teachers receive up to date materials from curriculum developers	125	4.29	0.850
	Valid N (listwise)	125	4.041	0.991

Source: Field Survey, 2019

Part 3 of the question was carved from research question 1 which was: what are the educational benefits of teachers using their mobile phones'

applications in their lesson delivery? A Likert Scale questionnaire made up of ten statements were posed to teachers to answer based on their personal view on what the educational benefits will be for them when they use their mobile phone applications to teach. The results of their responses are discussed as follows;

The first statement enquired from teachers if they thought downloading video and audio materials relating to their area of teaching and playing them out to students during lessons will help students to understand the lessons. The results from teachers as represented in Table 13 indicated [mean = 4.16; std = 1.003]. These results can be interpreted as most of the teachers with a mean of 4.16 approximately 4 agreed to the fact that videos and audios downloaded and played to teachers could help students to understand more. The results from the teachers were in line with Rashid, & Elder, (2014) who said in their work that mobile phone application helps to improve access to education while maintaining the quality being delivered. They added that mobile phone devices had made learning to occur at any place at any time. This was because the videos downloaded could be played during remedial to individual students or multiple students.

The second statement enquired from teachers if using the internet technology on their mobile phones that could serve as a supplement to textbooks in the class. Their results as presented in Table 13 indicated [mean = 4.14; std = 0.922]. The results from the table showed a mean of 4.14 which is approximately 4. A mean of 4 represented that most of the teachers agreed to statement 2 of the internet to be a source of getting supplement content for textbooks that they use to teach.

Statement three was meant to find out from teachers if they thought their professional competence could be enhanced as a result of accessing a variety of information using their mobile phone applications. The results of the responses as presented in Table 13. The results indicated [mean = 4.27; std = 0.937]. A mean of 4.24 is approximately 4 which meant most teachers agreed to the development of their professionalism when they use their mobile phone technology to access information. The results of their response agreed with (Noddings & Witherell, 1991). Their study revealed that knowledge produced and shared by teachers with colleagues all contribute to the professional development of teachers. This is when teachers share their experiences on social platforms.

Statement four was meant to get the teachers' views on whether collaboration with colleague teachers on social media platforms could be of help to them in developing good teaching and learning methods that could improve on performances of students. Their responses as shown in Table 13 indicated [mean = 3.79; std = 1.117]. The mean of 3.79 is just above the medium of 3 but nearer 4 which is "agree" on the Likert Scale. This results signified that a majority of teachers agreed that collaboration with colleagues on social media platforms could give them access to a good methodology for improved lesson delivery which could result in improved performance of their students. This response from the teachers followed the trend as discovered by (Hudson-Ross & McWhoter, 1996) in their study that without new approaches to instructions that meet the changing needs of learners, their chances of poor performance is high so the need for teachers to explore for new ideas. Thus the need for teachers

to collaborate to share ideas about changing trends that can positively affect the performance of their learners.

The statement five wanted to get the views of teachers about what their thoughts were with regards to them having access to a variety of lesson information and how whether that could increase the rate of work output at the workplace. The results of their response as shown in Table 13 indicated [mean = 4.31; std = 1.011]. The result from the table showed that most teachers with a mean of 4. 31 approximately 4 agreed to the statement. This meant that with teachers using their mobile phones to access a variety of information either from the internet or through social media platforms could help increase the work output of teachers. The results from their responses conformed to (Ferry, & Ferry, 2009) who felt that the mobile phone technology is providing the professional growth of teachers. This is because mobile phone technology is becoming an integral part of the teaching field (Kirschner & Selinger 2003).

Statement six sought to find out from teachers if the use of the mobile phone to access information from the internet is could bring more content than relying only on the textbooks provided. The responses of teachers to this statement as presented in Table 13 indicated [mean = 4.06; std = 0.99]. The results on this statement indicated a mean of approximately 4 which meant teachers agreed to the statement. Thus the internet provided more information as compared to the use of only the textbooks. This result confirms the assertion of (Valk, Rashid, & Elder, 2014) who said in their work that mobile phone application helps to improve access to education while maintaining the quality being delivered. Thus more information means an increase in their horizon of knowledge of which the teachers will be able to impart to students accurately.

Statement seven sought to get teachers' views about the capacity of mobile phone storing more information as compared to a textbook. The results of their responses as presented in Table 13 indicated [mean = 3.76; std = 1.110]. These results indicated a mean of approximately 4 which meant most teachers agreed to the statement. Thus the storage capacity of the mobile phone is more than textbook capacity. The mobile phone can keep thousands of text and image information as compared to a textbook.

Statement eight sought to find out from teachers if they thought the use of the mobile phone could create some form of collaboration between teachers and parents of their students. The results from teachers as presented in Table 13 showed [mean = 3.91; std = 0.880]. A mean of 3.91 (4) meant that most of the teachers agreed and believed that the mobile phone could serve as a collaborative tool that could connect parents and teachers. This they believe could help address promptly to feedback and vice versa. Their response is in line with the findings of (Hara & Burke 1998) who attributed children's academic performance at the early stage largely to the involvement of their parents. They said children whose parents took full interest and collaborate or complement the work of their wards' teachers performed better than those whose parents took little interest.

Statement nine of part three of the questionnaire sought to find out from teachers what their views were regarding parents receiving an assignment from teachers to be given to their wards even during weekends and vacations via the mobile phone. Their responses as presented in Table 13 indicated [mean = 3.72; std = 1.082]. This results showed that the majority of teachers with a mean of 3.72 (4) agreed to the idea of parents receiving an assignment on behalf of their

wards via mobile phones. This could continue the learning process even at home. It makes the parents involved in the education of their wards as confirmed by (Hara & Burke 1998) who attributed children's academic performance at the early stage largely to the involvement of their parents. They said children whose parents took full interest and collaborate or complement the work of their wards' teachers perform better than those whose parents took little interest.

Statement ten of part three of the questionnaire wanted the opinion of teachers as to whether they thought the mobile phone could help them be updated with new trends of educational materials. Their responses as shown in Table 13 indicated [mean = 4.29; std = 0.850]. The results showed that most of the teachers with a mean of 4.29 (4) agreed to the assertion that the use of their mobile phone could be of help since it keeps them updated with current trends of issues.

Part three of the questionnaire saw a mean of means to be 4.041 (4) and an average standard deviation of 0.991. A mean of 4 indicated that the majority of teachers thought the mobile phone could be used by the teacher to increase performance during the teaching and learning process.

Table 14 showed the results of the cost benefits of teachers using their mobile phone applications to enhance their lesson delivery.

