UNIVERSITY OF CAPE COAST

EFFECT OF EMERGING TECHNOLOGY ON ACADEMIC ACHIEVEMENT OF STUDENTS IN THE UNIVERSITY OF CAPE COAST

DESIRE MAWUKO KOMLA AYITE

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BY

DESIRE MAWUKO KOMLA AYITE

Dissertation submitted to the College of Distance Education, University of Cape Coast, in partial fulfillment of the requirements for the award of Master of Education Degree in Information Technology

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DECLARATION

Candidates' 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: Desire Mawuko Komla Ayite

Supervisor's Declaration

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

Supervisor's Signature: ……..…….. Date: ……..……

Name: Dr. Paul Nyagorme

ABSTRACT

The main aim of this study was to find out the effect of emerging technology on academic achievement of students in the University of Cape Coast (UCC) in Ghana. The quantitative research survey design was employed to carry out the study. In all, four research hypotheses were formulated and tested using Chi-Square, Spearman's correlation, independent sample t-test and regression analysis tools with the help of IBM SPSS Statistics software. The instrument was pilot tested at the University of Education, Winneba and a Cronbach's alpha, $\alpha = 0.79$ was obtained. Ethical clearance and introductory letters enabled the researcher to collect data, using a questionnaire from 357 respondents out of 400 questionnaires administered (response rate = 89.3%). Results obtained from the five departments selected showed that there was statistically significant difference across departments in the availability of tablets ($p=0.004$), free online courses ($p=0.006$), cloud computing ($p=0.022$), projectors and laptops ($p=0.036$), and calculators ($p=0.000$). Also, the study showed that there were weak negative and positive (-0.049 to 0.082) relationships between the extent to which respondents use emerging technologies especially, the use of internet to search for information was statistically significant (0.040). In addition, there is no significant difference in the performance of female and male respondents since $p = 0.535 > \alpha = 0.05$. Finally, the respondents revealed that a decrease in the availability of emerging technologies increases their performance which supports the conceptual framework of the study. The study concluded that the availability of emerging technology does not affect academic performance.

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DEDICATION

To my mother Celestine Adih, uncle Vincent Kokouvi Ayite, my siblings Wisdom, Eli, Joelle and Emma, and my late dad Paul Dotse Ayite

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CHAPTER ONE

INTRODUCTION

Background to the Study

All over the world, education is considered as the key to national development. There is no doubt that education has evolved over the years. With it comes all kinds of technology that are used to facilitate the delivery and acquisition of new knowledge to learners. Prasad (2016) indicated that the influence of emerging technology is felt in almost all developed countries, but not limited to them since most developing countries of the world are also making use of it.

As humans continue to develop creative ways of doing things, so does the tenets of education. Thus, over the centuries, there is a constant change in the teaching and learning methodologies. Mapotse (2014) posited that due to the development in science and technology in the world, there has been a change and the rate of change continues to accelerate at a pace of increasing magnitude. Teaching and learning methodologies are constantly changing based on the technology present at each developmental stage of education.

Educational technology has changed the face of education over the years. According to Ouyang and Stanley (2014), educational technology over the past 50 years has evolved rapidly. From a general point of view, it is common to say that every teaching and learning activity is influenced by the technology present at a given time. In the past, most classroom teachers were limited to few resources or technology forcing them to adopt the teacher-centred (chalk and talk) approach. Thus, teachers are normally found to do most of the talking while students watch and listen passively to the

information being delivered (Ottevanger, van den Akker & de Feiter, 2007). Ottevanger et al. (2007) also stated that this type of teaching is mostly dominated by lot of note copying and scarcely any practical activities. Thus, students concentrate on note taking rather than trying to understand what is being taught. More often than not, the teacher-centred approach has been criticized due to its inability to produce high achieving students in science and science related subjects (Hartsell, Herron, Fang, & Rathod, 2009). If the teacher centred method is continuously criticized, it could mean that there are better ways of teaching students.

Emerging technology is often seen as the introduction of computers and its related devices into the educational sector. Normally, it should be noted that the inception of computers and other Information and Communication Technology (ICT) devices into the educational sector will cause some level of variation in the teaching and learning process. What is worth pondering over is whether the integration of emerging technology has played any role in the development and understanding of students. Granito and Chernobilsky (2012) noted that even though emerging technology is gradually being integrated into the educational sector, the actual influence of using it in the instructional process is still unfamiliar. Teaching professionals are still baffling with the role of technology in the student's desired learning experience and how it affects the retention and comprehension level of the student.

In the quest to carry out a national project that make use of digitization of their cultural heritage, Serbians focused on how new technologies in the educational sector could be used (Lajbenšperger, Šegan, & Rajić, 2013). This action prompted the project managers to consider two options. First, it was

listed that the digitized technology be used to preserve the cultural heritage of the people in the Republic of Serbia as the new dimension of science and technology. Secondly, is the adoption of a new program which aims at promoting scientific and technological level among the youth. According to Lajbenšperger et al. (2013), it is revealed that in 2012, more than one hundred teachers and students from high schools in the Podunavlje District of Serbia were trained in the basic principles of using digitization of cultural heritage. Students and teachers from the areas of mechanical and electrical engineering in the Smederevska Palanka and Gymnasium of Velika Plana in Velika Plana, Serbia were those who took part in the training and were urged to use the new knowledge in the school curriculum. This shows the commitment of the people of Serbia in transforming their educational system using emerging technology and at the same time preserves their cultural heritage. It might be possible to observe the same commitment in the African continent.

Recently, most African countries have started giving much attention to the use of emerging technology to solve problems. Many governments in the sub-Saharan Africa are investing in emerging technologies that can be used in educational institutions to elevate the rate of students' comprehension and understanding. For instance, a report from the Ethiopian Ministry of Education (MoE) indicated that emerging technologies will continue to be adopted exponentially and used by most educational institutions across the country (MoE, 2014). Upon the effort of the Ethiopian government, it was seen in the study conducted by Geta and Tadesse (2015) that the use of emerging technology such as computer aided instructions, projectors, video clips among others have helped 90% of the students to perform better. The result of

emerging technology integration in the educational sector has also seen appreciable level of positive influence on students as in the case of Serbia. Other African countries may not be excluded from this technological development.

South Africa, one of the most developed African countries, is not left out in the race of integrating emerging technology into education. Bester and Brand (2013) indicated that the use of technology has a major advantage of not only maintaining students' attention in class but also motivate learners to pay attention. Concurrently, Shelly, Cashman, Gunter and Gunter (2004) established that technology has the potential to increase motivation and class attendance. This, according to Shelly et al. (2004) emerging technologies have the potential to bring most children from advantaged homes and families to school since naturally, they are not interested or motivated to attend school. In addition, Shelly et al. (2004) buttressed the point raised by Bester and Brand that technology helps to maintain students' attention. Empirical evidence from the work of Bester and Brand showed that there was a significant difference between students taught using emerging technology and those taught using the conventional/traditional method. The points raised by these researchers present that there is evidence of gradual technology integration into the African educational system. However, some developing countries in Africa might be facing challenges in this area.

Some countries in Africa might not realize the importance of ICT or technology integration not only for the educational sector but also in other sectors of their economy. A common thought that might be troubling them might be, the relevance of emerging technology, how to integrate it, the cost

involved in implementing a successful integration among others. Aduwa-Ogiegbaen and Iyamu (2005) posited that in the 21st century, lack of knowledge and skills in emerging technology is considered the new form illiteracy. However, in Nigeria, the integration of computers and other technological tools are lacking in more than 90% of the public schools (Aduwa-Ogiegbaen, & Iyamu, 2005). According to Aduwa-Ogiegbaen, and Iyamu, there is in contemplation in Nigerian government that "If a country such as Uganda which has less than a-fifth of Nigeria's resources, is now using information and communication technology to help secondary school students to become better information users, why is Nigeria lagging behind?" From a lay man's point of view, it could be said that some countries do not see the reason to invest into emerging technology and its integration into education. Meanwhile, the success story of Uganda has put a challenge to the Nigerian government. The attention given to emerging technology and its integration into the Ghanaian educational system might also be influenced by the breakthrough in other African countries.

Over the past years, governments in Ghana have been committed to integrating technology into education. It is a common knowledge in Ghana that, governments have supported the development of ICT by providing both teachers and students with laptops in what is known as "better Ghana agenda". As of the year 2015, policies on how to integrate emerging technologies are being put in place to improve upon those drafted from 2003 and reviewed till 2008 and finally promulgated in 2009 (Ministry of Education, 2015). Daniel (2011) revealed that the impact of ICT education in Ghana has a positive influence on the output of staffs in Rural Enterprises Project. The reason being

that, they can effectively use ICT devices in communication, field data processing and analysis among others.

The provision of laptops to teachers and students alone might not mean that technology has been integrated into education. There is a need to find out how these technological tools are being used in education. From a lay man's point of view, having access to gadgets/materials that do not help to achieve the purpose for which it is designed could be classified as "white elephant;" a problem that needs to be solved.

Statement of the Problem

In the teaching and learning process, technology lies at the core of delivery of information to learners. The integration of emerging technology into the learning process is to help learners use the newest technology available to improve upon their academic achievement. According to Liu, Hsieh, Cho and Schallert (2006), there is proof that there is augmentation in achievement and self-efficacy when emerging technology is used. The proper use of emerging technology by students can help in improving performance.

Unfortunately, despite the numerous resources provided by emerging technology, some students are still finding challenges in their academics. In Ghana, it is generally known that students fail in some courses due to lack of understanding of concepts taught. According to a study conducted by Ahmed, Chowdhury, Rahman and Talukder (2014), the findings revealed that 242 private university students were facing academic difficulties and may eventually opt out of the school if there is no intervention organised for them. According to Ahmed et al. (2014), these students have the desire to continue

their academic journey, but faces challenges relating to language, rigid grading system, wrong course selection, laziness towards studies among others.

Likewise, students in the University of Cape Coast are facing similar challenges. According to the information obtained from Management Information System section of the University of Cape Coast, 1,751 students failed in the first semester while 1,610 students failed in the second semester out of the 19,055 who sat for the two semester examinations for the 2014/2015 academic year. Similar results were recorded for the 2015/2016 and 2016/2017 academic years respectively. The failure rate may be attributed to lack of understanding, laziness towards studies among others. However, there exists a paucity of research in this domain in the Ghanaian context.

The purpose of integrating emerging technology into education is to help both students and learners to achieve positive outcomes (Cramer, & Smith, 2002; Granito, & Chernobilsky, 2012). It may be possible that emerging technology can help Ghanaian university students to benefit from its use. The opposite may also be true where the students prefer the conventional/traditional style of learning.

Purpose of the Study

In light of this problem, the study sought to find out the how the use of emerging technology influences the academic achievement of students in the University of Cape Coast in the Central Region of Ghana.

Research Objectives

The study aimed at achieving the following objectives:

1. To identify the types of emerging technologies available for students across departments for academic work at the University of Cape Coast.
2. To determine the extent to which emerging technologies influence the academic performance of students in University of Cape Coast.
3. To assess the influence of the use of emerging technologies on academic achievement of male and female students of University of Cape Coast.
4. To assess the factors that influences the use of emerging technology for academic work by students of University of Cape Coast.

Research Hypotheses

The following hypotheses were tested at a significance level of 0.05 and inferential statistics were used to either reject or fail to reject them.

H_{01}: there is no statistically significant difference between emerging technologies available across departments and their use for academic work at the University of Cape Coast.

H_{02}: there is no statistically significant relationship between how often students use emerging technologies and their academic performance.

H_{03}: there is no statistically significant difference between male and female students regarding the use of emerging technologies in their academic performance.

H_{04}: there is no statistically significance difference between the academic work of students and the factors that influence the use of emerging technologies.

Assumptions

The following assumptions were tested to ensure the statistical tools used produced the correct values.

1. It is assumed that the sample of the study is normally distributed across departments
2. It is assumed that the sample of the study is homogenous

Significance of the Study

This study will be beneficial to all major stakeholders in the University of Cape Coast and beyond as it will create awareness in the use of emerging technology to support education; the best ways of judiciously using emerging technology to achieve academic improvement. Also, the study will help identify the influence of emerging technology use in the educational sector. That is, the ways in which emerging technology are affecting students' performance. Based on the results obtained, relevant recommendations will be made for further studies. Further, the study will be beneficial to researchers and the general public as it will add to the database of literature available in the area of study. Simply put, future researchers may use this study as a source of literature in their study.

Delimitation of the Study

This study is restricted to only one tertiary institution in the Cape Coast Metropolis of the Central Region of Ghana. Per the purpose of the study, only one university was used in the Cape Coast Metropolis to enable the researcher

have control over the study. Likewise, the study only considered students who make use of emerging technology gadgets in their academic activities. Also, the study included the Department of Mathematics and ICT Education, Biochemistry, English, Arts Education, and Business and Social Sciences Education departments in the University of Cape Coast.

Limitations of the Study

In the study, it may be possible that the respondents did provide responses that may not reflect what they actually do with emerging technology devices. This may be so because, all the items on the questionnaire, especially the open-ended items were not fully completed before returning them. In addition, it was difficult to obtain the required literature for the study. Moreover, though the use of emerging technological tools may not be the only factor contributing to students' performance. Yet, it was used as the yardstick for measuring academic performance in this study. Therefore, generalisation of the findings of the study to the entire Central Region or beyond should be done with caution as the data was collected from only one tertiary institution in the region.

Definition of Terms

For the purpose of this study, the following definitions were considered to be appropriate. These definitions were formulated by the researcher and unless noted otherwise remain a working definition for this study.

Emerging Technology: electronic devices that accept data, processes it, bring output and/or store the information. They also help in communicating and/or provide a means for accessing information from the internet.

Conventional Technology: these are resources that help in teaching and learning or performing a task that does not necessarily make use of electronic devices. Examples include abacus, textbook, model/drawing/picture, writing board and writing materials among others.

Distractor: this is an event or activity that lures the learner from the main purpose of learning in the course of using emerging technology.

Intervening variables: these are events that influence a learning or teaching process.

K-12 educational system: this is a system of education starting from kindergarten (1st grade) to 12th grade.

Organisation of the Study

Per the laid down structure of the University of Cape Coast, this study is organised into five chapters; chapter one through to five. Chapter one mainly presented on the introduction to the entire study. Thus, it comprised the introduction and background to the study coupled with statement of the problem, the purpose of the study, research objectives and hypotheses as well as the significance of the study, delimitations, limitations, definition of terms and organisation of the study.

The study also presented on literature review in chapter two to give support to the study and also to help answer the research hypotheses guiding the study. However, chapter three elaborated on the research methods employed in carrying out the study. The chapter focused on the research design, the study area, population of the study as well as the sampling procedure, data collection instruments, and procedures, data processing and analysis, and the ethical issues of the study.

In addition, the study showed the results and discussions in chapter four in line with the research hypotheses. Finally, chapter five summarised the entire study by providing the main findings and drawing conclusions based on the findings. Also, recommendations and suggestions for further studies were made at the end of the study.

CHAPTER TWO

LITERATURE REVIEW

Overview

The main aim of this chapter is to provide support for the study. It sought to provide bases for comparison between studies that were carried out by people prominent in the research area. It also presented opinions from people knowledgeable in areas relating to the study. This chapter was organised under the following headings.