Table 14 Cost benefits of teachers using their mobile phone applications to enhance lesson delivery (Part 4)

S/N	Statement	N	Mean	Standard Deviation
1	Syllabus in soft copy is more cost-effective than hard copies	125	3.73	1.328
2	Teacher's guide and syllabus in PDF format on my mobile phone	125	3.95	1.007
3	The cost of transporting books and materials is more costive than emailing softcopies	125	4.12	1.029
4	GES should develop its mobile application to have all the materials	125	4.43	.817
5	There is a delay in delivery of materials via transport	125	4.36	.846
6	Certain subject area textbooks have not received any consignment aside the first one	125	4.21	.978
7	Some subject areas lack the requisite teaching and learning aids	125	4.20	1.070
8	The remoteness of certain areas makes it difficult to access and supply them with textbook	125	4.35	.873
9	The use of mobile phones to teach is more cost-effective than supplying teachers with laptops	125	3.18	1.392
10	The mobile phone can be used to organize INSET on conferencing platforms	125	3.87	1.164
	Total(Mean of means)/Deviations	125	4.17	1.050
	Valid N (listwise)	125		

Source: Field Survey, 2019

Part four of the questionnaire was to answer the second research question which was: What are the cost benefits of teachers using their mobile phone applications in the educational setting as compared to other systems? Ten statements were posed in a Likert Scale format of which a mean of "1" meant teachers strongly disagreed with the statement, '2' meant teachers disagreed, "3" for teachers who not certain of their stands thus undecided, "4" meant teachers agreed and "5" meant teachers strongly agreed to the statement. The results of their responses were presented in tabular form in Table 14. A brief description of the results are as follows;

Statement one wanted to find out from teachers if they thought soft copy versions of syllabi and textbooks on their mobile phones were cost-effective as compared to printed versions. The results from Table 14 showed a mean of 3.73 and standard deviation of 1.328 [mean = 3.73; std = 1.328]. The results indicated that most of the teachers with an approximate mean of 4 agreed with the statement hence thought that the mobile version of teachers' guide and syllabi saves cost as compared to printed versions. This result is in tune with (Valk, Rashid, & Elder, 2014) who concluded their study and thought the opportunity cost of investing in mobile learning as compared to other educational technology is cost beneficial to stakeholders.

Statement two sought to find out from teachers whether they would like to have all of their teacher's guides and syllabi on their mobile phones in the form of PDF. The results of their response as presented in Table 14 indicated a mean of 3.95 and a standard deviation of 1.007. [mean = 3.95; std = 1.007]. The result 0f their responses with a mean approximately 4 meant that most teachers were

in support of the statement. This meant that teachers would prefer to have a PDF version of their syllabi than having the printed or hardcopy ones.

Statement three wanted to find out from teachers what their take was regarding the cost of transporting printed materials from the nation's capital to the interior parts of Ghana as compared to having those materials sent to individual mobile phones of teachers. A majority of teachers with a mean of 4.12 and a standard deviation of 1.029 indicated that teachers felt the materials sent to their mobile phones is less costive as compared to transporting them to various directorates for onward distributions. [mean = 4.12; std = 1.029]. The results from as presented in Table 14 also felt in line with (Motlik, 2008; Sharples, Taylor, & Vavoula, 2007; Traxler & Dearden, 2005) in their study which they pointed to the fact that students and teachers in the remotest parts of the state stood equal chance of benefiting from mobile learning as they will not have to pay for their materials to be delivered.

Statement four wanted to find out from teachers if they support the idea that the Ghana Education Service (GES) should develop their education mobile application that will make access to teaching and learning materials easy and less expensive. Their responses as presented in Table 14 indicated [mean = 4.43; std = 0.817]. With a mean of approximately 4 indicated that most teachers agreed with the statement to have the Ghana Education Service develop their mobile application to consist of all teaching and learning materials to reduce cost. As asserted earlier this response meant a reduce in cost and increase in the benefit for all stakeholders in the educational sector as (said by Valk, Rashid, & Elder 2014).

Statement five of the questionnaire wanted to further find out from teachers if they thought too much time was lost before books and other teaching materials finally got to them. The results of their responses as presented in Table 14 indicated a mean of 4.43 and a standard deviation of 0.846 [mean = 4.36; std = 0.846]. The results showed that most of the teachers with a mean of 4 agreed with the statement. Thus it takes a long time before certain teaching materials are delivered for use. This may be due to transport breakdown or delay in receiving funds for such distributions to take place.

Statement six sought to find out from teachers what their view was with regards to the notion that certain subject areas do not have teaching materials. Thus it was long since they had their last supply. Their responses as shown in Table 14 indicated [mean = 4.21; std = 0.978]. The results showed a mean of 4 which meant most of the teachers agreed with the statement. They believe certain books after the first consignment had since not been redistributed. This could have been a result of the lack of financial strength to tackle the issue. It could have also been because those who have not been receiving are from remote areas where transportation is challenging.

Statement seven wanted to know from teachers what their view was concerning the statement that there were no teaching and learning aids for some subject areas. The results of their responses as indicated in Table 14 [mean = 4.20; sta = 1.070]. The result showed that the majority of teachers with a mean of 4 agreed with the statement. Thus they believed that some subject areas had not gotten any teaching and learning materials since they were first supplied.

Statement eight wanted to know from teachers what they thought about the statement that some schools in some parts of the country do not have access

to textbooks and other teaching and learning materials. Their responses as shown in Table 14 indicated [mean = 4.35; std = 0.873]. This meant that with a mean of approximately 4, teachers agreed with the statement. Thus they thought that there are remote parts of the country whose schools do not get access to textbooks and other relevant teaching and learning materials. This might be due to their location thus vehicle may not be able to access the places. This assertion was confirmed by (Valk, Rashid & Elder, 2014) who said in their work that mobile phone application helped to improve access to education while maintaining the quality being delivered. They added that mobile phone devices have made learning to occur at any place at any time.

Statement nine wanted to get teachers to respond to the assertion that the use of mobile phone applications to support teaching is cost-beneficial than the distribution of laptops to teachers. The results of their response as shown in Table 14 indicated [mean = 3.18; std = 1.392]. Their response with a mean of approximately 3 meant that most of the teachers were undecided as to the cost benefits of comparing them using their mobile phones and government distributing laptops to them. Their responses were either driven by their notion that buying the mobile phones themselves is costive as compared to the government giving it to them for free.

The tenth statement was about the view of teachers towards the use of mobile phones to take part in In-Service Training and Education (INSET) reduces the cost of participation. The results of their responses as presented in Table 14 indicated [mean = 3.87; std = 1.164]. The mean of 3.87 was approximately 4 which meant the teachers supported the statement and felt organizing INSET online with participants using their mobile phones to access

saves cost to various stakeholders and improves the quality of professional teachers. Thus saving cost and no compromising on quality as said by (Valk, Rashid, & Elder, 2014).

The mean of means of the ten statements of part four of the questionnaire was calculated and the results as shown in Table 14 indicated 4.16875 which is approximately 4. The mean of four meant that teachers on average agreed to all the ten statements in part four of the question.

Results from Interview with Head Teachers

Based on the responses given by teachers on the questionnaire, the researcher did a follow up to interview the head teachers of the various basic school whose teachers took part in the survey. They were asked 9 questions of which they were to confirm "Yes" otherwise "No".

The first question was to find out whether their teachers prepare lesson notes before going to class to teach. All 13 headteachers responded in the affirmative and thus 100% to indicate that their teachers go to class fully prepared with the lesson notes. They were then asked whether teachers state the reference of the content they were delivering in their lessons notes and their responses were unanimous thus all 13 (100%) headteachers said yes to that question.

They were again asked whether teachers stated their mobile phones as part of the references that they stated on their lesson notes. Their responses were 3 (23.1%) said their teachers stated the mobile phone as part of their references but 10 (61.9%) said their teachers did not state the mobile phone as part.

The fourth question was whether teachers used their mobile phones to make calls while in school and their responses were 12 (92.3%) of them said

yes whereas 1(7.7%) responded no. Their general view was that teachers do use mobile phones while in school.