1. Theoretical Review
    a. Concept of Technology
    b. Educational Theories Related to Emerging Technologies
2. Conceptual framework
3. Empirical Review
    a. Emerging technologies in education
    b. The use of emerging technologies to satisfy academic needs
    c. Effects of emerging technologies on students' performance
    d. Gender Influence on the Use of Emerging Technologies for Academic Work
    e. Factors influencing the use of emerging technologies in education
    f. New threats to academic success

Theoretical Review

Concept of Technology

Technology has been part of the educational system since ancient time. Changes in educational technology have been with us for more than half a

century. Ouyang and Stanley (2014) testified to this fact by noting that educational technology has evolved rapidly over the past 50 years. Simply put, technology has become an integral part of the educational system over decades and will continue to evolve to suit the changes in any given era. Understanding technology is also another problem since people often misconstrued it for electrical gadgets.

Different researchers define educational technology in various forms; all directed towards a common understanding. For instance, the Association for Educational Communications and Technology (AECT) define educational technology concept as follows. "Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources" (AECT, 2004, p. 1). From this definition, it is imperative to say that educational technology is an art work that focused on how to create resources to facilitate the teaching which will lead to better understanding of learners. Consequently, educational technology has changed over the years to facilitate teaching and learning. Figure 1 illustrates some major changes that have occurred over the years.

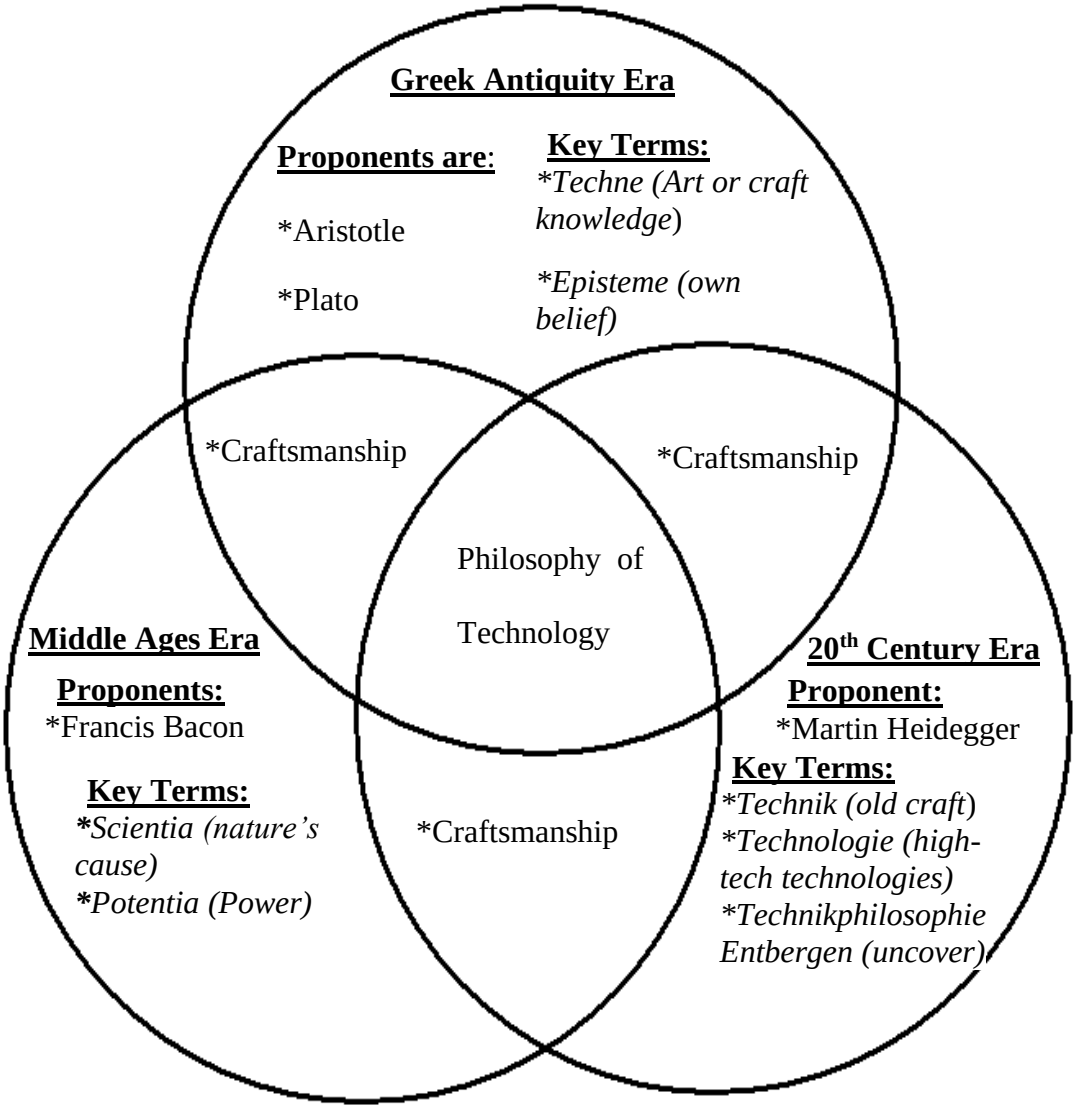

Figure 1: Stages in the Development of Educational Technology

Source: Construct developed based on information from Reydon (2012)

As shown in Figure 1, though the various eras of technological development are identified by peculiar key terms, the common denominator is the "Philosophy of Technology;" a construct developed from Reydon (2012). Thus, all these periods tried to throw more light on how previous philosophers explain the term technology. Also, comparing the Greek antiquity to the middle ages and 20th century, it is observed that they all have the same

underlying factor; craftsmanship. Throughout the periods, philosophers explain how craft which is the art of creation should be dealt with. For instance, during the period of Greek antiquity, craftsmanship was referred to the carpenter's craft-knowledge about how to make objects from wood (Fischer, 2004). On the other hand, the middle ages craftsmanship was not only attributed to the mere imitation of art such as weaving, armament making but also incorporated the mechanical arts together with the liberal arts to form knowledge to be taught (Whitney, 1990). Again, as presented in the work of Reydon (2012), the 20th century era included more sophisticated forms of craftsmanship such as electrical engineering.

Simply put, philosophy of technology which is not originally an academic activity has evolved over the years to improve on how best to improve human productivity. This act of technology made it an interesting concept to follow into the future, study it and observe how it is transforming the life of people from the home, society, educational institution and in the industries.

Educational Theories Related to Emerging Technologies

As educational technology continues to develop exponentially, there is the need to concentrate on theories that underlie its use in the educational sector. Concomitantly, Ouyang and Stanley (2014) stated that 21st century educational technologies are playing critical roles in almost all areas of the educational sectors with the advent of computers and networking technologies; just as the blackboard was introduced in distance education in the 1997s. As an academician, it is prudent to determine how new

technologies are used to improve students' achievement. Also, it is possible for emerging technologies to be aligned with existing technologies.

From the inception of educational technologies, major theories were propounded to guide its use. Concurrently, Ouyang and Stanley (2014) indicated that educational theories that have been developed in the 20th century are strongly linked with the development and utilization of educational technology. Ouyang and Stanley named theories such as behaviourism, cognitivism, constructivism and multiple intelligence as the main theories linked with educational technology. With these theories in place, it only suffices to direct how these theories can be applied in emerging technologies.

Theories have been propounded to guide educationist in discharging their duties to learners. These theories have been applied to the integration of emerging technologies in education. For instance, the principles of behaviourism, which is a school of thought that believed in observable behaviours as learning, was noted as a great contributor to programmatic instructions and computer assisted instruction (CAI) that helped in the development of educational technology (Ouyang, & Stanley, 2014). Likewise, Stoltenkamp, Siebrits and van de Heyde (2017) revealed that behaviourists principle has contributed greatly to the effectively integrate emerging technologies into education. Also, Stoltenkamp et al. (2017) stated that most of the emerging technologies allow students to practice and several attempts and are reinforced in their learning. There is no doubt that these practices follow the behaviourists principle propounded by prominent people such as Ivan Pavlov (Russian biologist and psychologies), Edward Thorndike and Burrhus Frederic (American psychologists) among others. This implies that

emerging technologies have not departed from the principles set up by educationists but rather incorporated it into learning to fit new trends in society.

Concomitantly, as it was in the case of learning theories that underpin the various schools of thought, emerging technologies are most likely to experience criticism of technologies based on the behaviourists principle. In support, Stewart (2013) posited that learning cannot be seen solely as observable changes in behaviour which is mostly criticized as a teacher-centred approach but also on the thought processes that leads to understanding. Inferring from this statement, one could opine that Stewart is simply making reference to the cognitivists' theory of learning. Therefore, cognitivism will concentrate on the thinking that goes on in the minds of the learners.

Cognitive processes focus on how learners and teachers perceive, understand and organise information in their minds. The thinking processes that go on in the mind of the learners need to be taking into consideration when integrating emerging technologies into education. According to Ouyang and Stanley (2014), emerging technologies can employ the use of computer assisted instructions to develop learner's capabilities of creative thinking. Researchers such as Stewart (2013) and Stoltenkamp et al. (2017) also supported the standpoint of Stanley by stating that learners do not only display behaviours as learning outcomes but construct knowledge in unguided methods of instruction. This type of instruction is also facilitated by the use of emerging technologies. Likewise, they can also be used in more sophisticated learning.

Another learning theory that allows students to construct their own understanding of concepts is known as constructivism. With this teaching and learning approach, learners actively construct their epistemological ideas about concepts to be learned. Constructivism is likened to pedagogies in teaching that is progressive and driven by the learner (O'Loughlin, 1992). Also, O'Loughlin stated that constructivism is a "Welcome antidote to traditional approaches." In addition, constructivism is seen as a building technique that capacitates individuals' representations of knowledge which is tested against their experience (McCormick, 1997). Even though many researchers opt for constructivism method of teaching, the importance of it should not be over emphasized as it can also lead to poor understanding in learners. Some learners might not be able to construct their epistemological understanding despite the numerous media presented to them by this method. However, educationists have also developed new theories to help in the integration of technology.

In the same way as technology continues to change, new theories have also been developed to help in its integration into education. One of such theories is the technological, pedagogical and content knowledge (TPACK). The concept of TPACK was coined by Mishra and Koehler (2006) in a conceptual framework designed to enable teachers to effectively meet the need of integrating technology in teaching; Technological Pedagogical Content Knowledge (TPCK). Part of Mishra and Koehler's framework was adapted from the Shulman (1986) concept of pedagogical content knowledge (PCK). Figure 2 presents a pictorial representation of the TPACK framework.

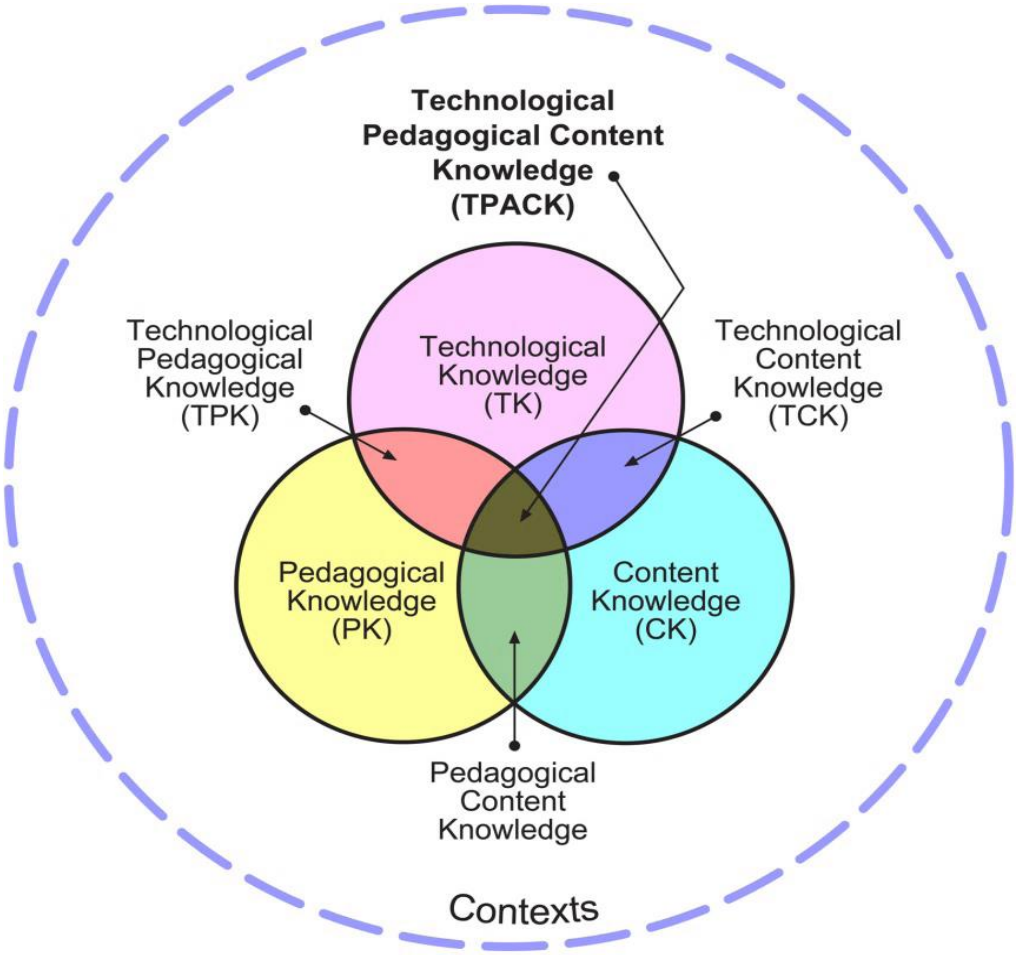

Figure 2- TPACK Framework by Mishra and Koehler (2006)

The framework illustrated in Figure 2 presents how all the components used by teachers in the teaching and learning process can be integrated together to produce a meaningful outcome. Thus, Figure 2 indicated that three separate domains in teaching, namely pedagogical knowledge (PK), content knowledge (CK) and technology knowledge (TK) comes together as a unit, they produce maximum output in a given environment. The contexts in this framework depict the environment or setting in which a lesson is delivered. The implication of this is that a particular lesson that is successful in one

environment might not necessarily be successful in another. Emerging technologies are no exception to this framework.

Conceptual Framework

There have been many studies that have been conducted on emerging technologies over the years. Many of these researches have concentrated their efforts in finding out the effect of emerging technologies on the achievement of learners with the focus on the contributing factors. However, this study wants to focus on a key factor called “distractors” and Figure 3 elaborates on the conceptual framework of the study called “The Desired Distraction, TDD”.