The fifth question was whether their teachers state the mobile phone as part of their Teaching and Learning Materials (TLMs) and their responses were 3 (23.1%) said their teachers stated the mobile phone as part of TLMs whereas the majority of 10 (76.9%) said their teachers did not.

The sixth question was to find out from the headteachers whether their schools had all the textbooks for the various subjects and their responses were 8 (61.5%) said they had all the textbooks in their schools whereas 5 (38.5%) said they did not have. Though the number of schools who had all textbooks for the various subjects enough there was still schools who lacked adequate textbooks for all subjects.

The headteachers were again asked if their teachers recorded video lessons with mobile phones in class during teaching and they responded that 2 (15.4%) said their teachers do so whereas 11 (84.6%) said their teachers do not do so.

The next question was to find out from the headteachers if they had soft copies of the teaching syllabi on their mobile phones and their responses were, 5 (38.5%) said they had whereas 8 (61.5%) said they did not. The last yes or no question was to find out from headteachers if they wish their teachers had soft copies of their teaching guides on their mobile phones and their responses were 8 (61.5%) said yes whereas 5 (38.5%) said otherwise.

A general opened question was asked for the headteachers to express their personal views about the impact that the mobile phone could have on their teachers concerning the work of their teachers. It was opened to either be

positive or negative view. The general views expressed by the majority of the headteachers were that the mobile phone could be of enormous help to teachers as it had several benefits. Only two headteachers took an opposing stand thus they felt the mobile phone could create disruptions in class during a lesson. The others who took a stand for the idea of the mobile phone being beneficial to teacher said among other things as: the mobile phone had “the antidote to the challenges” teachers were facing with regards search for TLMs; the mobile phone helps teachers to “download educational materials”; the mobile phone can “improve” the teaching and learning process; the mobile phone can be classified as “an ICT tool” for communication; the mobile phone can “cater for the individual learning styles” of pupils; the mobile phone makes the lesson "practical"; the mobile phone keeps teachers "updated" on current materials and content; the mobile phone served as a "source" of information and research as well the mobile phone served as an "easy access" to information thus to quote some of the views of the headteachers.

Though most of them supported the idea of the mobile phone being beneficial to their teacher, they had their reservation and consistently express the need for proper measures to be put in place to avoid abuse and misuse of the mobile phone. This prompted another interview session with the District Training Officer for the AAK district to find out how and what measures could be put in place to ensure that the mobile phone could be put to good use which can improve on the quality of education at the basic level.

Interview Session with District Education Training Officer (DETO) for A.A.K.

*R.Q.3: How Can Teachers be enlightened about the use of their mobile phone's technology to enhance their lesson delivery***?**

The District Education Training Officer (DETO) was engaged in an interview based on the results and findings from the survey and the interview with the headteachers. The interview lasted close to 33 minutes. This was in fulfilment with Creswell et al (2003) on the type of mixed-method approach. The Sequential designs and more specific the sequential explanatory is used when the results of the quantitative lead to collecting and analyzing qualitative.

The major thematic areas of the interview were; the general opinion of the DETO towards the use of the mobile phone by teachers to support lesson deliveries. The second theme was to find out why teachers had smartphones as seen in part 1 of the question where 120 (96.0%) yet were not using them to support their lesson delivery process. There was the issue of how teachers can use their mobile phone technology to support their teaching process; what were some of the expected challenges to face and suggested ways to deal with them as raised by the headteachers; whether he supported the teachers of the same subject across the district to have common technological platform which is accessible through their mobile phones and above all how INSET can be organized on the various platforms including their challenges and potential success.

The result from the first thematic area was collated and presented as; his general opinion as to the importance of the use of the mobile phone by teachers to enhance their lesson delivery. "*The employer is supposed to supply teachers*

with laptops and if they had not done that but teachers are having mobile phones and able to use them to support teaching, then that should a plus to teacher". His response was to say the mobile phone especially the smart ones were gradually replacing the era of laptops. The DETO further explained that if the employer wasn't able to supply the laptop due to lack of funds and teachers are using their own money to acquire mobile phones and intent using them for teaching that will save the employer and this case Government of Ghana through Ministry of Education some money to spend on other problems.

The DETO again described teachers as "researchers" who needed regular search for new information and hence the mobile phone could play that very important role as a researching tool. He added that when teachers received proper training on the effective use of their mobile phones for lesson deliveries there wouldn't be the need for some teachers to be "carrying big dictionaries" to school but would rather get to the internet, type the said word and receive a quick reply.

The DETO further described the mobile phone as being to "download". Thus teachers will have the opportunity to access information from the internet and download relevant information for use when the need had arisen. He specifically made mention of the Kindergarten stage where teachers needed to their mobile phones to be able to play out rhymes and phonic sounds during teaching and learning. (Sung et al. 2016) also attested to the fact that mobile devices have certain features and these features may be able to enhance the effects of certain pedagogies, such as self-directed learning, inquiry learning, or formative assessment. He, however, kept hammering on "if teachers are properly trained". These findings seemed to agree with (Coe, Aloisi, et al.,

2014) in their article *what makes great teaching? A review of the underpinning research* defined effective teaching as "that which leads to high achievement by students is valued outcomes, other things being equal". His views also were in line with the findings of (Aubusson et al., 2016) in their research echoed the fact that mobile learning is a potential process that could change the face of education but had their reservations on the timing not appropriate yet.

The DETO's response to why he felt all the teachers had mobile phones and even 120 (96.0%) having smartphones yet were not using them to help in their lesson delivery his responses were that; the teachers may be ignorant of the essence of their mobile phone with their line of work. "It is one thing having the mobile phone and another thing being able to use it" to quote his exact response. He explained that it may also be a result of not having any training which would enlighten them as to how to use their mobile phones to support learning.

The researcher then asked how the DETO thought could be adopted to help create awareness for teachers to be able to use their mobile phones to support learning. He responded that more researchers needed to do more research works on the subject matter thereby creating more awareness for people to know. He also said it the responsibility of the employer to train teachers on the benefits the phone had and they could adapt it to their teaching. He further added that since the employer may not have the funds to undertake this training process, they can partner with other organizations to undertake the training workshops. His major recommendation was the need for In-Service Training and Education (INSET).

The researcher again asked the DETO how the challenges and concerns raised by headteachers could be addressed. Major among the concerns was the potential abuse of the use of the mobile especially during instructional hours to make calls and chat on social media. The researcher put to him if he supported the introduction of punitive measures alongside the training and awareness period as suggested by some headteachers. His response was no to the punitive actions to be taken in the case of abuse. He rather suggested that if teachers were made to be aware of "how powerful" their mobile phones were to their work, they will not even have the time to abuse it`s usage. Thus there was the need to disabuse the minds of teachers by enlightening them on the benefits that their phone could give them. For teachers who would still abuse or misuse their mobile devices, he said it can take the supervisory role of the headteachers to ensure that the teachers appropriately use the phones for the intended purpose while delivering lessons. He added that "any head who will not support the idea of allowing teachers to use their mobile phones to teach were not doing their schools any great service".

The researcher asked him whether he supported the idea of having various groups of subject teachers having a common social media platform. He responded in the affirmative and even adding that he had created such a platform for all English Language Teachers in the District and it is giving benefits to the individual teachers. This he explained had helped the teachers to collaborate with others in cases where someone needed clarity on something, the person had to only post and a variety of responses were offered as solutions. He, therefore, recommended all subject teachers had such platforms to ensure collaboration. His assertion confirmed the finding of (Clement & Vanden-

Berghe 2000; Burbank & Kauchak 2003; Aubusson et al., 2007) who explained collaborative learning to be critical to the professional learning of teachers. His response was also in line with that of (Noddings & Witherell, 1991) who thought the knowledge produced and shared by teachers with colleagues all contribute to the professional development of teachers.

The researcher then concluded with questions to his profession as an educational trainer and as to whether he felt the mobile phone could be used to undertake an In-Service Training and Education (INSET). He responded in the affirmative and added that in the case where you needed to provide a piece of information to members, it is quick and less expensive to deliver the training materials. He, however, was mindful of the type of training workshop. He said in the case where there is a need for hands-on experience to be acquired by participants, the best will be to have a face-to-face discussion. He said he would have been possible that will lead to another cost of buying internet service for live streaming. He also added the challenge of getting all teachers at the same time to be online for the training to take place. When asked how that could be solved, he suggested a partnership between the Ministry of Education (MOE) and the Ministry of Communication (MOC) to provide materials in digital format for teachers to have constant access to. He further suggested that the telecommunication networks who are mostly the Internet Service Providers (ISP) should partner with the employer to give access to downloads of educational materials which he said could motivate teachers to get fully involved. He then concluded by saying he supported the development of a Basic School mobile application which would have all subject materials on a common app.

Discussions

In trying to find answers to the research questions asked from the beginning of the study, an average mean of $3.5 \leq x \leq 5$ (where x is the mean agreeing to the statement made) was pecked as agreeing to the survey question whereas below meant teachers were not supporting the statements. An overall mean of approximately 4 was discovered which led to the findings being made from the results. The findings were then grouped according to the individual research questions.

R.Q.1: What are the educational benefits when teachers use their mobile phone's technology in their lesson delivery?

The results from this research question showed that [mean=4.042400; std=0.696797] to the discovery that the mobile phone and for that matter the smartphone had enormous educational benefits which included;

The mobile phone's applications could help teachers to download videos and audios of abstract lessons to be shown or played to their students. This could increase the level of understanding of students in the classroom. Students at the basic level of education learn better when they see audio-visuals as well as motion pictures of a lesson. This stimulates their formation of schemas. This finding is in agreement with Rikala (2013) who thought the camera and video functionality of the mobile phone can be used to take pictures and videos of student's craftwork which could be printed later for class magazines. This will benefit the student in terms of performance, the teacher will benefit from achieving an objective and the employer as well will benefit from the returns of their investment.

The results also led to the discovery of the educational benefit of teachers using their mobile phones to teach. The findings were that the mobile phone could be used to access a variety of information from different sources. The information could range from the content of a lesson to charts to be used. One such source of the information was the internet. The teacher can use their mobile to browse the internet will rely on a lot of information which will make their lessons interesting. With much information at their disposal, the teacher goes to class fully prepared and confident, their students will be taught with the best content and above all the educational benefit will be the best crop of generational problem-solving graduates. The country at large stands the biggest to gain from all this.

Findings from the study again indicated that when teachers used their mobile phone to teach, the mobile phone technology could be a medium of collaborating teachers of a particular subject area through a common social media platform. This collaboration can be used for peer reviews after the day's lesson taught. Teachers who faced challenges while delivering certain topics could share their challenges on their respective platforms which will draw a variety of views on how to address the challenge. This is a faster means of receiving feedback and could provide different ways to tackle a problem. The students stand the greater portion of benefiting from that. This discovery was in line with (Clement & Vanden- Berghe 2000; Burbank & Kauchak 2003; Aubusson et al., 2007) who explained collaborative learning to have a critical role to play in the professional development of teachers. These platforms could be described as a *run-to-for-help* platform.

The researcher also made a finding which was beneficial to the educational sector and discovered that when teachers used their mobile phone's technology to teach, it will increase their work output (productivity). This is in the sense that a teacher with their mobile phone at hand and able to have access to a variety of information and can seek for help at any time about a lesson from other professionals will place that teacher at a position to give out their outmost best to increase work done. This is what every employer seeks from its employees. The discovery matches that of (Ferry, & Ferry, 2009) who thought that mobile phone technology is providing the professional growth of teachers.

The study again made findings of the educational benefit of teachers using mobile phones in their area of teaching and saw that the mobile phone's applications had functions that could deliver teaching and learning to the individual houses of students. This found out when it was revealed that teachers could get the contacts of all parents in their class and create a common platform of which they could regularly post home activities for parents to supervise be it weekends or when students are on vacation. With this learning continuous at home and parents are made to play active roles in the education of their wards.

The researcher once again discovered that teachers stood a greater chance of benefiting from using their mobile phones to teach. This was revealed when it was discovered that teachers will be able to stay up to date with current teaching and learning modules. With their mobile phones, teachers will always get trending educational materials be they from the internet or their platforms. When the employer though the GES updates their curriculum and post them to their portals, teachers can browse and have access to them within moments of their upload or one person could access the information send them their

collaborative platforms for all their colleagues to have a feel of them. This will enable the teachers to peruse the document earlier before the academic year begins.

There was another finding made by the researcher in the cause of the study which had to do with the mobile phone's ability to breach the equity and quality of education gap between urban and rural areas. In the case where teachers at the remotest places of the country are not able to get educational materials due to lack of access routes, the said teachers could get soft copies on to their phones which they will not be left out in terms of quality and equity. Teachers in the remotest areas can get their weekly materials downloaded onto their phones during the weekend when they have access to the internet. They can then use the materials offline during their lessons.

The general findings on the educational benefits of teachers using their mobile for teaching were that the devices served as portable tools that can equally function like the laptop computer. Their portability makes them easy to use, less expensive, and very beneficial to the teaching and learning process.

R.Q.2: What are the cost benefits derived from teachers using their mobile phone in the process of lesson delivery?

The results of the study have again led to the findings of the cost benefits of teachers engaging their mobile phones in their line of work [mean= 4.040000; std= 0.621003]. The cost benefits may include;

The use of mobile phones by teachers in their work can help the employer reduce the cost of printing materials to be used by the teachers. Every teacher is supposed to have a curriculum based on the number of subjects taught. Together with a teacher's handout sometimes referred to as the teacher's guide.

These were all materials that the employer had to print out for teachers across the length and breadth of the country. The money which would be spent on printing and binding could be rechanneled to other infrastructural development especially places that still practice classrooms under-trees. The materials could be sent to teachers in the PDF format for teachers to download and use. As the goal of every employer is to reduce cost and increase productivity, the mobile phone stood the chance of providing that service.

Another finding made concerning the cost-benefit was that the mobile phone could save the employer the money spent on transporting the printed materials from the printing centres to the various areas of the country. When educational materials are ready for distribution, they are moved to the regional directorates who intent to distribute to the district directorates for onward distribution to the individual schools. The money involved in the overall movement alone could be used to be sufficient to develop other infrastructure. Sometimes even the vehicles do not get to all schools in the entire schools thereby leaving them out of the benefit. With teacher's usage of their mobile, they will get to have access to books straight from the printing centres to the individual teachers without any movement of vehicles.