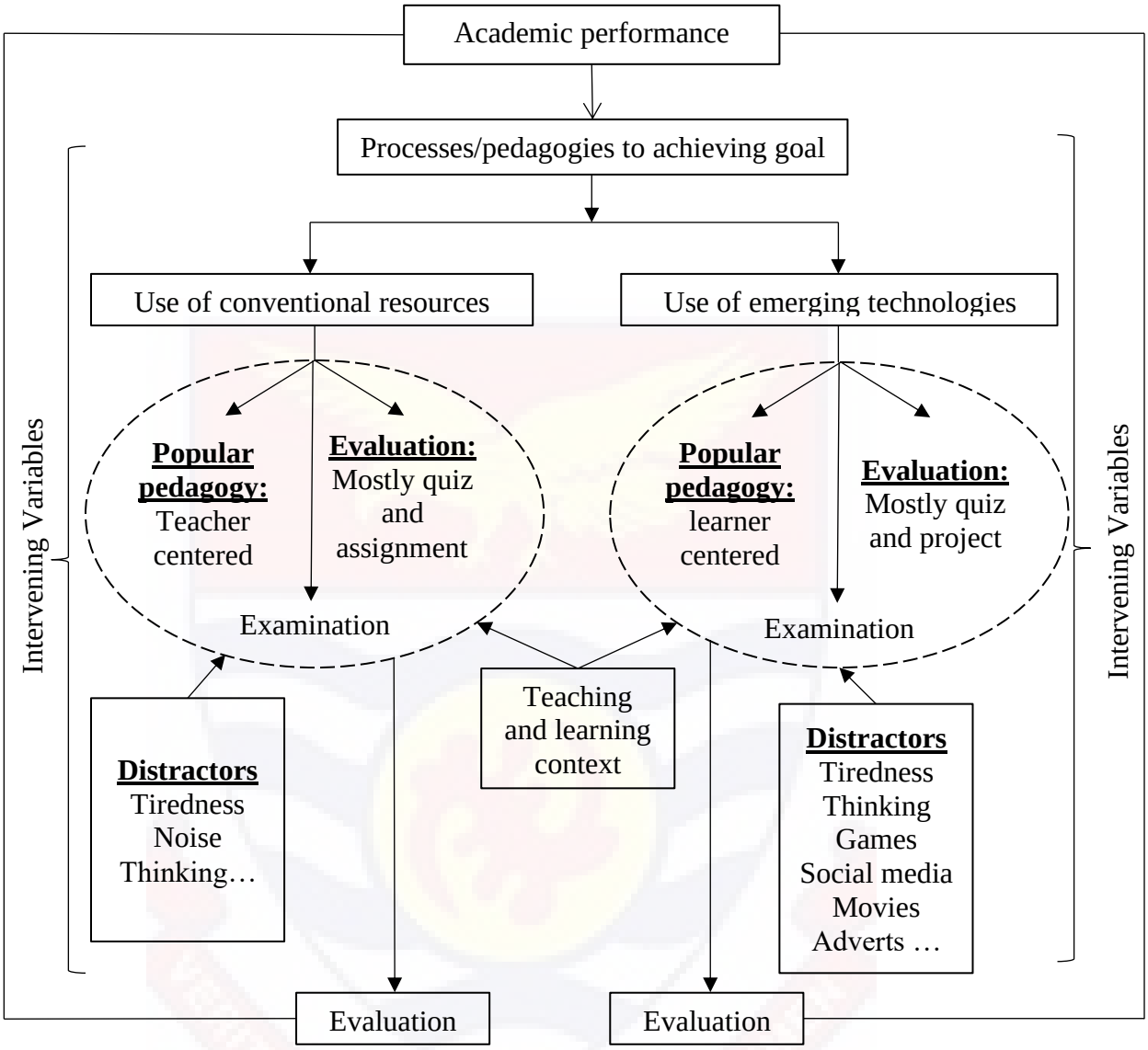

Figure 3: The Desired Distraction (TDD)

Figure 3 showed the researcher's own construction of the study. The main focus of this framework is the influence of factors that are introduced in the learners' learning period due to emerging technologies. These factors are termed "distractors" by the researcher of the study. The researcher looks at education as a whole and tried to compare between distractors within the traditional learning style and the emerging learning style adopted by learners.

The framework is to make one to understand how emerging distractors might affect learners' output. From the top-down model presented in Figure 3, academic performance is directly linked to the evaluation no matter what teaching strategies and resources used. The processes used in carrying out the educational goals are either conventional (traditional) teacher centred methods or the learner centred methods via emerging technologies. That is, the conventional method used in achieving educational goals is seen by the researcher as mainly carried out through the teacher centred approach with emphasis on quizzes, assignments and examinations as the main methods of evaluation. These are seen as individual based since most of these evaluation methods are limited to each individual student. However, with the emerging technologies, educational goals are achieved by using the learner-centred approach or the constructivists approach with the evaluation methods being mainly quizzes, projects, and examinations among others. Most of these evaluations are somehow similar and also, these processes are not static but relative. This means they can change depending on the context in which they are being used.

However, in terms of external factors that distract learners' learning, the researcher of the study is of the view that distractors are more in the use of emerging technology as compared to those of the conventional teaching approach. The researcher presented that in traditional learning environment, learners have few distractors when they really want to learn. On the contrary, there are more distractors when learners incorporate emerging technologies in their learning. The more the distractor, the more the learner is likely to be lured by them, hence the name "The desired distractor, (TDD)". Thus, even

though the distractors might be present during the learning process, the individual needs to activate them before attending to it. This might retard the actual learning and hinder academic performance. In light of this, the researcher of the study wants to find out if learning with emerging technology has a positive effect on students' learning.

Empirical Review

Emerging Technologies in Education

The past decades have seen tremendous amount of improvement in the development of technological tools and resources. These technological tools and resources have also been integrated into educational sector to make work simple and interesting. Reports from Horizon Project supported that there is consistent integration of emerging technologies into the educational sector. Table 1 revealed the major findings from Horizon Project Reports (HPR) from 2008 to 2015.

Table 1: Emerging Technologies in Education as Reported by HPR 2008-2015

HPR	One Year or Less	Two to Three Years	Four to Five Years
2008	Grassroots Video *Collaboration Webs*	Mobile Broadband Data Mashups	*Collective Intelligence* Social OSs
2009	*Mobiles* Cloud Computing	Geo- Everything The Personal Web	Semantic Aware Apps Smart Objects
2010	*Mobile Computing* *Open Content*	Electronic Books *Simple Augmented Reality*	Gesture-Based Computing *Visual Data Analysis*
2011	Electronic Books *Mobiles*	*Augmented Reality* Game-Based Learning	Game-Based Learning *Learning Analytics*

Table 1, continued

2012	*Mobile Applications* Tablet Computing	Gesture-Based Computing *Learning Analytics*	Gesture-Based Computing Internet of Things
2013	*MOOCs* Tablet Computing	Games & Gamification *Learning Analytics*	3D Printing Wearable Technology
2014	*Flipped Classroom* *Learning Analytics*	3D Printing Games and Gamification	Quantified Self Virtual Assistants
2015	Bring Your Own Device (BYOD) *Flipped Classroom* *(- Learning Analytics)* *(-Mobile Apps)*	Makerspaces - Wearable Technology *(- Collaborative Environments)* (-Games & Gamification)	Adaptive Learning Technologies - The Internet of Things (- Wireless Power) (- Flexible Displays)

Source: Horizon Project Reports, Holotescu (2015)

As stated in Holotescu (2015), items in italics, as presented in Table 1, were expected emerging technologies that gave effectiveness to open learning environments. These are:

i. Mobile Applications (the term is similar or close/connected to Mobile Learning, Tablet Computing, Bring Your Own Device and Electronic Books)
ii. Open Content
iii. Augmented Reality
iv. Learning Analytics (as part of the Visual Data Analysis trend in HR 2010)
v. Massively Open Online Courses (MOOC)
vi. Flipped Classroom
vii. Collaborative Environments (Collaboration Webs).

From this extract, it is imperative to note that the introduction and used of emerging technologies in education continue to grow day-in-day-out. The presence of these technologies can be seen as an asset to students to get

information as easily as possible. Per the research conducted by Kim and Kim (2016) on the determinants of the adoption of mobile cloud computing services, 60.9% of the respondents believed that the services of cloud computing are essential. Likewise, 79.5% of the respondents were optimistic about using more services provided via cloud computing in the near future. Concepts that trouble students could also be explained to them via collective intelligence, collaboration webs, open content, electronic books, massive open online courses among others.

With the emergence of these technologies, learners become exposed to varieties of information sources. Consequently, learners may frequently update their information on recent and pressing or complex issues relating to their field of study. Notwithstanding, information could be shared by learners across discussion forums to build their knowledge (Draper, 2015). In the same line, Draper as cited in Draper (2015) noted that knowledge building activities do not form integral features of most communities but requires facilitation to enhance deep understanding and advancement of knowledge. Thus, even though these emerging technologies have been with us for some time now, it does not necessarily mean that it will enhance deep learning but rather needs to be promoted among students and teachers to obtain maximum positive outcome.

Another important technology that is springing up rapidly in education is the use of mobile devices. In Ghana, it is common to observe that almost every Ghanaian from senior high school level or from 15 years upwards own and use mobile phones. This reflects on Parsons (2014) that 75% of those who subscribe to mobile devices are in developing countries. As reported by Ofosu

(2009), access to mobile phones in Ghana is extensive. Based on this, it may be anecdotally said that the use of mobile phones has penetrated the education system, especially in tertiary institutions where there is much freedom for learners to explore.

Concurrently, Leo (2006) showed that most adults in developed and developing countries are using mobile technologies to perform numerous activities ranging from calling to accessing information. AlTameemy (2017) posited that mobile phones can be used for academic purposes of making use of instructional technology and applications. The use of mobile technologies in Ghana can be attributed to the number of mobile phone subscribing companies (Vodafone Ghana, MTN, Tigo, Airtel, Glo, and Expresso) that make communication relatively cheap and competitive.

Notwithstanding, the use of other technological devices is also used in education. Personal Digital Assistants (PDAs) proved to be a device that enhances education at various levels. Son, Kim and Park (2004) exhibited eight categories of PDA usage in K-12 educational setting. According to Son et al. (2004), PDAs are used in education to transfer, share and retrieve data, to evaluate, manage class, document among others. Therefore, it is imperative to say that PDAs have a great potential to improve on the way students and teachers share resources which may lead to better dissemination of information.

The Use of Emerging Technologies to Satisfy Academic Needs

Emerging technologies have been with us since the time to Greek antiquity till date. In almost all the generations that have past, each new technology that has emerged found its use in the educational sector. According

to Moslander (2000a), one of the major technologies that faculties are requiring their students to use is the internet. Moslander also posited that many faculty students are being trained towards using the internet to find information and even most of the students are convinced that they can find the latest information while surfing via the World Wide Web (www). Learners all over the world can access information with ease with this kind of technology. It is not surprising to say that this technology helps learners to get information on a variety of topics.

Likewise, education has seen major technological integration that can be used to improve on learners' understanding. The integration of multimedia, for instance, could be said to have either positive or negative effect on how learners learn and perform. Multimedia presents learners with multiple learning modes that can support all types of learning styles. Concurrently, Stemler (1997) submission about the integration of multimedia in education revealed active learner participation in the learning process than a passive one. In addition, Stemler posited that "True interactivity implies that the learning process is, in some degree, modified by the actions of the learners" (p. 340). Notwithstanding, Schwier and Missanchuk (1988) showed that the learner interaction with multimedia maybe the underlying difference when compared to the traditional instruction. Therefore, it is imperative to say that emerging technologies have been used for sometime and the results prove to be better. However, it is necessary to note that these researches may be influenced by some extraneous variables.

Likewise, other emerging technologies have brought about new methodologies employed by teachers to deliver their content. Some teachers

view the integration of some new technologies as an opportunity to make their lessons more interesting and interactive. As presented by Alamri, Bader and Alsaleh (2017), emerging technologies helped to create a 'flipped classrooms' which served as blended learning for learners; that is, learners take up courses online and also do class assignments. In support, Al Rowais (2016) opined that this type of learning provides opportunities for lecturers not to engage in only lecturing but more personalized guidance and interaction with learners. According to Alamri, Bader and Alsaleh, the integration of mobile learning and MOOC help in the implementation of this type of blended learning. More emerging technologies seem to make use of resources provided on the internet. This will require some daily, weekly, monthly or yearly expenditure. Thus, even though the internet is free, some sites might require you to purchase some of their services before getting access to certain resources. Also, regular payment needs to be made to the Internet Service Provider (ISP). This implies that the use of some emerging technologies will be expensive in the long round while some will be economical.

Still, some important technologies have been integrated into education to make teaching and learning of difficult concepts easy and comprehensive. For instance, researchers have shown that technologies such as games and gamification, cloud computing, virtual and remote laboratories, three-dimensional printing among others have been integrated into education and used for various purposes. Few among these researchers include Cheng, Xiong and Zhang (2015), Deterding, Sicart, Nacke, O'Hara and Dixon (2011), Sachs, Haggerty, Cima and Williams (1993), Nedic, Machotka and Nafalski (2003). Simply put, emerging technologies can be said to include a variety of

branches. All these branches can be grouped into strata and study as such. However, this study will focus on just a few (smartphones, tablets, laptop, personal digital assistants) that is mostly being used widely at the University of Cape Coast campus.

Effects of Emerging Technologies on Students' Performance

Over the years, technology has evolved and help to improve upon our way of living. Many work places have inculcated the use of technologies that are emerging into their working procedures. Education has also followed the same path. However, we may wonder if this development is helping learners. It has been emphasized by Prensky (2004) in a study conducted on mobile phones that instead of preventing kids from coming to school with mobile phones, why not use them for educational advantage since they (mobile phones) can be used to learn. The implication of Prensky's statement is that, emerging technologies can be directed towards profitable use rather than the negative anticipation. Thus, these technologies can help promote the performance of students.

It is easy to say that emerging technologies will help learners to perform better in their academics. Most people are of the view that with the help of computers or emerging technologies, performance will increase and considerable amount of knowledge could be gained by learners. In support, Kejawa (2017) stated that computers help to comprehend things that we do not know and also to embellish maximum performance of existentiality. Notwithstanding, Gaff (2002) also noted that computers can be used to enhance the teaching and learning of all subjects. Though this is true, the opposite can also be true depending on how these emerging technologies are

used. This implies that, learners could also regress in performance when they misuse technological devices.

Most at times, people think that with the use of emerging technologies, their performance will increase drastically. For example, a recent encounter with my employer revealed that, for him, once emerging technologies (computers, projectors, printers, etc.) are available for teaching ICT, all students need to score the highest grade. This is not always the case as there are other factors that need to be considered. For instance, in a longitudinal study carried out by Weaver (2000), it was shown that there exists only a small relationship between computer use and the students' performance. Weaver's result showed from all the items presented, none recorded a correlation coefficient above 0.035 in mathematics, science and reading. In support, the British Educational Technology Association (BECTA) as cited in Elohor (2013) revealed that there is no relationship between emerging technology resources and either reading or mathematics. Based on this information, it is imperative to state that the emerging technology used does not produce much difference in performance. According to BECTA, from all the relationships with emerging technologies, none exceeded 0.07. Therefore, BECTA concluded that emerging technologies are 99.5% independent of pupil's performance. Simply put, emerging technologies need to be utilized properly to avoid impeding factors that will hinder the performance of learning.