The study also brought to light another cost-benefit of teachers using their mobile phones as the phone's ability to store information for as long as possible. The storage function of the mobile phone could reduce the cost incurred by the employer to regularly print new materials to replace worn-out ones. When teachers have the soft copies of the materials on their phones there wouldn't be the need for the employer to think of safety space as well as disasters that could spoil them. In the case where one's phone is spoiled or gets stolen,

the information could be accessible whenever they get new ones or when repaired in the case of spoiling. The ability of the mobile phone to store lots of books on it means the teacher was saved from carrying heavy teaching materials to the school. An example of such heavy materials would include dictionaries. Therefore while the employer saves cost, the teacher is offloaded from their heavy loads.

The findings also revealed the mobile phone of teachers being used in their line of work could save the government of the day lots of money they would have used to purchase and distribute laptop computers for all teachers. Thus the government policy for a free laptop for all teachers could be solved when teachers are allowed to use their phones in their line of work. The mobile phone and for that matter the smartphone now come with Operating Systems (OS) that enable them to function just like the computer. Thus they can accept data, they can manipulate data, they can store processed data as information and they can display information. All of these functions make up a computer. In the case where teachers are using their mobile phone device and their related technology then the can use them to help in their teaching instead of government dedicating budget. The mobile phone is even more portable to use than that of the laptop.

The final discovery made from the study showed that when teachers use their mobile phone technology for teaching it could reduce the cost of organizing training workshops or INSET. This is possible because a resource person has to come to a workshop with manuals for the training which would have been printed with a budget. With the mobile phone, resource persons could send training manuals to participants even before the workshop for adequate

preparations. The resource person could be made to part of a social media platform where non-hands experienced training could be delivered at the comfort of the teachers' home or individual locations. With their mobile phones and access to the internet, they are good to go. These professional resource persons could continue to be on these platforms to offer assistance to teachers at any time.

R.Q.3: How Can Teachers be enlightened on how they can make use of their mobile phone's technology to enhance their lesson delivery?

The results from the study again led the researcher to discover how teachers could be enlightened and motivated to use their mobile phone technology to enhance their teaching.

The study revealed that teachers needed a form of education and training which would focus on bringing to light the functions of the mobile phone and how those functions could be beneficial to the teacher. This revelation could encourage teachers to use their phones to teach if they are aware that their work would be easier and their productivity will increase. Education is therefore found to be the way forward in getting teachers to use their mobile phone technology.

The study also revealed that to get teachers to use their mobile phones to enhance their area of teaching there was the need for more academic researches about mobile learning in Ghana which will bring it to the centre of discussion. This is believed to create more awareness of how powerful the mobile phone is not just only for teachers but in other sectors of the economy.

The study also revealed that to get teachers to use their mobile phones to enhance their lesson deliveries, there was the need for the telecommunication

networks (Telco's) who are largely internet service providers to cut down charges on downloads of educational materials. Teachers will be motivated to use their mobile phones for research on the internet when the cost of accessing the information is free or moderately low. The telcos could make downloading from educational sites free. When this was done it would ginger teachers to make good use of their phones knowing they will not bear the cost.

The study again discovered that to make teachers use their mobile phone technology to enhance their teaching there was the need for the Ministries of Education and Communication to partner in order to come out with an education mobile application which would have all the needed teaching materials on so teachers could access and make use of them. When this is done it will not only increase performance on the part of the teachers, it will go a long way to save the employer some cost as found earlier.

Chapter Summary

This research study was aimed at finding out the educational benefits that came along when teachers used their mobile phones to teach, the cost benefits associated with teachers using their mobile phones to teach and above all the effective ways by which teachers could use their mobile phone technology to enhance their teaching. The results were discussed in this chapter and major findings were discovered. Key among the findings was that if teachers were to get an education on the benefits of using their mobile phones to teach, they will adopt the mobile phone as part of their teaching and learning tools which would eventually lead to an increase in performance and decrease in cost to the employer.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This research work was aimed at finding out and establishing guidelines by which basic school teachers could adapt their mobile phone as a tool to enhance their lesson deliveries. The results were to help cut the cost of printing teaching and learning aids. Research questions were posed to give direction to the research process.

Research Question 1 was, what are the educational benefits when teachers use their mobile phone's technology in the lesson delivery?

Research Question 2 was, what are the cost benefits when teachers use their mobile phone in their lesson delivery?

Research Question 3 was, how can teachers use their mobile phone technology effectively to enhance their lesson delivery?

The study was descriptive research in nature which adopted the mix method approach. Data was gathered from both primary and secondary sources. The primary data was gathered using a survey questionnaire as well as interviews. The secondary sources were gathered through reviews of related articles that formed most of the literature review section of this research.

The target population was made up of 198 involving teachers and headteacher in the Moree circuit in AAk district. 139 were sampled from the population through a random selection of teachers and all headteachers of the schools involved together with the DETO of AAK district. A total of 84 females and 55 males were involved. The study made use of descriptive statistics during the

analysis stage. Statistical tools used in for the analysis were the mean, standard deviation as well as frequencies.

Key Findings

The researcher made the following key findings that answered the research questions;

1. The study conducted proved that the mobile phone had educational benefits when they are properly used by teachers in their lesson delivery. Key among the benefits are it serves as a research tool; it creates a collaborative platform for teachers from various schools and subject areas; it serves as a storage tool which can keep a lot of content ranging from text, audio, image and video; the mobile phone was seen to a tool that can help teachers stay up to date with current methodology and content for teaching.
2. The study again showed that the mobile phone had cost benefits to the major stakeholders in education. Thus, the employer will save money meant for printing of text books if they developed an educational application for various levels of education. The cost of transporting learning resources could be channeled into different sectors thereby saving the government some money. Teachers in remote areas will not have to travel several miles to district centres for updating of knowledge thus In-service Training and Education (INSET). The government will save themselves the cost of purchasing a laptop for every teacher in the country if the teacher is able to integrate their mobile phones in their teaching.

3. The study was able to come out with ways by which teachers could effectively use their mobile phones in their lesson delivery. Key among them were training and sensitisation. The study showed the need for teachers to be trained on the educational benefits of the mobile phones they buy. Thus when teachers were trained and they became aware of the importance of the phone, they would use them in their teaching.

Other Related Findings

A summary of the findings made from the results of the data gathered revealed a number of them which included;

a) The findings from the results indicated that teachers could use their mobile phone technology to download multimedia teaching and learning materials which could enhance effective teaching.

b) The results of the study again indicated that teachers could use their mobile phone technology to get access to a variety of information from a variety of sources to increase their content delivery during teaching.

c) The study also indicated that teachers could use their mobile phone technology to collaborate with colleague teachers which could enable them to share solutions to problems related to their subject areas of teaching.

d) They once again revealed that when teachers use their mobile phone technology to teach, it increased their work output thus productivity.

e) Teachers could use their mobile phone technology as a medium to deliver teaching to the doorstep of their students even during vacations through the parents of their students.

f) When teachers use their mobile phone technology to teach, they (teachers) can stay up to date with current trends and methods in teaching to increase the performance of both teachers and their students eventually.

g) Teachers using their mobile phone technology to teach could breach the gap of inequity between the rural and urban schools in terms of distribution and supply of educational materials like teachers guide.

h) Teachers using their mobile phone technology to teach could cut down the cost of printing teacher's materials for teaching which could save the employer some money for other developments to take place.

i) Teachers using their mobile phone technology to teach could also reduce the cost of transporting teaching materials from the national level through to individual schools.

j) The storage functional ability of mobile phone technology could be used to keep teaching materials to reduce the cost of reprinting, transporting and replacing worn-out materials.

k) Teachers using their mobile phone technology to teach could save the government the money that would have been used to purchase laptops for distribution to teachers across the country.

l) Teachers can take up training programmes (INSET) with the use of their mobile phone technology which can train more teachers at a time.

m) The result of the study revealed that for teachers to effectively use their mobile phone technology to enhance teaching, there was a need

for teachers to be giving training on the educational benefits of the mobile phone.

n) More research work about the educational benefits of mobile phone technology should be undertaken by academia to put the lights on the awareness of the functions of the mobile phone.

o) The effective use of the mobile phone by teachers to enhance their lesson delivery could be achieved when the Ministries of Education and Communication to collaborate to develop a basic school educational mobile app.

Conclusions

The researcher concluded the study with a wrap of some findings that were deviating from initial anticipation. Some of which included some headteachers not endorsing teachers to use their mobile phone technology in their teaching. This they claimed will make room for teachers to abuse the usage. On the contrary, the DETO thought otherwise but rather enumerated effective ways that could help teachers adopt the usage of their mobile phone technology in their lesson delivery.

In an anticipation of developing punitive measures to ensure non-abusiveness of by teachers on the device, the DETO felt any punitive measure that may come with a mobile teaching policy will make that policy dead on arrival. The DETO rather wanted an alternative way which meant teachers taking through a training session that will make them see the benefits they stand to gain.

This study has brought to light the perception that teachers have about their mobile phones to the line of work. Whereas most teachers had smartphones

they felt reluctant using them in their line of duty. This may be due to them having little knowledge about the educational benefits of their mobile phone or due to their negative perception of the destructive nature of the mobile phone being put in the public.

Teachers were indecisive as to whether to opt for them using their mobile phone technology to teach or receiving laptops from the government. This might have been due to the teachers' unawareness of the teachers on the functionality of the smartphone and that of the laptop to almost be same and even the mobile phone being functionally better than the latter.

Recommendations

Based on this research study, the following were discovered and are being suggested to be put in place to help teachers effectively use their mobile phone's technology to enhance their lesson delivery:

Recommendation to the Employer

The study recommends to the government through MOE to partner with MOC to develop a common mobile app for basic school curriculum in the country for teachers to download and use to enhance their teaching. The study also recommends that the government subsidises the sale of smartphones for teachers specifically to buy and could help every teacher have access to a smart mobile set.

The study recommends to the government to find other sources of electrical power to all rural areas in the country for teachers to keep charging their mobile phones. It could be solar panels or wet battery technology.

Recommendation to Policy Implementers (GES)

The study recommends to the GES to organize a nationwide training workshop for teachers on the educational benefits of using their mobile phone's technology to enhance their lesson deliveries. The study recommends to the GES to create subject social media platforms for teachers based on their subject area or level of teaching to enable them to share problems on challenging topics and seek diverse solutions. The study recommends the NACCA to and Colleges of Education to adopt the mobile phone's technology as part of ICT tools which would properly be taught in the cause of training on teachers.

It is also recommended that mobile learning (m-learning) be introduced as a course at the teacher training institutions' curriculum where they will gain the experience on how to use the phone before getting to the field to teach.

Recommendations to the Telecommunication Networks

The study recommends to the various Telco's to make downloading from educational websites free to encourage teachers to take up more research works on the internet. The study recommends to Telco's to extend their network coverage to every part of the country to enable equal opportunities to all teachers in accessing digital information.

Recommendations to N.G.O.s

The study recommends that various Educational N.G.Os should partner with academia to undertake more research works on how the mobile phone's technology could be of immense help to the teacher and society.

Suggestions for Further Research

The findings made from this research study coupled with the limitations as well the related literature review has brought about new areas of study to be

taken up. A descriptive analysis of the use of mobile phone's technology by both teachers and students in high schools in Ghana and the effects on performance. The study could be extended to cover the whole country to get a broader picture that will be more representative.

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APPENDICES

APPENDIX A

QUESTIONNAIRE FOR TEACHERS

This research is aimed at getting responses of basic school teachers on the importance of their mobile phone applications to their line of work. Your responses will be treated with confidentiality. You are therefore entreated to give your personal ideas on the questions.

The research is in four parts, part one is to collect personal details and a multiple choice based on your experience with the mobile phone. The other three requires you to give your perception on the use of mobile phone applications by teachers for academic purposes.

Your responses remain a great contribution to a new era of teaching in basic schools.

Thank you.

PART ONE

Please tick **(√)** once in the boxes provided to give details of yourself

1. Sex Male ☐ Female ☐

2 Age **20-29** ☐ **30-39** ☐ **40-49** ☐ **50-59** ☐

Please tick (√) for (Yes) or (No)

Question	**Yes**	**No**
3. Do you own a mobile phone?		
4. If your answer to (3) is yes, is it a smart phone?		
5. Are you able to download and install applications from applications store?		
6. Do you use applications on your mobile phone to teach?		
7. Have you downloaded and installed any application relating to your area of teaching?		
8. Do you state mobile phone applications as part of your teaching and learning materials in your lesson notes?		

Please provide a brief description based on your experience

9. Underline the mobile application's category that you download often.

a. games b. social media c. lifestyle d. education

10. Please provide one educational application you have downloaded onto your phone. ……..

PART TWO

Please you are required to tick **(√)** for your personal view on how teachers can use mobile phone application before, during and after their lesson delivery.

Key for Responses: **SD** = **S**trongly **D**isagree **D** = **D**isagree

U = **U**ndecided **A**= **A**gree **SA**= **S**trongly **A**gree

#	Statements	SD	D	U	A	SA
1	I use my mobile phone applications to access information during the preparation of my lesson notes.					
2	I use my mobile phone to download charts from educational sites to serve as teaching and learning materials.					
3	I have downloaded an educational application into my mobile phone to enhance my subject area.					
4	I have downloaded the teaching syllabi onto my mobile phone for easy referral.					
5	I use the camera application of the mobile phone to take pictures of pupils who put up more effort as motivation.					
6	I use the audio recording function of my phone to record contributions of pupils to be played later for them.					

7	I use mobile phone applications to help students with special needs.					
8	I interact with colleagues about my topic am about to teach using social media applications before actual teaching.					
9	I share what I have taught for the day with colleagues on social media for them to critique.					
10	I receive the feedback from the critique of friends to be used to improve for the next lesson.					

PART THREE

Please you are required to tick (√) for your personal view on the **benefits** of mobile phone applications to teachers.

Key for Responses: **SD** = **S**trongly **D**isagree **D** = **D**isagree

U = **U**ndecided **A**= **A**gree **SA**= **S**trongly **A**gree

#	Statements	SD	D	U	A	SA
1	Using mobile phones to download and playing videos or audios as learning materials help students to understand.					
2	Content accessed from the internet with the mobile phone serves as supplement to textbooks.					
3	Teachers show professional competence when they have access to variety of content for their students.					
4	Collaboration with friends on social media before a lesson helps teachers develop good teaching methods for delivery.					
5	When teachers have access to variety of content for their work they put up their best to increase productivity.					
6	Using the mobile phone to access information from the internet brings more content as compared to textbooks.					