Gender Influence on the Use of Emerging Technologies for Academic Work

Over the years, gender plays a part in the achievement of academic work and/or the type of work. In academia, there are gender disparities leading to males dominating in most departments. For instance, Acker (2006) opined that gender disparity is dominant in most universities; a habit that has become a natural event and creating gender gaps. The perpetuation of this situation may be due to the inequalities in the number of male and female students admitted to tertiary institutions.

The disparities in the proportion of male and female students may influence academic work just as it is observed among university staffs. According to the study conducted on net generation in Australia, it was found that the confidence in using digital technologies varies among students (Jones, 2012). Göransson and Rolfstam (2013) suggested that women are relegated to the background in the areas of technology and technical development since most technological developments are done by men and for men. It could be inferred that female students might be limited in the use of emerging technologies in education. However, this might not always be the case.

The involvement of female in higher education may vary from country to country. Female students may even outnumber male students in some countries. Many researchers have shown that equal avenues are offered to female students in Poland and Sweden where younger females are better educated than men (Etzkowitz, Kemelgor, & Uzzi, 2000; Gras-Velazquez, Joyce, & Derby, 2009; Ramsey, & McCorduck, 2005). On the contrary, these researchers noted women are not adequately represented in scientific

investigations. The notion that females contribute more to education than males cannot be substantiated. Female students are likely to underperform when compared to male students.

Factors Influencing the use of Emerging Technologies in Education

The emergence of new technologies into the teaching and learning environment has been influenced by some factors. These factors either promote total integration of the emerging technology or hinder it. Agyei and Voogt (2014) categorised these factors into two; the learner characteristics and the work environment characteristics. From the viewpoint of Bate (2010), teachers turn to use more and more emerging technologies (mostly, the use of ICT) in their delivery methods if they believe in collaborative learning. This could mean that, the theoretical beliefs of the learner or the teacher informs the type of learning resources to use. An elaboration on the learner and the work environment characteristics were also presented by Agyei and Voogt.

Learner Characteristics

Dissatisfaction with the status quo: this is the extent to which learners and teachers view the inclusion of emerging technologies in education as fulfilling. According to Jonassen (2002), teachers that believe in collaborative learning establishes relationship with students as their partners and make use of ICT as an intellectual and cognitive tool. According to Jonassen, this may bring satisfaction to both learners and teachers since it promotes learning and creativity in students. Therefore, experiences of learners or teachers in the use of emerging technologies may inform how often they are used.

Sufficient knowledge and skills: in order to sufficiently use emerging technologies, users (learners and teacher) need to acquire the knowledge and

skills require in using them. This presupposes that the learners and teachers should be conversant with the emerging technologies in the educational system. Unfortunately, Webb and Cox (2004) perceived that there is a lack of knowledge and skills in the use of technological tools that could be used in planning and delivering concepts to learners. It could be said that adults will turn to prefer a more traditional or conventional ways of learning and/or teaching. In support, findings from Moslander (2000b) exposed that adult students' beliefs and experience about information technology and library system differ greatly according to the age of the student. Anecdotal comments also suggest that younger or newer generations prefer the use of emerging technologies to the conventional ways since most of them (younger generations) easily get the skills needed to use it.

Commitment: it is natural to develop sophisticated skills if you continually practice or rehearse a piece of work/procedure. As indicated by Agyei and Voogt (2014) in their study of student teachers, the respondents were willing to make use of ICT-activity based learning (ICT-ABL) to increase students' learning. In a supporting statement, Riel and Becker (2008) showed that teachers will evidently integrate ICT-based methods in their teaching if they have strong commitments to improve students' learning. The reason for including ICT-based innovations in the study might result to the fact that the current generation of students is more acquainted to the use of emerging technology.

Availability of time: time is one of the essential resources in teaching and learning. To make the most out of education, one has to make time to do so. With the introduction of emerging technologies, time has been noted as one of

the barriers in implementing technology in higher educational institutions (Ebersole, & Vorndam, 2003). Likewise, Agyei & Voogt (2014) noted that time is needed by teachers in the preparation and planning of how to use ICT-ABL before using it in the teaching and learning process. Despite the fact that the concentration is on teachers, these teachers are equally students who are acquiring knowledge on how to use technology (emerging technology) in their teaching.

School Environment Characteristics

Availability of resources: this is a major limitation in the educational sector. Concomitantly, research conducted by Ekpo as cited in Ogbondah (2008) revealed that there is a shortfall in instructional materials and that this makes teachers and students improvise to make the lesson successful. Also, about a decade ago, studies revealed that only about 4% of the African population had access to computers and internet (Murphy, Anzalone, Bosch, & Moulton, 2002; Resta, & Laferrière, 2008). Even though in the past decade there has been major integration of teaching and learning resources in terms of emerging technology, it is not adequate to satisfy the needs of all educational institutions. Teachers and students who lack innovation in finding alternative ways of using these emerging technologies may not have any influence of them in their teaching and learning process.

Reward or incentives: naturally, motivation stimulates the rate at which people work. For instance, in a study conducted on computer algebra systems (CAS), it was stated that the use of emerging technologies by teachers helps to increase students' motivation to understanding deeper concepts, Martinovic and Karadag as cited in (Jesso, & Kondratieva, 2016). The learner can be

motivated internally to find out the understanding of certain concepts via the use of technological tools.

Participation: with emerging technologies, students might participate more in the teaching and learning process. From the point of view of Agyei and Voogt (2014), student-teachers who are almost ready to enter the teaching profession could contribute their sense of ownership using ICT-ABL designs in teaching.

School culture: the school environment may decide on how teachers and students engage in the teaching and learning process. Thus, the school environment might hinder or boost the way students learn and perform. Chukwuemeka (2013) posited that environment is a key player in most people's life; students, teachers, employers or employees. In addition, research findings reveal a significant difference between students taught in an ideal environmental setup and those taught in a dull environmental setup. Similar situations might occur when emerging technologies are used in the learning environment. The simple provision of technological tools cannot improve or enhance the performance of students but how they are being used by learners.

New Threats to Academic Success

The integration of emerging technologies may bring along new challenges. These challenges have to do with how to effectively use these technologies at the appropriate time. It may happen that some students will be using these technologies wrongly instead of devoting them to improve the understanding of concepts. Research findings on the use of emerging technologies such as smartphone applications on a 24-hour base revealed that users are over stressed with sleep disturbances, anxiety, decrease in performance and reduced physical activity (Bian, & Leung, 2015; Thomée,

Härenstam, & Hagberg, 2011). Also, according to findings from Tossell, Kortum, Shepard, Rahmati and Zhong (2015), addicted users of smartphone applications launch them frequently to chat with friends while non-addicted users launch these applications to get important information. This development of emerging technology use can cause users to develop habits that will hinder academic performance.

Similar situations may occur with other emerging technology such as computers where students may download movies and spend the entire nights watching movies or playing video games. In support, Bianchi and Phillips (2005), addiction to new technologies may gradually develop into an automatic habitual pattern difficult to control. Therefore, a new trend in education should be studied and corrected before it goes out of order.

Chapter Summary

This chapter revealed issues in line with the general aim of the study, which is the effect of emerging technologies on academic performance. The chapter indicated that there are a number of factors that either help to improve individual's performance or hinder it. Thus, the learning environment, learning resources, students' focus in the use of resources among others contribute to academic performance. However, the chapter also showed that emerging technologies have been with us since the time of Greek antiquity. That notwithstanding, the conceptual framework of the study focused on factors that hinder effective use of emerging technologies as distractors (games, social media, movies, distracting adverts among others). Likewise, the literature revealed that new threats such as addition to new applications and

development of habitual patterns in the use of emerging technologies is a major factor that needs to be checked.

CHAPTER THREE

RESEARCH METHODS

Overview

The main aim of the study was to find out the effects of emerging technology on the academic performance of students in the University of Cape Coast. Based on this aim, this chapter outlined the research procedures and methods that were used in data collection and analysis. Thus, the chapter covered the research design, the study area, target population, sampling procedures, data collection instrument, data collection procedures, data processing and analysis, and ethical issues. A summary of the chapter was also provided at the end of the chapter.

Research Design

To achieve the aim of the study, the quantitative research design was used. Thus, the quantitative research survey design was conducted. According to Creswell (2014), this research design is the type that helps researchers to explain natural occurrences of events by collecting data using research instrument(s). This method was used because it gave the respondents the ability to respond to the items presented, both closed-ended and open-ended. Concomitantly, Cohen, Manion and Morrison (2007) opined that this type of research design helps to collect data within a given time frame with the purpose of describing the nature of prevailing study and/or findings the values against which variables can be compared to. The researcher may depend on this technique to compare test results and make inferences from it which is also in line with a statement by Creswell (2003).

Further, this type of research design helped the researcher to collect data quickly to meet the duration stipulated for the study. According to Yauch and Steudel (2003), quantitative study enables the researcher to collect data and produce results out of it since there is little demand on the time spent collecting data. Consequently, the researcher was able to complete the research on time.

On the contrary, quantitative design may also present some flaws. The researcher might fail to elaborate on phenomena that actually happens due to the focus on theory or hypothesis testing instead of focusing on theory or hypothesis generation; a condition termed confirmation bias (Johnson & Onwuegbuzie, 2004). Also, Johnson and Onwuegbuzie noted that quantitative design may produce abstract findings or knowledge that may be too broad for immediate application into a given setting, context, and individual. To avoid these shortcomings, the researcher of the study was vigilant and adopted scientific strategies that prevented the study from these shortfalls by clearly drawing the plan to follow for a quantitative study. That is, the study followed strictly the research hypotheses that guided the study in order not to go astray.

Study Area

The study area is the University of Cape Coast, in the Cape Coast Metropolis of the Central Region of Ghana. From the 50th Vice-Chancellor's Annual Report, it is revealed that the University of Cape Coast is a product of Ghana's leaders who gained independence for the country with a special regard to Osagyefo Dr. Kwame Nkrumah (Vice-Chancellor's Annual Report, 2017). Also, the report indicated that University of Cape Coast started as a University College of Science Education in October 1962 with just two

departments; Department of Arts and Science Education where 155 students were enrolled.

From the massive infrastructural development and the introduction of new courses, the university now has a total population of about 19,222 of full-time students. In addition, the report revealed that the university currently has five colleges with six faculties and eight schools. These departments helped in running many programmes in humanities, education, sciences, medicine, allied sciences among others. Further, the university is devoted to making education accessible to majority of Ghanaians by establishing learning centres across all the 10 regions of Ghana. All these developments positioned the University of Cape Coast to be a worldwide acclaimed university. Figure 4 presents the map of the university community.

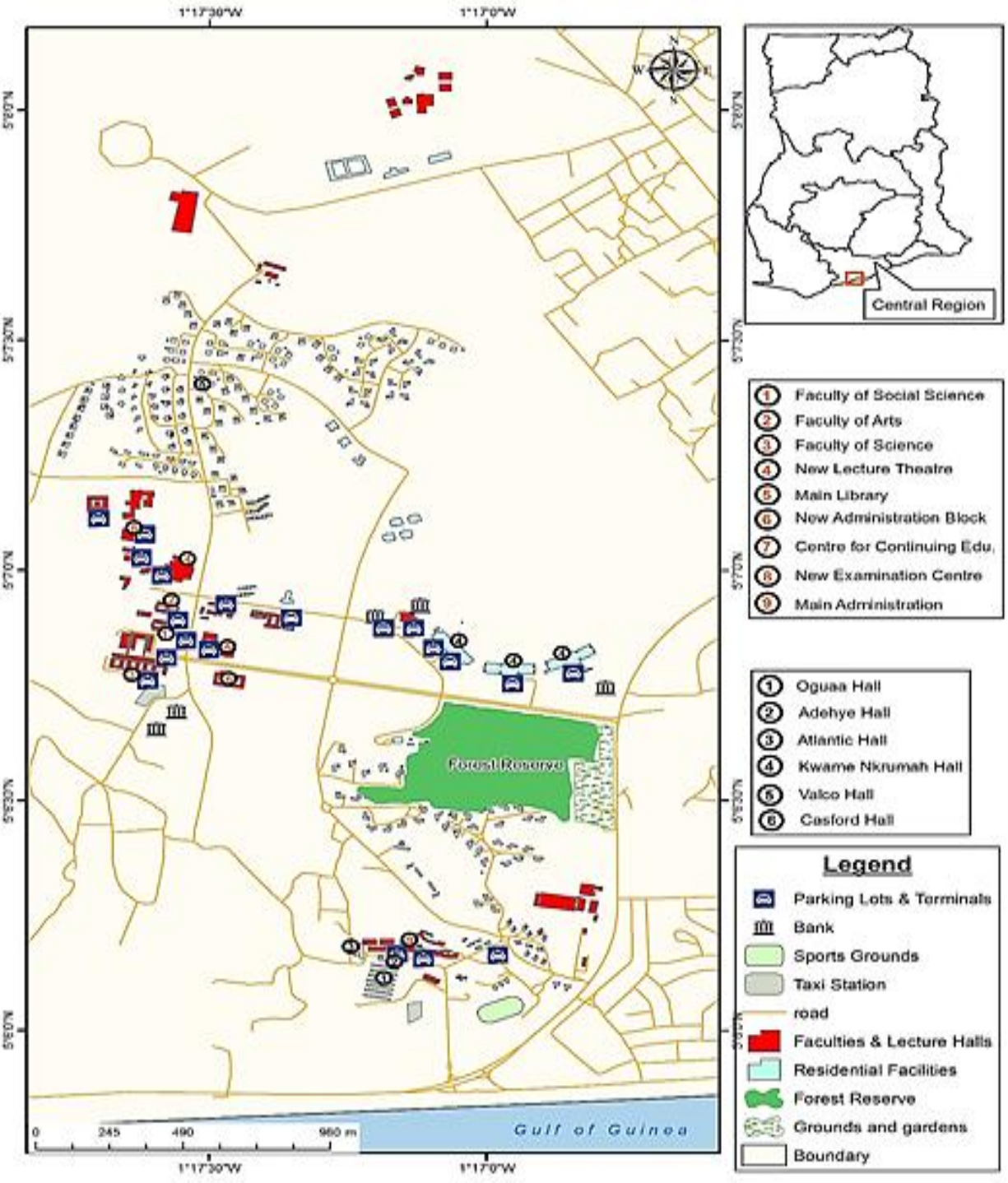

Figure 4: Map of University Cape Coast

Source: Geography Department, University of Cape Coast (2018)

Population

Defining the population of the study is another important criterion that needs to be looked at critically. A wrongful definition of the population might render the entire study useless if the right respondents are not selected. Amedahe (2002) stated that population is the mass of cases that adequately meet a designated set of criteria. In support, Castillo (2009) also added that a population is a large assemblage of individuals that develop the key focus of a scientific inquiry. For this reason, and for the purpose of the study, the target population of the study considered was all full-time (regular) students in the University of Cape Coast. This target population was selected for the study because it fits the purpose of the study and helped to obtain information to answer the research hypotheses formulated for the study.

The targeted population is estimated to be 19,300 students based on the information obtained from last three academic years. For 2014/2015 academic year, the number of students was 19,353. However, the number of students for the 2015/2016 and 2016/2017 academic years was 19,389 and 19,222 respectively. This information is available in the 49th Congregation Basic Statistics book issued by the student records and management information section (SRMIS, 2017) of the University of Cape Coast.