7	The mobile phone applications can store more information for teachers than textbooks.					
8	Mobile phone applications can create collaboration between teachers and parents through interaction applications.					
9	Parents can receive assignments on behalf of their wards from teachers when students are home through mobile applications.					
10	Mobile phone applications could help teachers be updated with current materials released from curriculum developers.					

PART FOUR

Please you are required to tick **(√)** for your personal view on the **cost benefits** of mobile phone applications to teachers.

Key for Responses: **SD** = **S**trongly **D**isagree **D** = **D**isagree

U = **U**ndecided **A**= **A**gree **SA**= **S**trongly **A**gree

#	Statements	SD	D	U	A	SA
1	Soft copies of syllabi and textbooks on mobile phones is cost effective as compared to printed ones (hardcopies)					
2	I would like to have all my teachers guide and syllabi on my phones in the form of *Portable Document Format* (PDF).					
3	Transportation of printed books from the National Quarters to schools cost much money than sending soft copies to teachers on their phones.					
4	The GES should develop their own educational mobile application to take care of TLMs provision.					
5	Too much time lost before new books finally arrive at various schools for teachers to use.					
6	Certain subject have not being receiving text books at all from GES after they were supplied for the first time.					

7	There are no teaching and learning aids for some subject that teachers teach.					
8	Some areas and schools in Ghana do not have textbooks for both teachers and students due to the remoteness of their location.					
9	The use of mobile phone applications to support teaching is cost effective than distributing laptops to teachers.					
10	INSET could be organized on a common platform with participants using their mobile application to participate which will reduce cost.					

Thank you once again for completing the questionnaire.

Your responses will go a long way to contribute to the success of basic education in Ghana.

APPENDIX B

INTERVIEW GUIDE FOR HEADTEACHERS

Question	Yes	No
1. Do your teachers prepare lesson notes before teaching?		
2. Do teachers state the references of their content in their lesson notes?		
3. Do teachers state mobile application as part of their references?		
4. Do teachers use mobile phones to make calls in school?		
5. Do teachers state their mobile phones as part of their teaching and learning materials?		
6. Do you have textbooks for the subjects taught in your school?		
7. Do teachers use mobile phone applications such as video and audio recording of their class activities during teaching?		
8. Do you have soft copies of the syllabi on your phone for your teachers?		
If No, do you think teachers need soft copies on their phones		
9. Do you wish to see teacher's textbooks in soft copies so that they can access them using their mobile phones?		

10. In your opinion, what is the impact of mobile phones on teachers in relation to their quality of teaching?

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APPENDIX C

The FRAME model (The Device Aspect) by Shneiderman and Plaisant (2005).

Criteria	Examples & Concepts	Comments
Physical Characteristics	Size, weight, composition, placement of buttons and keys, right/left handed requirements, one or two-hand operability	Affects how the user can manipulate the device and move around while using the device.
Input Capabilities	Keyboard, mouse, light pen, pen/stylus, touch screen, trackball, joystick, touchpad, hand/foot control, voice recognition	Allows selection and positioning of objects or data on the device. Mobile devices are often criticized for inadequate input mechanisms.
Output Capabilities	Monitors, speakers or any other visual, auditory, and tactile output mechanisms.	Allows the human body to sense changes in the device; allows the user to interact with the device. Mobile devices are often criticized for limitations in output mechanisms such as small screen-size.
File Storage and Retrieval	Storage on the device (RAM or ROM) or detachable, portable mechanisms such as	Consistency and standardization of storage and retrieval systems greatly affect usability.

	USB drives, CDs, DVDs, and SD cards.	
Processor Speed	Response rates; speed with which the device reacts to human input.	Determined by the amount of RAM, fi le storage speed, user-interface speed, and system configuration. Unusually long or short response rates may affect error rates as the user may forget initial goals and/or task sequences
Error Rates	Malfunctions resulting from flaws in hardware, software, and/or interface design.	Users may not be able to perform desired tasks and may lose confidence in the device.

Source; Koole, (2005).

The FRAME model (The Learner Aspect)

By Ausubel (1968), Gagne (1977), Caroll and Rosson (2005), Driscoll (2005), Tulving and Donaldson (1972), Paivio (1979), Tirri (2003, p. 26).

Criteria	**Examples & Concepts**	**Comments**
Prior knowledge	Cognitive structures already in memory, anchoring ideas1, schema theory, Gagne's conditions for learning	Affects how easily a learner can comprehend new concepts. Potential problems include "assimilation bias" (a reluctance to adopt new procedures)
Memory	Techniques for successful encoding with the use of con textual cues: categorization, mnemonics, self-questioning, semantic & episodic memory, tactile, auditory, olfactory, visual imagery, kinesthetic imagery, dual coding, and encoding specificity.	Inclusion of multimedia by providing a variety of stimuli may help learners understand and retain concepts more easily.
Context and Transfer	Inert vs. active knowledge.	Actively using information aids for learners to remember,

		understand, and transfer concepts to varied contexts.
Discovery Learning	Application of procedures and concepts to new situation; solutions for novel problems.	May stimulate learner to develop skills to "filter, choose, and recognize" relevant information in different situations
Emotions and Motivations	Feelings of the learner towards a task; reasons or accomplishing a task.	A learner's willingness or ability to adopt new information may be affected by his/her emotional state or desire to accomplish a task. Activity Theory may provide additional avenues of investigation into motivation.

Source; Koole, (2005).

The FRAME model (The Social Aspect) by Wardhaugh (1968), Kearsly (1995).

Criteria	Examples & Concepts	Comments
Conversation and Cooperation	Social constraints; 4 maxims (rules): quantity, quality, relation, and manner.	Affects quality and quantity of communication; miscommunications may occur when any of the 4 maxims are not met.
Social Interaction	Conversation as a cooperative activity, sharing of signs and symbols.	Agreement on the meaning of signs and symbols may affect reinforcement of social and cultural beliefs and behaviours.

Source; Koole, (2005).

The FRAME model (The Device Usability Intersection)

Criteria	Examples & Concepts	Comments
Portability	Portability and durability (dependent on physical characteristics, number of components, and materials used to construct the device).	Affects the user's ability to move the device to different environments and climates.
Information Availability	Anytime, anywhere access to information stored on a device. (This is a distinct from information transfer, a characteristic of social technology (DS).)	Enables just-in-time learning; information accompanies the user; the user can retrieve stored information when and where it is needed.
Psychological Comfort	Learnability1, comprehensibility, transparency, intuitiveness, memorability1, and metaphors.	Psychological comfort affects cognitive load and the speed with which users can perform tasks. Metaphors, chunking information, mnemonics, simplification of displays, and reduction of required actions may reduce cognitive load
Satisfaction	Aesthetics of the interface, physical appearance of the device, functionality, preferred cognitive style.	Because satisfaction and enjoyment is highly personal and culturally determined, it is very difficult to predict

Source; Koole, (2005)

The FRAME Model (The Social Technology Intersection) by Shneiderman & Plaisant (2005).