Sampling Procedure

Sampling procedure is also another technical area in a research that needs careful consideration. It is important to choose the right sampling technique that will produce results based on the objectives of the study. Therefore, to provide solutions for the effects of emerging technologies on academic achievement, the researcher used the stratified sampling technique.

This method was considered to be appropriate since it focuses on selecting special characteristic groups that provided the required information for the study. According to Walker (2014), stratified sampling gives room for systematic selection of the proportions of the population which may give the researcher differences in response. In support, Crossman (2017) positioned that using a stratified sample will always achieve greater precision than a simple random sample, provided that the strata have been chosen so that members of the same stratum are as similar as possible in terms of the characteristic of interest. This technique was used in conjunction with the simple random sampling method to select departments.

Meanwhile, in selecting the sample size of the study, the researcher made use of the Krejcie and Morgan's table for sample size selection. This was considered by the researcher because it uses general formula that helps to obtain a sample size that is representative of the population. Thus, based on the information from Krejcie and Morgan (1970), 377 respondents were selected from level 300 students out of an estimated population of 19,300.

These students were selected based on one of their elective courses that they offer from the department. Therefore, an entire class of students was selected. From the Department of Mathematics and ICT Education, 102 students were selected, 82 from Biochemistry Department, 64 from English Department, 65 from Arts Education Department, and 64 from the Department of Business and Social Sciences Education.

Data Collection Instrument

To collect the data for the study, the researcher made use of a research questionnaire. This instrument was used because it was identified as an instrument that helps to collect accurate and quality data within a short period of time. Moreover, it helped the researcher to combine both open-ended and close-ended items to provide more support for the research design. Alongside, it was revealed that questionnaire is known to be quite valid and reliable if well structured (Sarantakos, 2005). The questionnaire was developed by the researcher to collect information that was used to test for all the research hypotheses that guided the study. The questionnaire was divided into five sections; section A for obtaining bio data, and sections B to E for obtaining information to answer research hypotheses 1 to 4 (refer to Appendix A).

However, despite the numerous advantages in the use of questionnaires, there are some challenges associated with it. According to Burns and Grove (2001), questionnaires are known to have validity and accuracy problems if not well developed. That is, the view of the instrument measuring the required information is questioned. To avoid these problems, there is a need to check validity and reliability of the instrument.

Validity of the Instrument

Validity is the ability of the instrument to measure the required information. As defined by Wood, Ross-Kerr and Brink (2006), the validity of an instrument is the ability of the instrument to measure what it is supposed to measure. Simply put, all factors under consideration must be catered for by the instrument used. For this reason, the researcher of the study employed the services of people knowledgeable in the study area to give their professional

touch to it. The instrument was shown to at least three different lecturers in the University of Cape Coast to critique positively. This was done judiciously and helped to put the instrument in a better shape to measure what it was designed to measure. Further, the instrument was constructed in simple and clear language to avoid any form of ambiguity of the items.

Also, a pilot study was conducted at the University of Education, Winneba to help in further simplification of the items. This was based on the recommendation from Bryman (2015) that piloting helps to test the instrument of the study by using a small set of respondents that have similar characteristics compared to the target population of a study.

In addition, the researcher, with suggestions from three lecturers in University of Cape Coast restructured the questionnaire by rewording items that were ambiguous. This is in line with Creswell (2008) statement that, it is critical and imperative to ensure clarity of questions and the ability of the instruments to collect data to measure and answer the research questions/hypotheses of a study. Thus, by doing so, the items were considered to be comprehensive with regards to the study variables.

Reliability of the Instrument

It was important to also measure how consistent the instrument was when used in a similar study. As stated by Mugenda and Mugenda (2003), the reliability of an instrument measures the extent to which it produces the exact same results when used in similar research. Therefore, a pilot study was conducted to measure the reliability coefficient of the instrument. The reliability coefficient, $\alpha = 0.79$ was obtained when a sample of 50 students from the University of Education Winneba was used. This informed the

researcher that the instrument was reliable since according to Cho and Kim (2014), an alpha value greater or equal to 0.7 or 0.8 is acceptable for an instrument to be considered reliable. Additionally, according to Creswell (2008), reliability coefficient of the instrument (questionnaire), measured in Cronbach's alpha value, provides basis to measure the internal consistency and trustworthiness of the items on the instrument. The Cronbach's alpha test was run on the closed-ended items to determine their reliability. On the other hand, open-ended items were constructed in simple statements to avoid any ambiguity and to provide support for the close-ended items.

Data Collection Procedure

The instrument used for data collection was a research questionnaire. This instrument was used to collect the quantitative data needed for the study. In order to use this instrument, ethical clearance was sought from the Institutional Review Board of the University of Cape Coast before the administration of the questionnaires. In addition, the researcher of the study requested for an introductory letter from the College of Distance Education, University of Cape Coast. These letters were used to seek permission from the heads of the departments selected for the study. When permission was granted, the researcher liaised with the teaching assistants to know the lecture periods of a course mounted for students of the given department.

Subsequently, the researcher sought permission from the lecturers involved to administer the questionnaire to their students before the lecture began. This period was considered ideal because after the lecture, majority of the students might leave or might be in haste to fill the questionnaire which might have led to more unreliable data. With the lecturers' permission, the

teaching assistants and in some cases the lecturers informed the students to come for lecture 30 minutes earlier on the date where the questionnaire was administered. This was done to avoid losing the precious time allocated for teaching and learning. At each point of the data collection, the researcher introduced himself and explained the purpose of the research to the respondents as well as assured them of the anonymity of their information.

Data Processing and Analysis

The data collected for the study was organised and arranged in an orderly manner to ensure clarity and consistency. In addition, the researcher coded all the data into the (International Business Machine, Statistical Product for Service Solutions) IBM SPSS Statistics software; a software originally known as Statistical Package for Social Sciences, version 21. This software was used because it is specially designed to analyse quantitative data. As noted by, Gravetter and Wallnau (2004), SPSS is the most suitable package for analysing quantitative data. Therefore, the researcher considered this software for data processing.

Data was analysed using the frequency counts and percentage for the bio data of the respondents. The multiple response was also used to obtain percentage and frequencies on the availability of emerging technologies for students. For the research hypotheses, Chi-Square analysis tool was used for research hypothesis 1, and the Spearman Ranked Correlation Coefficient (ρ) was used for research hypothesis 2. The independent sample t-test was used to test for research hypothesis 3 while the regression analysis was used to test research hypothesis 4.

On the other hand, the researcher categorised the open-ended items after going through the responses from the questionnaire and were entered into the IBM SPSS software to obtain the frequency of people that gave various responses. In return, the open-ended items provided supporting information that buttressed the results obtained from the analysis.

Ethical Issues

For ethical issues, the researcher obtained an introductory letter and ethical clearance from the College of Distance Education, and the Institutional Review board of the University of Cape Coast respectively. These served as the basis on which the researcher conducted the study at the university. Further, the researcher introduced himself to the respondents and assured them of their anonymity. That is, the respondents were not requested to write their names on the instrument given to them. In addition, it was clearly stated on the questionnaire that anybody that responds to the questionnaire does that voluntarily and on his/her own freewill. Moreover, respondents were informed that partaking in the study was not compulsory and will not be used against them in any form; either academically or in future.

Chapter Summary

This chapter revealed that the study adopted the quantitative technique of research design. This chapter also revealed that the study made use of a combination of stratified sampling and the simple random sampling method to select level 300 students from the University of Cape Coast. Again, the study used a research questionnaire to collect data from the targeted population after conducting a pilot study at the University of Education Winneba. Moreover, the data collected was processed using the IBM SPSS Statistics software.

Results obtained from the analysis and discussion were presented in chapter four.

CHAPTER FOUR

RESULTS AND DISCUSSION

Overview

This chapter is aimed at presenting results obtained from the analysis done to provide evidence to support the aim of study, which is the effect of emerging technology on the academic achievement of students in the University of Cape Coast. In this regard, the findings of the study are presented in line with the research hypothesis that guided the study. The study also presented information on the bio data of respondents. In all, 357 completed questionnaires were obtained and used out of the 400 printed; this gave a response rate of 89.3%.

Biographic Characteristics of Respondents

Even though this part of the study was not directly linked to the research hypotheses, it helped to obtain relevant information that without which some hypotheses could not have been computed. Information on the biographic characteristics of the respondents were obtained from the section A of the research questionnaire and presented using frequency counts and percentages. Table 2 presents information on the gender, age, department and the number of respondents that use any of the four main technologies stated in item 4 of the research questionnaire.

Table 2: Biographic Characteristics of Respondents (N = 357)

	Frequency	Percent
Gender		
Male	243	68.1
Female	114	31.9
Age		
Below 20 years	10	2.8
20 to 24 years	288	80.7
25 to 29 years	45	12.6
30 to 34 years	12	3.4
35 years and above	2	0.6
Department		
Maths and ICT Education	96	26.9
Biochemistry	78	21.8
English	61	17.1
Arts Education	62	17.4
Business and Social Sciences Education	60	16.8
Do you use any of the emerging technological tools when learning?		
Yes	357	100.0

Source: Field survey, Ayite (2018)

From Table 2, it is clear that the number of males surpasses that of the females. Table 2 revealed that 243 (68.1%) of the total number of respondents were males while 114 (31.9%) were females. This information reflects the general number of students as presented in the 49th Congregation Basic Statistics book issued by the student records and management information

section (SRMIS) of the University of Cape Coast. From this book, as at 2016/2017 academic year, the total number of males were 12,469 (64.9%) and that of females were 6,753 (35.1%). With this information, it could be said that the number of respondents used was representative of the target population.

Also, a glance at the age group of the respondents indicates that majority of them were within the age group of 20 - 24 years. This age group recorded 80.7% (288) of the total number of respondents. Next, the age groups of 25 – 29 years, 30 – 34 years and below 20 years recorded values of 12.6% (45), 3.4% (12) and 2.8% (10) respectively. From this result, it can be said that majority of the respondents are young and have the ability to effectively engage in knowledge acquisition that will be needed in the job market.

In addition, Table 2 showed that the respondents were selected from five different departments. The highest number of respondents was obtained from the Department of Mathematics and ICT Education; 96 (26.9%) respondents. Also, the Biochemistry, English, and Arts Education departments provided 78 (21.8%), 61 (17.4%) and 62 (17.4%) of respondents respectively while 60 (16.8%) of the respondents were from the Business and Social Sciences Education Department. These numbers represent the completed number of usable questionnaires that were used in the study.

Interestingly, it was revealed that all the respondents, 357 (100.0%), agreed that they make use of emerging technology in their learning. Despite the fact that some of the respondents might prefer the traditional way of learning, they indicated that they sometimes refer to information obtained using emerging technological devices. Per this study, the technological

devices used by students are classified under four main categories and presented in Table 3.

Table 3: Technological Devices Owned by Respondents (N = 357)

	Frequency	Percent of Cases
Smartphone	341	95.5
Tablet (iPad)	42	11.8
Laptop (Desktop)	225	63.0
PDA	5	1.4
Total	613	171.7

Source: Field survey, Ayite (2018)

Table 3 was tabulated from a dichotomy group at value 1. This resulted in obtaining a total number of responses of 613. However, the analysis is based on the case percent to show the percentage of respondents who own each of the technological devices in Table 3. As expected, smartphone recorded the highest number of 341 out of 357 respondents representing 95.5%. Per this result, it showed that only 4.5% of the respondents did not own smartphone. However, they possess other technological devices.

It could be said that those who did not own smartphone might fall under those who own tablet or iPad. Those who own tablet or iPad were 42 representing 11.8 of the respondents. Once more, majority of the respondents indicated that they own laptops/desktop computers. These computers are considered necessary for tertiary students since they are supposed to present assignments that need to be typed. Also, laptop and desktop computers speed up the typing process as compared to those who use smartphones to type their

assignments. Some of the technological devices or tools may be considered less useful by students.

Personal digital assistance (PDA) can be named as one of the devices that is not likely to be useful by students in tertiary institutions. The use of smartphones and tablets may be replacing the usefulness of PDAs since most of the functions performed by PDAs are now available on smartphones and tablets. Therefore, it is not surprising to obtain only 5 (1.4%) of the respondents who own PDAs. It may also be possible that emerging technologies available to each department might affect the performance of students in these departments.

Availability of Emerging Technologies across Departments

Information obtained on the availability of emerging technologies in education is used to test for research hypothesis 1. This information was obtained from the section B part of the research questionnaire used. The available technologies in all departments are tabulated in Table 4.

Table 4: Available Emerging Technologies in Departments (N = 357)

Items	N	Case Percent
Mobile phone (Smartphones)	335	93.8%
The internet	317	88.8%
Laptops and Desktops	310	86.8%
Projectors	293	82.1%
Electronic books	243	68.1%
Tablets (Android, iPads)	222	62.2%
Free online courses/learning platforms	180	50.4%
PDAs	73	20.4%
Cloud computing	73	20.4%
Projectors and laptops	42	11.8%
E-learning lab equipment	25	7.0%
Calculator	16	4.5%

Source: Field survey, Ayite (2018)

At a glance, it can be seen that some technological tools recorded higher values than others. From Table 4, it is indicated that mobile phones (smartphones) are the commonest devices among students; this was revealed by 335 (93.8%) out of 357 respondents. The internet which can be easily accessed with the phone, laptops and desktops, and projectors were indicated by 317 (88.8%), 310 (86.8%), and 293 (82.1%) to be readily available for use respectively. Also, electronic books (e-books), tablets, and free online courses/learning platforms were shown by 243 (68.1%), 222 (62.2%) and 180 (50.4%) to be available respectively. These emerging technological resources were indicated by more than half of the respondents.

From other researches, emerging technologies are common in developing countries. This is not surprising since according to records, 75% of those who subscribe to mobile devices are in developing countries (Parsons, 2014). It also appears that most of the respondents use mobile phone technology to access other resources such as the internet, e-books, online courses among others. This information is in line with the statement made by AlTameemy (2017) that mobile phones can be used for academic purposes by making use of instructional technology and applications. In one way or another, each student needs to access information on the internet at one point in time. If nothing at all, each student needs to register courses every semester, check results and view his/her examination time table on the students' online portal.

The use of some emerging technologies recorded limited use among students. That is, these technological tools are used by less than a quarter of the respondents. For emerging technologies such as Personal Digital

Assistants (PDAs) and cloud computing were being used by 20.4% of the respondents. Also, as indicated in Table 4, even though laptops/desktop computers and projectors are readily available as shown by 86.8% and 82.1% of the respondents respectively, their utilisation in presentations is minimal (11.8%). Further, e-learning lab equipment and calculators were the least named by the respondents of the study; 7.0% and 4.5% respectively.

From these results, one could say that there are limitations in the use of the resources available at the disposal of teachers and students. Considering the availability of mobile phones, laptops/Desktops and cloud computing, only few students indicated that these devices are available. Contrary to the low responses recorded for PDAs, cloud computing, e-learning lab equipment, Kim and Kim (2016) recorded higher values (60.9%) for the availability and use of cloud computing services. Likewise, PDAs are noted to be integral part of the K-12 educational system (Son, Kim, & Park, 2004). This means that much needs to be done by students to increase the level of use of cloud computing and PDAs. The availability of these devices may vary across departments.