Criteria	Examples & Concepts	Comments
Device Networking	Personal area networks (PANs), wide area networks (WANs), wireless local area networks (WLAN), synchronization software, wireless fidelity (WiFi), cellular connectivity.	The various connectivity standards allow users to connect to other users, systems, and information. Networking in mobile systems is often hindered by low bandwidth on wireless networks.
System Connectivity	Internet access and document transfer protocols.	Users must be able to exchange documents and information within and across systems. His affects the organization of individuals and systems that are attempting to interact.
Collaboration Tools	Shared tools such as calendars,	Collaboration tools allow co-authoring

	authoring tools and project management tools.	documents; coordinating tasks; attending or providing lectures and demonstrations; holding meetings synchronously or asynchronously, voting, decision-making, performing commercial transactions; and accessing laboratory or other rare equipment

Source; Koole, (2005)

The FRAME Model for Mobile Learning (The Interaction Learning Intersection) by Moore (1989), Vygotsky (1978).

Criteria	Examples & Concepts	Comments
Interaction	Learner-learner, learner instructor, learner-content; computer-based learning (CBL); intelligent tutoring systems, zone of proximal development.	Different kinds of interaction can all stimulate learning to varying levels of effectiveness depending on the situation, learner, and task.
Situated Cognition	Authenticity of context and audience.	A real purpose and audience for a learning task may serve to increase learner motivation.
Learning Communities	Cognitive apprenticeships, dialogue, problem solving, communities of practice.	Learners work with others in an effort to achieve mutual goals. Learners have varying degrees of control over the learning process.

Source; Koole, (2005)

The FRAME Model for Mobile Learning (The Mobile Learning Process) by Caroll, Kellogg, and Rosson (1991), Vygotsky (1978), Brown (2005).

Criteria	Examples & Concepts	Comments
Mediation	Task artefact cycle, mediation.	The nature of the interaction itself changes as learners interact with each other, their environments, tools, and information.
Information Access and Selection	Information noise, identification of patterns and relationships, relevancy, and accuracy.	As the amount of information available increases, learners must increase their efforts to recognize and evaluate the appropriateness and accuracy of information.
Knowledge Navigation	Knowledge production vs. knowledge navigation.	In knowledge production, teachers determine what and how information should be learned. In knowledge navigation, learners acquire skills to appropriately select, manipulate, and apply information to their own unique situations and needs.

Source; Koole, (2005)

APPENDIX D

Table of Reliability Test Results

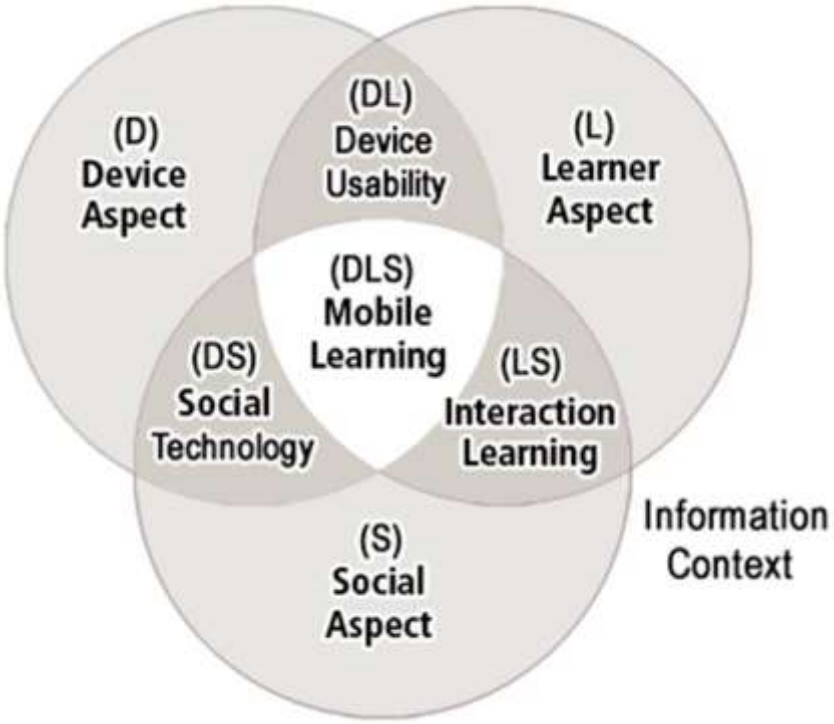
Reliability Statistics

Cronbach's Alpha	N of Items
.817	39

Source: Field Survey, 2019

APPENDIX E

Figure of the Model for Framing Mobile Learning



APPENDIX F

PILOT TEST OF QUESTIONNAIRE

Descriptive Statistics

	N	Mean	Std. Deviation
Do you own a mobile phone?	35	1.00	.000
If your answer to (3) is yes, is it a smart phone?	35	1.06	.236
Are you able to download and install applications from applications store?	35	1.06	.236
Do you use applications on your mobile phone to teach?	35	1.34	.482
Have you downloaded and installed any application relating to your area of teaching?	35	1.37	.490
Do you state mobile phone applications as part of your teaching and learning materials in your lesson notes?	35	1.77	.426
Underline the mobile application's category that you download often	35	3.20	1.279
Valid N (listwise)	35		

Source: Field Survey 2019

Descriptive Statistics

	N	Mean	Std. Deviation
I Use mobile phone for research during lesson note preparation.	35	4.03	.985
I Use mobile phone for downloading TLMs	35	3.71	.987
I Downloaded an educational app to enhance my area of teaching	35	3.94	.938
I Downloaded the teaching syllabus onto my phone	35	3.74	1.245
I Use camera function as a motivator to students work	35	2.86	1.141
I Use the recording function of phone to record and play later for students during lessons	35	2.66	1.027
I use phone to support persons with disabilities	35	2.60	.946
I interact with colleagues about subject areas before teaching in class	35	2.97	1.124
I share my lesson for the day on social media for friends to critique	35	2.66	.906
I receive and use critique from friends for improvement	35	2.94	1.136
Valid N (listwise)	35		

Source: Field Survey 2019

Descriptive Statistics

	N	Mean	Std. Deviation
Mobile phones used in class help students to understand	35	4.29	1.073
Internet content serve as supplement to text books from GES	35	4.34	.802
Variety of teaching materials helps in improving teacher professional competences	35	4.34	1.056
Collaboration between teachers on a platform before lessons helps develop teaching methods	35	3.71	1.319
Access to variety of content increases productivity	35	4.54	1.010
Internet provides more information as compared to textbooks	35	4.20	.797
Mobile phone stores more information than textbooks	35	3.91	1.011
Mobile phones can create collaboration between teachers and parents	35	3.77	.877
Mobile phones can be used to send students assignments to parents during holidays	35	3.57	1.220
Mobile phones can help teachers receive up to date materials from curriculum developers	35	4.26	1.010
Valid N (listwise)	35		

Source: Field Survey 2019

Descriptive Statistics

	N	Mean	Std. Deviation
Teacher's guide and syllabus in PDF format on my mobile phone	35	3.97	.985
The cost of transporting books and materials is costive than emailing softcopies	35	4.20	.901
GES should develop their own mobile application to have all the materials	35	4.49	.818
There is delay in delivery of materials via transport	35	4.54	.701
Certain subject area textbooks have not received any consignment aside the first one	35	4.09	1.197
Some subject areas lack the requisite teaching and learning aids	35	4.06	1.211
Remoteness of certain areas make it difficult to access and supply them with textbook	35	4.60	.695
The use mobile phones to teach is cost effective than suppling teachers with laptops	35	3.31	1.409
The mobile phone can be used to organise INSET on conferencing platforms	35	4.29	.860
Syllabus in soft copy is cost effective than hard copies	35	3.29	1.487
Valid N (listwise)	35		

Source: Field Survey 2019