Testing of Hypothesis One

H_{01}: there is no statistically significant difference between emerging technologies available across departments and their use for academic work at the University of Cape Coast.

This hypothesis sought to find out if there is a significant difference between the emerging technologies available to students across the selected departments and their use of academic work. To find the significant

difference, the researcher used the Chi-Square analysis tool for arriving at the results. This information is presented in Table 5.

Table 5: Chi-Square Values for the Availability of Emerging Technologies across Departments – Part 1 (N = 357)

	Value	df	Asymp. Sig. (2-sided)
Mobile Phone * Department			
Pearson Chi-Square	0.532	4	0.970
Likelihood Ratio	0.542	4	0.969
Linear-by-Linear Association	0.297	1	0.586
Laptops/Desktops * Department			
Pearson Chi-Square	4.635	4	0.327
Likelihood Ratio	4.856	4	0.302
Linear-by-Linear Association	0.024	1	0.878
PDAs * Department			
Pearson Chi-Square	4.167	4	0.384
Likelihood Ratio	4.242	4	0.374
Linear-by-Linear Association	0.207	1	0.649
Projectors * Department			
Pearson Chi-Square	6.142	4	0.189
Likelihood Ratio	6.215	4	0.184
Linear-by-Linear Association	0.703	1	0.402
Electronic books * Department			
Pearson Chi-Square	3.468	4	0.483
Likelihood Ratio	3.471	4	0.482
Linear-by-Linear Association	0.230	1	0.631
Internet * Department			
Pearson Chi-Square	5.171	4	0.270
Likelihood Ratio	6.401	4	0.171
Linear-by-Linear Association	0.688	1	0.407
E-learning lab equipment * Department			
Pearson Chi-Square	1.551	4	0.818
Likelihood Ratio	1.817	4	0.769
Linear-by-Linear Association	0.483	1	0.487

*p > 0.05

Results obtained from the Chi-Square analysis revealed that some emerging technologies do not differ significantly from one department to another. Table 5 presented results that do not have significant difference

between the emerging technologies available to students and their departments. With regards to results presented in Table 2, five departments were used in this study.

Per the results in Table 5, there is no statistically significant difference across the five departments in terms of mobile phone, x^2 (4, N = 357) = 0.532, p = 0.970; laptops/desktops, x^2 (4, N = 357) = 4.635, p = 0.327; PDAs, x^2 (4, N = 357) = 4.167, 0.384; projectors, x^2 (4, N = 357) = 6.142, p = 0.189; electronic books, x^2 (4, N = 357) = 3.468, p = 0.483; internet, x^2 (4, N = 357) = 5.171, p = 0.270; and e-learning lab equipment, x^2 (4, N = 357) = 1.551, p = 0.818.

Even though the results showed that there were slight changes in the values obtained due to the number of respondents who indicated each of the resources, it does not differ significantly from department to department. These findings are in line with that of Park, Kim, Lee, Son and Lee (2005). Park et al. (2005) conducted a study to determine the effects of visual illustrations on learners' achievement and interest in PDA based learning. Their study found no significant difference among the normally distributed independent groups before the study (pre-interest), F (2, 42) = 1.168, p > 0.05. Also, after the study, there was no significant difference in the interest of use of PDAs among the groups, F (2, 42) = 0.433, p > 0.05. Therefore, it is imperative to say that the distribution/availability of PDAs, mobile phones, laptops/desktops, projectors, electronic books, internet, and e-learning lab equipment are virtually the same across departments that took part in the study. Other emerging technologies may present differences in the results as presented in Table 6.

Table 6: Chi-Square Values for the Availability of Emerging Technologies across Departments – Part 2 (N = 357)

	Value	df	Asymp. Sig. (2-sided)
Tablets (Android, iPads) * Department			
Pearson Chi-Square	15.209	4	0.004
Likelihood Ratio	15.152	4	0.004
Linear-by-Linear Association	3.650	1	0.056
Free online courses/learning platforms * Department			
Pearson Chi-Square	14.525	4	0.006
Likelihood Ratio	14.668	4	0.005
Linear-by-Linear Association	3.260	1	0.071
Cloud computing * Department			
Pearson Chi-Square	11.400	4	0.022
Likelihood Ratio	11.757	4	0.019
Linear-by-Linear Association	0.827	1	0.363
Projector and laptops * Department			
Pearson Chi-Square	10.267	4	0.036
Likelihood Ratio	9.679	4	0.046
Linear-by-Linear Association	8.318	1	0.004
Calculator * Department			
Pearson Chi-Square	26.293	4	0.000
Likelihood Ratio	26.721	4	0.000
Linear-by-Linear Association	12.623	1	0.000

*$p < 0.05$

From Table 6, the Chi-Square results on the availability of emerging technologies across departments were presented. The results presented a difference in the availability of emerging technologies across department since $p < 0.05$. Based on the results from Table 6, there is a statistically significant difference in the availability of emerging technologies in terms of tablets (Android, iPads), x^2 (4, N = 357) = 15.209, p = 0.004; free online

courses/learning platforms, x^2 (4, N = 357) = 14.525, p = 0.006; cloud computing, x^2 (4, N = 357) = 11.400, p = 0.022; projector and laptops, x^2 (4, N = 357) = 10.267, p = 0.036; and calculator, x^2 (4, N = 357) = 26.293, p = 0.000.

These results indicated that, emerging technologies such as tablets, free online courses, cloud computing, projectors and laptops, and calculators differ significantly from department to department. Though, literature did not show the difference in the availability of the named emerging technologies across departments, it was noted that tablet computing, collaborative webs, massively open online courses (MOOC) were expected emerging technologies that helped to open learning environments (Holotescu, 2015). The differences of these emerging technologies in the various departments could be due to the fact that some departments have not fully integrated their use as compared to the rest of the departments. To identify where the differences were, there was the need to do a post-hoc test for each emerging technology; hence, the Fisher's Exact test was used to determine the differences starting from Table 7.

Table 7: Post-Hoc Test on Availability of Tablets across Departments

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
DMICT Edu. * Biochemistry					
Pearson Chi-Square	0.021	1	0.884		
Fisher's Exact Test				1.000	0.506
N of Valid cases	174				
DMICT Edu. * English					
Pearson Chi-Square	4.478	1	0.034		
Fisher's Exact Test				0.044	0.026
N of Valid cases	157				
DMICT Edu. * Arts Education					
Pearson Chi-Square	0.758	1	0.384		
Fisher's Exact Test				0.476	0.245
N of Valid cases	158				
DMICT Edu. * DBSS Edu.					
Pearson Chi-Square	6.790	1	0.009		
Fisher's Exact Test				0.012	0.007
N of Valid cases	156				
Biochemistry * English					
Pearson Chi-Square	3.573	1	0.059		
Fisher's Exact Test				0.081	0.043
N of Valid cases	139				
Biochemistry * Arts Education					
Pearson Chi-Square	0.932	1	0.334		
Fisher's Exact Test				0.359	0.218
N of Valid cases	140				
Biochemistry * DBSS Edu.					
Pearson Chi-Square	5.568	1	0.018		
Fisher's Exact Test				0.024	0.014
N of Valid cases	138				
English * Arts Education					
Pearson Chi-Square	7.175	1	0.007		
Fisher's Exact Test				0.009	0.006
N of Valid cases	123				
English * DBSS Edu.					
Pearson Chi-Square	0.209	1	0.648		
Fisher's Exact Test				0.717	0.392
N of Valid cases	121				
Arts Education * DBSS Edu.					
Pearson Chi-Square	9.682	1	0.002		
Fisher's Exact Test				0.003	0.002
N of Valid cases	122				

Source: Field survey, Ayite (2018)

Key: DMICT Edu. = Department of Mathematics and ICT Education

DBSS Edu. = Department of Business and Social Sciences Education

The post-hoc test showed that there is a statistically significant difference between the availability of tablets (Android, iPads) across departments. There is a significant difference between Mathematics and ICT Education, and the English departments, x^2 (1, N = 157) = 4.478, p = 0.044; Mathematics and ICT Education, and Business and Social Sciences Education departments; x^2 (1, N = 156) = 6.790, p = 0.012; Biochemistry, and Business and Social Sciences Education departments, x^2 (1, N = 138) = 5.568, p = 0.024; and Arts Education, and Business and Social Sciences Education departments, x^2 (1, N = 122) = 9.682, p = 0.003.

The pairwise combination of the rest of the departments did not show significant differences in the availability of tablets' use for academic work. Meanwhile, the Phi contingency table (Appendix B) gives the strength and direction of the results obtained as the crosstabulation shows the values for each department. The Phi value (-0.3) showed that there is a negative weak association between Mathematics and ICT Education, and English departments. On the other hand, the Phi value (0.2) showed that there is a weak positive association between Mathematics and ICT Education, and Business and Social Sciences Education departments. Also, the Phi value (0.2) showed that there is a weak positive association between Biochemistry, and Business and Social Sciences Education departments while the association between English, and Arts Education departments is negatively weak (Phi value = -0.2).

From the cross-tabulation tables (Appendix B), 67.7% of the respondents were from the Mathematics and ICT Department while 32.3% were from the English Department. This implies that there are more students

that use tablets in the Mathematics and ICT Department than the English Department. This information depicts the fact that Mathematics and ICT Education students use more technological devices since they (especially ICT students) need it to do more practical works. The same reason may account for the difference between Mathematics and ICT Education students (69.9%) and Business and Social Sciences Education students (30.1%).

Also, the cross-tabulation tables showed that 65.0% of the students were from the Biochemistry Department whereas 35.0% were from the Business and Social Sciences Education Department which suggested that more students in the Biochemistry use tablets for their academic work as compared to those in the Business and Social Sciences Education. The reason for Biochemistry students using more tablets for their academic work could be linked to the need to watch tutorials and animations on topics that are difficult to understand.

Similarly, results obtained from the cross-tabulation between English, and Arts Education departments implies that there are more students in Arts Education Departments that use tablets for academic work as compared to those in English Departments since the results indicated 59.7% and 40.3% indicated these results from the departments respectively. Per previous results, there is a significant difference between the use of tablets for academic work between the Arts Education, and Business and Social Sciences Education departments. It is shown that there are more students (62.2%) in the Arts Education as against those in the Business Education (37.8%) that use tablets for academic work. There may be varying reasons for the differences recorded from these departments. One common thing that is to be considered is the use

of the tablets in academic work. The rest of the emerging technologies might present different results for the post-hoc test.

Table 8: Post-Hoc Test on Availability of Free Online Courses across Departments

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (2-sided)
DMICT Edu.* Biochemistry					
Pearson Chi-Square	6.480	1	0.011		
Fisher's Exact Test				0.015	0.008
N of Valid cases	174				
DMICT Edu.* English					
Pearson Chi-Square	0.966	1	0.326		
Fisher's Exact Test				0.108	0.207
N of Valid cases	157				
DMICT Edu.* Arts Education					
Pearson Chi-Square	0.009	1	0.926		
Fisher's Exact Test				1.000	0.528
N of Valid cases	158				
DMICT Edu.* DBSS Edu.					
Pearson Chi-Square	9.543	1	0.002		
Fisher's Exact Test				0.003	0.002
N of Valid cases	156				
Biochemistry * English					
Pearson Chi-Square	1.801	1	0.180		
Fisher's Exact Test				0.230	0.121
N of Valid cases	139				
Biochemistry * Arts Education					
Pearson Chi-Square	4.808	1	0.028		
Fisher's Exact Test				0.041	0.021
N of Valid cases	140				
Biochemistry * DBSS Edu.					
Pearson Chi-Square	0.521	1	0.471		
Fisher's Exact Test				0.486	0.293
N of Valid cases	138				
English * Arts Education					
Pearson Chi-Square	0.651	1	0.420		
Fisher's Exact Test				0.470	0.266
N of Valid cases	123				
English * DBSS Edu.					
Pearson Chi-Square	3.746	1	0.053		
Fisher's Exact Test				0.067	0.040
N of Valid cases	121				
Arts Education * DBSS Edu.					
Pearson Chi-Square	7.446	1	0.006		

Fisher's Exact Test		0.007	0.005
N of Valid cases	122		

Source: Field survey, Ayite (2018)

Similarly, the post-hoc test on the availability of free online courses/online platforms as shown in Table 8 depicts a clear difference between the departments. That is, the departments of Mathematics and ICT Education, and Biochemistry showed a significant difference, x^2 (1, N = 174) = 6.480, p = 0.015. Also, the departments of Mathematics and ICT Education, and Business and Social Sciences Education disclosed a significant difference, x^2 (1, N = 156) = 9.543, p = 0.003. In addition, there was a significant difference between the departments of Biochemistry, and Arts Education, x^2 (1, N = 140) = 4.808, p = 0.041. The departments of Arts Education, and Business and Social Sciences Education also presented a significant difference, x^2 (1, N = 122) = 7.446, p = 0.007.

Based on these values, further analysis was performed to determine the strength of association between each paired department that showed a significant difference. The Phi value (0.2) obtained between the departments of Mathematics and ICT Education, and Biochemistry indicated a weak positive association. Further analysis from the cross-tabulation table (Appendix B) showed that there are more students in the Mathematics and ICT Education department (64.4%) than in Biochemistry department (35.6%) that take up online courses.

Another weak positive was recorded between the departments of Mathematics and ICT Education, and Business and Social Sciences Education as the Phi value = 0.3. Similarly, there are more students in the Mathematics and ICT Education (73.4%) that take online courses as compared to those in

the Business and Social Sciences Education Department. Once more, this information buttressed the point that mathematics and ICT education students make good use of online courses and emerging technology resources as compared to other departments.

On the other hand, a weak negative association was identified between the students from the Biochemistry Department and those from Arts Education Department with the Phi value = - 0.2; the cross-tabulation showed that those from the Arts Education take more online courses (53.6%) than those from Biochemistry Department (46.4%). However, the paired combination between Arts Education Department and Business and Social Sciences Education showed a weak positive association with a Phi value = 0.3. It was also shown that students from the Arts Education Department (63.8%) patronised more online courses as against those from the Business and Social Sciences Education Department (36.2%). The rest of the paired departments did not show significant differences in the availability of online courses/online learning platforms.

In light of the results obtained, it can be said that the respondents of the study use tablets to access online educational resources. These resources might help them to search for new concepts in their various fields of study. This is contrary to findings from literature where some students, upon giving them tables to use for a year, indicated that social network applications serve as temptations to them (Park, 2013). Turkle (2008) supported that the use of tablets can cause divided attention in learning as it reduces the level of self-reflection. The most important thing to note is the rate of use of these emerging resources available to students across the various departments.

Cloud computing just as online courses may also present significant differences across departments.

Table 9: Post-Hoc Test on Availability of Cloud Computing across Departments

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (2-sided)
DMICT Edu.* Biochemistry					
Pearson Chi-Square	10.232	1	0.001		
Fisher's Exact Test				0.001	0.001
N of Valid cases	174				
DMICT Edu.* English					
Pearson Chi-Square	3.813	1	0.051		
Fisher's Exact Test				0.059	0.037
N of Valid cases	157				
DMICT Edu.* Arts Education					
Pearson Chi-Square	1.106	1	0.293		
Fisher's Exact Test				0.361	0.193
N of Valid cases	158				
DMICT Edu.* DBSS Edu.					
Pearson Chi-Square	1.986	1	0.159		
Fisher's Exact Test				0.192	0.110
N of Valid cases	156				
Biochemistry * English					
Pearson Chi-Square	1.144	1	0.285		
Fisher's Exact Test				0.317	0.207
N of Valid cases	139				
Biochemistry * Arts Education					
Pearson Chi-Square	3.961	1	0.047		
Fisher's Exact Test				0.061	0.040
N of Valid cases	140				
Biochemistry * DBSS Edu.					
Pearson Chi-Square	2.598	1	0.107		
Fisher's Exact Test				0.143	0.086
N of Valid cases	138				
English * Arts Education					
Pearson Chi-Square	0.749	1	0.387		
Fisher's Exact Test				0.496	0.262
N of Valid cases	123				
English * DBSS Edu.					
Pearson Chi-Square	0.264	1	0.607		
Fisher's Exact Test				0.644	0.390
N of Valid cases	121				
Arts Education * DBSS Edu.					
Pearson Chi-Square	0.121	1	0.728		
Fisher's Exact Test				0.826	0.450

N of Valid cases	122

Source: Field survey, Ayite (2018)

Indications form Table 9 showed that there is only one paired department that was statistically significant in the use of cloud computing for academic work. That is, there is a significant difference between the Mathematics and ICT Education Department and the Biochemistry Department, x^2 (1, N = 174) = 10.232, p = 0.001. It is also revealed in further analysis that there is a positive weak association between the two departments (Phi value = 0.2) with students from Mathematics and ICT Education Department (78.4%) making use of the services of cloud computing more than those from the Biochemistry Department (21.6%). Therefore, there is no need to check for the strength for the association between the rest of the paired departments.

In line with the results revealed on the degree of difference that exists between the departments used in this study with regards to the availability of online course/learning platforms, cloud computing also showed statistically significant difference between the availability and use of cloud computing for academic work. The difference in the availability as indicated by the respondents of the study might be due to the fact that there is the fear of use of personal information by cloud computing service providers as indicated by Kim and Kim (2016). Meanwhile, students must exercise caution when it comes to the use of cloud computing services and online resources as they may become addicted to them. Calculators as an emerging technology in academia received the least number of responses.

Table 10: Post-Hoc Test on Availability of Calculators across Departments

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (2-sided)
DMICT Edu.* Biochemistry					
Pearson Chi-Square	11.415	1	0.001		
Fisher's Exact Test				0.000	0.000
N of Valid cases	174				
DMICT Edu.* English					
Pearson Chi-Square	4.546	1	0.033		
Fisher's Exact Test				0.049	0.027
N of Valid cases	157				
DMICT Edu. * Arts Education					
Pearson Chi-Square	9.149	1	0.002		
Fisher's Exact Test				0.002	0.001
N of Valid cases	158				
DMICT Edu. * DBSS Edu.					
Pearson Chi-Square	6.374	1	0.012		
Fisher's Exact Test				0.010	0.008
N of Valid cases	156				
Biochemistry * English					
Pearson Chi-Square	2.595	1	0.107		
Fisher's Exact Test				0.191	0.191
N of Valid cases	139				
Biochemistry * DBSS Edu.					
Pearson Chi-Square	1.309	1	0.252		
Fisher's Exact Test				0.435	0.435
N of Valid cases	138				
English * Arts Education					
Pearson Chi-Square	2.066	1	0.151		
Fisher's Exact Test				0.244	0.244
N of Valid cases	123				
English * DBSS Edu.					
Pearson Chi-Square	0.325	1	0.569		
Fisher's Exact Test				1.000	0.506
N of Valid cases	121				
Arts Education * DBSS Edu.					
Pearson Chi-Square	1.042	1	0.307		
Fisher's Exact Test				0.492	0.492
N of Valid cases	122				

Source: Field survey, Ayite (2018)

At a glance, it is clear that there is a significant difference between four paired departments. The Department of Mathematics and ICT Education, and Biochemistry showed a statistically significant difference, x^2 (1, N = 174) = 11.415, p = 0.000. The combinations of departments such as Mathematics and ICT Education, and English; Mathematics and ICT Education, and Arts Education; and Mathematics and ICT Education, and Business and Social Sciences Education showed statistically significant difference with the values of x^2 (1, N = 157) = 4.546, p = 0.049; x^2 (1, N = 158) = 9.149, p = 0.002; and x^2 (1, N = 156) = 6.374, p = 0.010 respectively.

Once more, to determine the strength of the association between these departments, the Phi values were obtained. The results showed that there is a weak positive association (Phi value = 0.3) between the Mathematics and ICT Education Department and Biochemistry Department. In addition, it is shown that more students in the Mathematics and ICT Education Department (100.0%) have access to calculators than students in the Biochemistry Department (0.0%). In addition, the contingency results showed that there is a weak positive association (Phi value = 0.170) between the two departments. Further analysis showed that there are more students that have access to calculators in the Mathematics and ICT Education Department (86.7%) than those in the English Department (13.3%). This is surprising as no one may anticipate that English students will state calculator as one of the emerging technologies available to them.

Finally, the Phi value of 0.2 showed a weak positive association between the Mathematics and ICT Education Department and the Arts Education Department with those in the Mathematics and ICT Department

having access to more calculators (100.0%) than those from the Arts Education Department (0.0%). This finding is contrary to that of Christmann (2009) on the effects of statistical analysis software and calculators on statistics achievement. Christmann obtained no statistically significant difference ($p = 0.622$) on the effect of microcomputer -based statistical software and handheld calculators on statistics students' achievement. It is confident to say that the use of calculators or emerging technological tools may have little impact on the academic achievements of students.

As indicated in the results of the analysis, it showed that there are emerging technologies available for students' use for academic work. These findings are in line with those presented in other researches. That is, smartphones, tablets, laptops, PDAs among others have been indicated to be emerging technologies that help to increase interactivity in teaching and learning. However, these tools may lead students to become addicted to the technological resource they are comfortable with.

Moreover, the results obtained from the Chi-Square analysis indicated that there is a significant difference in the availability of the emerging technologies across the departments used in the study. Based on this, it is imperative to reject the null hypothesis (H_{01}). Research hypothesis 2 may also produce similar results.

Influence of the Extent of Use of Emerging Technologies on Students Academic Performance

The rate of use of emerging technologies may influence the academic performance of students. In this regard, research hypothesis two sought to find out the influence of how often students use emerging technologies on their

academic performance. To answer this research hypothesis, information from the demographic characteristics of students as well as those obtained from section C were used.

Testing for Hypothesis Two

H_{02}: there is no statistically significant relationship between how often students use emerging technologies and their academic performance.

This hypothesis was tested using the Spearman Ranked Correlation Coefficient (ρ). This statistical tool was used because the variables involved are ranked and continuous. Table 11 presents the results obtained from the analysis.

Table 11: Correlation on the Extent of Use of Emerging Technologies and Academic Performance

Items	ρ	Sig. (2-tailed)
I use services provided by messaging apps such as WhatsApp to get relevant academic information	0.006	0.904
I participate in my class online group discussions	0.038	0.471
I read e-books with emerging technological tools to get more understanding of concepts	0.081	0.127
I research, type, complete and submit my assignments and projects using emerging technological tools	0.067	0.204
I watch tutorials and videos on difficult concepts	-0.044	0.405
I use emerging technological tools to access information on the internet	0.109	0.040
Emerging technological tools allow me to use multimedia resources when learning	0.082	0.121
I usually compare lecturer's lessons to online information	0.006	0.904
I take online courses easily with the aid of technological tools	0.045	0.401
I watch educational movies and play educational games more than I learn with emerging technologies	-0.028	0.597
I use online cloud accounts to backup my educational documents	-0.049	0.352

Source: Field survey, Ayite (2018)

When the items presented in Table 11 were correlated against academic performance, only weak relationships were obtained and only one of them is statistically significant. The extent to which respondents use services provided by messaging apps such as WhatsApp to get relevant academic information recorded a correlation coefficient ρ = 0.006 and a significant value, sig. = 0.904. This implies that there is a weak positive relationship between the two variables, but the relationship is not significant to conclude that there is an established relation between the two variables.

Similar situations were obtained for participating in class online group discussions, ρ = 0.038, sig. = 0.471; reading e-books, ρ = 0.081, sig. = 0.127; doing assignments with the help of emerging technological tools, ρ = 0.067, sig. = 0.204 among others. Moreover, a weak negative relationship was obtained on the extent to which some of the variables were used. The variables that correlated negatively against academic performance include watching tutorials and videos on difficult concepts, ρ = - 0.044, sig. 0.405; watching educational movies and playing educational games more than learning with emerging technologies, ρ = -0.028, sig. = 0.597; and using online cloud accounts to backup educational documents, ρ = -0.049, sig. = 0.352. On the other hand, for the item "I use emerging technological tools to access information on the internet," ρ = 0.109 and a sig. = 0.040 was obtained. This implies that there is a statistically significant relationship between the extent of use of emerging technology to access information on the internet.

The findings of this study revealed only small relationships between the extent to which the use of variable involved influence academic performance even though only one of them is statistically significant. This

finding confirms the results of Weaver (2000) that there exists only a small relationship between computer use and the students' performance in mathematics, science and reading with a correlation coefficient of 0.035. Contrarily, (BECTA) as cited in Elohor (2013) revealed that there is no relationship between emerging technology resources and either reading or mathematics. Students' performance could actually depend on how students are committed to learning than the resources available to them.

The use of emerging technologies in learning could be considered as a minor element of learning since only small or no relationships is obtained from their use on academic performance. As BECTA indicated that the relationship of the variables used in the study carried out exceeded 0.07, this study found that the highest relationship obtained is 0.109 on students use of emerging technologies to access information on the internet.

Therefore, it is evident to reject the null hypothesis that there is no statistically significant relationship between how often students use emerging technologies and their academic performance since one of the significant values obtained is less than the critical value 0.05.

Gender Influence on the Use of Emerging Technologies on Academic Performance

This section presents results on the influence of gender use of emerging technologies on the academic performance of students. Information obtained from section A and section D of the research questionnaire were used in performing the analysis. Respondents' opinion on the influence of emerging technologies on their academic performance is presented in the following statements.

I get clearer understanding from online tutorials on concepts that I do not understand during lectures (201 respondents).

Animations make it easier to understand abstract concepts (177 respondents).

Easy access to electronic books helps to obtain alternate sources of information (176 respondents).

Emerging technologies helped to improve research by reducing the amount of time needed to go through huge files. These technologies helped me to improve upon my performance (232 respondents).

Emerging technologies negatively influence my performance since I use them to watch movies more that I use them to learn (23 respondents).

The responses provided in this section are in line with those reported by other researchers; the use of emerging technological tools provides avenues for students to explore other sources of information. Alamri et al. (2017), emerging technologies helped to create a 'flipped classrooms' which served as blended learning for learners; that is, learners take up courses online and also do class assignments. To some extent, it can be said that emerging technologies help to acquire more educational resources.

On the other hand, it was discovered that emerging technologies helped almost 2/3 of the students to achieve positively, and a minute portion of them (23 out of 357) indicated that it affects them negatively. Thus, emerging technology can be termed as a double edge sword. It can be beneficial or detrimental to any individual depending on how it is being used. Bianchi and Phillips (2005) support this point of view as they noted that the addiction to new technologies may gradually develop into an automatic habitual pattern difficult to control. Therefore, emerging technologies may also serve as a threat to achieving academic excellence when not checked. However, to determine the influence of gender use of emerging technologies on academic work, the independence sample t-test was used.

Testing for Hypothesis Three

H_{03}: there is no statistically significant difference between male and female students regarding the use of emerging technologies in their academic performance.

The independence sample t-test was used since the normality assumption was met at a significant level of 0.05. The normality graph as presented in Appendix C showed that the independence sample t-test can be used. Also, the Levene's test for equality of variances was met. From the Levene's test, F = 1.122, p = 0.290 which implies that equality of variances assumption is met since the p = 0.290 > 0.05. For this reason, the equal variances assumed was reported. The independence t-test is presented in Table 12.

Table 12: Independence Sample t-Test for Gender Influence on the Use of Emerging Technologies on Academic Performance

Groups	N	Mean	SD	Mean Difference	t	p
Male	243	3.151	0.451	0.031	0.612	0.541
Female	114	3.120	0.435			

*p > 0.05

Source: Field survey, Ayite (2018)

It can be observed from Table 12 that there is no statistical significant difference in the performance of respondents based on the gender use of emerging technologies since the t-value of 0.612 gave a p-value of 0.541 which is greater than 0.05. A mean of 3.151 was obtained for the 243 males respondents while female respondents of 114 obtained a mean value of 3.120. The standard deviations for these mean values are closely related giving a mean difference of 0.031.

The results obtained for the independences sample t-test are contrary to the perennial disparities that researchers have shown to be existing between males and female students. A typical example is found in the study of Göransson and Rolfstam (2013) when they suggested that women are relegated to the background in the areas of technology and technical development since most technological developments are done by men and for men. The contribution of female students in education in this study matched that of males as there is no significant difference in their performances even though there is a slight difference in their mean values.

In light of the above explanation, the researcher failed to reject the null hypothesis that there is no statistically significant difference between male and

female students regarding the use of emerging technologies and their academic performance.

Factors Influencing the Use of Emerging Technologies for Academic Work

This section of the study sought to find the factors that influence how emerging technologies are used to address academic issues. Information obtained from sections A and E are used to answer the research hypothesis formulated in line with this topic.

H_{04}: there is no statistically significance difference between the academic work of students and the factors that influence the use of emerging technologies.

To obtain the significant factors that influence the use of emerging technologies for academic work, the regression analysis was run from the IBM SPSS statistical software. The Pearson Correlation obtained for the variables against academic performance is tabulated in Table 13.

Before then, the multivariate normal distribution assumption and that of homoscedasticity were checked. The diagrams in Appendix D showed that the normality and homoscedasticity assumptions were met.

Table 13:Pearson Correlation on Students' Use of Emerging Technologies and their Academic Performance (N = 357)

Items	r	Sig. (1-tailed)
Enabling resources are not always available	0.112	0.017
Emerging technologies help me to contribute my quota to learning via chat rooms, social media groups and in presentations	0.102	0.027
Enabling facilities such as internet access are expensive	0.084	0.057
I am motivated to use emerging technologies when learning	0.072	0.087
The use of emerging technologies in learning consumes more time than the traditional way of learning	0.062	0.121
Emerging technologies help to understand difficult concepts	0.049	0.180
Emerging technologies, especially mobile phones, distract me during lectures	0.028	0.299
Technological resources are expensive to come by and maintain	0.024	0.325
Social media and the internet addiction contribute to a decrease in performance	-0.024	0.326
I find it difficult operating my devices effectively	-0.024	0.324
I find it difficult to locate the information I am looking for	-0.044	0.205

Source: Field survey, Ayite (2018)

Per the correlation values presented in Table 13, it appears that the only contributing factors that may influence the academic performance of students are the unavailability of enabling resources, and the use of chat rooms, social media groups and presentations that helped students to contribute their quota to learning. These two factors obtained correlation

coefficients of 0.112 and 0.102 with significant values of p = 0.017 and p = 0.027 (1-tailed) respectively against the current cumulative grade point average (CGPA) of the respondents. It could be inferred that lack of enabling resources is one of the major factors affecting the use of emerging technologies for educational purposes. Also, using emerging technologies to contribute to the development of learning goals in chat rooms, social media groups and in presentations may also be another important factor that contributes to the use of emerging technologies. However, to conclude on the significant factors, the coefficients' table of the regression analysis as shown in Table 14 was used.

Table 14: Regression Analysis of Factors Contributing to the Use of Emerging Technologies in Academic Performance

Model		Mean	SD	B
(Constant)	2.731			
Enabling resources are not always available		2.83	0.643	0.092

Source: Field survey, Ayite (2018)

For the regression analysis, variables were excluded at a confidence level of 95%. From Table 14, it was observed that only one variable was selected as a contributing factor to the use of emerging technologies for academic work. This is stated as follows.

Academic work = 2.731 + 0.092 Enabling resources are not always available.

Therefore, indications from Table 14 showed that for 1 standard deviation (0.643) increase in the unavailability of enabling resources, academic work improves by 0.092 standard deviations. From learners' perspective, the absence of emerging technologies can contribute positively to

their academic work. Contrary to findings from literature, both teachers and students use emerging technologies if they believe it could help achieve greater performance (Jonassen, 2002). It can be inferred that the respondents in this study have different view towards the use of new technological tools. On the other hand, Moslander (2000b) posited that adult students' beliefs and experience about information technology and library system differ greatly according to the age of the students which suggest that they might learn better in the absence of emerging technologies.

It is imperative to state that the time factor involved in the use of emerging technologies or its distractive nature, difficulty of operation and benefits does not have much influence on how respondents perform in their academic work. It is right to say that the respondents of the study prefer the traditional way of going around academic work. Hence, the research hypothesis four (H_{04}) is rejected since there is a statistically significant difference between the academic work of students and the factors that influence the use of emerging technologies.

Additional Testing for the Conceptual Framework of the Study

Per the discussion under the conceptual framework developed for this study, the research is of the view that external factors in relation to emerging technologies may influence the students' academic achievement negatively than that of those present in the traditional learning. Based on this, the open-ended items in the section E part of the questionnaire were provided. The Chi-Square analysis was run to determine whether there is a significant difference between factors influencing academic achievement of students. The results obtained are shown in Table 15.

Table 15: Chi-Square Analysis on Factors Influencing Emerging Technologies Use in Education

	N	df	Chi-Square	p
Traditional Method of learning				
Bulkiness of books makes it difficult to locate some topics	112	5	3.351	0.646
It wastes time looking for information	89	5	6.042	0.302
Noise from the environment	14	5	4.636	0.462
Limited information	123	5	5.661	0.341
Using emerging technologies in learning				
Social media distraction	145	5	6.214	0.286
Distraction by movies	39	5	7.149	0.210
Distraction by music	23	5	10.295	0.067
Distraction from adverts	143	5	5.996	0.307
It is difficult getting the right information	89	5	5.584	0.349

Source: Field survey, Ayite (2018)

At a glance, it is easy to note from Table 15 that there is no statistically significant difference in the opinions of the respondents on distractors. For the opinions given by the respondents, none of them was statistically significant against their performance when using the traditional method of learning. The opinion on the bulkiness of books make it difficult to locate some topics in relation to academic achievement recorded x^2 (5, N = 112) = 3.351, p = 0.646 whereas the opinion that traditional method waste time when looking for information recorded x^2 (5, N = 89) = 6.042, p = 0.302. In the same regard,

noise from the environment obtained x^2 (5, N = 14) = 4.636, p = 0.462, and the distractor of limited information obtained x^2 (5, N = 123) = 5.661, p = 0.341.

Similar results were obtained for the respondents' opinions on the use of emerging technologies in learning. For distractors such as social media, x^2 (5, N = 145) = 6.214, p = 0.286; movies, x^2 (5, N = 39) = 7.149, p = 0.210; music, x^2 (5, N = 23) = 10.295, p = 0.067; advert, x^2 (5, N = 143) = 5.996, p = 0.307; and difficult in getting the right information, x^2 (5, N = 89) = 5.584, p = 0.349 were obtained.

Even though the responses to the open-ended items did not show any significant difference in the distractors and academic performance, the regression analysis showed that there is a difference in terms of limited resources in emerging technologies. That is, the less the students use these technological tools for academic work, the less the performance. This is concomitant with the studies of Bian, and Leung (2015), Bianchi and Phillips (2005), and Thomée et al. (2011). According to them, students are over stressed with sleep disturbances, anxiety, decrease in performance and reduced physical activity when they have emerging technologies at their disposal.

Therefore, emerging technologies are seen as new threats to education if not managed with care. Students must be circumspect when using emerging technology as their source of information for academic work as it they take up most of their time and also distract them from the main aim of using them (emerging technologies).

Chapter Summary

The results and discussion presented in this chapter give reason to establish that learning with the use of emerging technologies does not guarantee improved performance in students' academic work. However, the chapter revealed that there are weak relationships ($\rho \leq 0.109$) between the use of emerging technologies available across departments and the academic performance of students. Also, gender use of emerging technologies does not differ significantly since their performance based on the statistical value obtained is not statistically significant ($p = 0.535$). Interestingly, this chapter also showed that for 1 standard deviation (0.643) increase in the unavailability of enabling resources, academic work improves by 0.112 standard deviations.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Overview

This chapter provides a summary of the entire study. Also, the research methodologies that were used to arrive at the findings of the study were presented as well as the key findings. In light of the findings of the study, conclusions were drawn and recommendations made. Suggestions for further studies were also presented in this chapter.

Summary

The main aim of this study was to find out the effect of emerging technology on the academic achievement of students in the University of Cape Coast in the Central Region of Ghana. That is, the study sought to establish how the use of emerging technologies in education influence the academic performance of students. In all, four research hypotheses were formulated and tested using inferential statistical tools. For each of the hypotheses, the assumptions were tested to ensure correct values were used to draw conclusions.

The study made use of the quantitative research survey design was used in conducting the study. Moreover, the quantitative approach was adopted in presenting the results of the analysis. In all, 357 usable questionnaires were used out of the 400 that were printed and administered to respondents from five departments in the University of Cape Coast. The questionnaires were administered after obtaining ethical clearance from the Institutional Review Board of the University of Cape Coast, and seeking

permission from the various heads of departments. Thus, a response rate of 89.3% was obtained.

To ensure the instrument was valid and reliable, a pilot study was conducted on 50 students from the University of Education, Winneba and an alpha value, $\alpha = 0.79$ was obtained and some ambiguous statements were made simpler with the help of lecturers. The data collected were analysed using both descriptive (frequency and percentages, mean and standard deviations) and inferential statistics (Chi-Square, Spearman ranked correlation, independent sample t-test and regression). The IBM SPSS Statistical software was used to obtain the results of the study. Based on the results of the study, the following key findings were obtained.

Key Findings

Finding 1a: The research found that the emerging technologies used by the respondents were more than the number of respondents that took part in the study which implies that some students possess more than one technological device. Smartphone dominates all other emerging technologies used by the respondents (341, 95.5%) while PDAs recorded the lowest number (5, 1.4%).

Finding 1b: Also, mobile phones (93.8%), internet (88.8%), laptops/desktops (86.8%), projectors (82.1%), electronic books (68.1%), Tablets (62.2%) and online courses (50.4%) were available and accessible to more than half of the respondents in the selected departments for the study. This means that respondents can make good use of these emerging resources whenever the need arises.

Finding 1c: From the emerging resources available to the respondents in the departments, it was found that mobile phones, laptops/desktops, PDAs, projectors, e-books, internet, and e-learning lab equipment were evenly distributed across the departments. There was no statistically significant difference between these resources across departments.

Finding 1d: On the other hand, it was found that tables, free online courses, cloud computing, projectors and laptops, and calculators differ from departments to departments. Some departments possess more of these devices than others. Even though projectors were noted to be evenly distributed across departments, their uses in the various departments differ significantly as the results obtained against them are statistically significant. Meanwhile, these devices recorded both weak negative and weak positive relationships across departments.

Finding 2: Again, the study found that there are weak relationships on the extent to which respondents use emerging technologies and their academic performance. Thus, there are positive and negative relationships between the extent to which respondents use emerging technologies and their academic performance. Meanwhile, the extent to which emerging technologies are used to find information on the internet was statistically significant with a p-value of 0.040.

Finding 3a: Almost half of the students indicated that the use of emerging technologies helps them to understand the concepts they previously do not understand. From the point of view of the respondents, emerging technologies help them to perform better than they would have without them.

It was only few (less than 7%) that responded that emerging technologies affected their performance negatively.

Finding 3b: Further, the study revealed that there is no statistically significant difference between male and female use of emerging technologies on their academic performance. The performance of males as compared to females was observed to be similar based on the significant value obtained ($p = 0.535$ which is greater than 0.05).

Finding 4a: More so, the study found that, the only factor that affected the performance of respondents was the unavailability of emerging technology resources. The respondents revealed that for every standard deviation (0.643) increase in the unavailability of enabling resources, academic work improves by 0.112 standard deviations. Simply put, the respondents do better when emerging technologies are not readily available for their use. Thus, emerging technologies serve as distractors to respondents when learning.

Finding 4b: Finally, the study exposed that, per the respondents' opinions, there was no significant difference in their performance when they learn using the traditional methods of learning or using emerging technologies in learning. That is the distractors or things that hinder smooth learning in the traditional and emerging methods of learning do not differ significantly. However, there was a significant difference in Finding 2 with the use of internet and academic performance.

Conclusions

Based on the findings of the study, it is evident to conclude that, the presence or availability of emerging technologies in the various departments does not automatically suggest that they will be used for learning by students.

Learners must make conscious effort to integrate the emerging resources available into their learning styles if only they want to benefit from the advantages these resources present.

Once more, how often students use emerging resources available to them is not sufficient to tag them as agents of academic boosters. Emerging resources serve different purposes; therefore, if students use them for playing games, or watching movies among others, performance will go down instead of improving. The use of emerging technologies is not a green card to academic excellence but how effective learners use it to learn.

Furthermore, it can also be concluded that gender difference does not affect the performance of students with regard to the use of emerging technologies for academic work. How well a person performs in academia mostly depends on what the person has learned and not the presence and use of materials that are perceived to present students with more opportunities as in the case of emerging technologies.

Finally, it is imperative to conclude that there are distractors in most learning methods. However, the difference in these distractors is influenced by the learner, but not the learning resources. Therefore, as emerging technologies present learners with both relevant information and distractors (such as movies, adverts among others), it is up to learners to determine what they want to derive from their use.

Recommendations

Based on the findings of the study, there is a need to educate students on effective use of emerging technologies to solve academic problems. According to the information obtained from the study, most students are of the

view that learning the traditional way benefits them more than when they use emerging technologies in learning.

Similarly, students should be educated on effective use of emerging technologies for academic purpose to limit the time spend on searching for information or reading through numerous pages to find a piece of information. The effective search for information or use of emerging technology resources can help prevent distractors that divert learners from focusing on the aim of using the resources.

Finally, female students should be briefed via departmental seminars on their abilities to outperform male students. The ancient notion that men do better than women in mathematics and science related areas should be unlearned by female students via these seminars as recent studies, including this one, shows no significant difference in the performance of male and female students with regard to the use of emerging technologies.

Suggestions for Further Studies

Despite this study have undergone thorough work, there is a need to uncover the in-depth knowledge on the use of emerging technologies by students. In view of that, a qualitative study should be conducted on the effects of emerging technologies on the academic performance of students. This will bring about factors that were not discovered in this study.

Also, another study should be conducted on gender involvement in the use of emerging technologies among secondary or university students as it will help discover the reason for the low representation of female students in computer related courses.

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APPENDICES

APPENDIX A

UNIVERSITY OF CAPE COAST

COLLEGE OF DISTANCE EDUCATION

SCHOOL OF GRADUATE STUDIES

Research Questionnaire

I am a Master of Education student in Information Technology conducting a research on the topic "**Effect of emerging technology on academic achievement of students in the University of Cape Coast**." You have been selected to take part in this study by providing your responses to the items in this questionnaire.

Note: Please note that the information provided on these items will be treated with high level of confidentiality. No information provided in this questionnaire will affect your academic performance or any future endeavour, but for the purpose of this study only. Moreover, you can decide not to take part in this study. By responding to this questionnaire, it means you have agreed that you responded to it wholeheartedly. That is, participating in this study is voluntary.

Please tick (✓) the option that best fits your opinion and provide your opinion on the open-ended items

Section A: Background Characteristics of Respondents

1. Gender:

   a) Male [ ]

   b) Female [ ]

2. Age:

   a) Below 20 years [ ]

   b) 20 to 24 years [ ]

   c) 25 to 29 years [ ]

   d) 30 to 34 years [ ]

   e) 35 years and above [ ]

3. Which department do you belong to?

   ……

   Tick all the technological devices that you own and fall under the following categories

   a) Smartphone (Android, iPhone) [ ]

   b) Tablet (including iPads) [ ]

   c) Laptop [ ]

   d) Personal Digital Assistant (PDA) [ ]

   e) Any other? (Specify):……

4. Do you use any of the devices named in item (4) when learning?

   a) Yes [ ]

   b) No [ ]

5. What is your current CGPA? ……

a. 3.6 – 4.0 [ ]

b. 3.0 – 3.5 [ ]

c. 2.5 – 2.9 [ ]

d. 2.0 – 2.4 [ ]

e. 1.0 – 1.9 [ ]

f. Less than 1.0 [ ]

Section B: Emerging Technologies in Education

Kindly tick (✓) all emerging technologies that are available and used in education to support teaching and learning. (**Emerging technologies** as used in this study is defined as electronic devices that accept data, processes it, bring output and/or store the information. They also help in communicating and/or provide means for accessing information.

6. Emerging technologies used in education

   a. Mobile phones (Smartphones) [ ]

   b. Tablets (Android, iPad) [ ]

   c. Laptops and Desktops [ ]

   d. Personal Digital Assistants [ ]

   e. Projectors [ ]

   f. Free online courses/online learning platforms [ ]

   g. Cloud computing (remote computer with educational information and resources) [ ]

   h. Electronic books [ ]

   i. The internet [ ]

7. In your view, candidly provide other emerging technologies that facilitate teaching and learning.

   ……

   ……

   ……

   ……

   ……

Section C: Extent of Emerging Technology Use to Address Academic Problems

To each of the items presented, tick (✓) the one that best represents how often it is being used to address academic problems

Emerging Technologies	Never	Hardly	Sometimes	Often	Always
8. I use the services provided by messaging apps such as WhatsApp to get relevant academic information					
9. I participate in my class online group discussions					
10. I read e-books with emerging technological tools to get more understanding of concepts					
11. I research, type, complete and submit my assignments and projects					
12. I watch tutorials and videos on difficult concepts					
13. I use emerging technological tools to access information on the internet					
14. Emerging technological tools allow me to use multimedia resources when learning					
15. I usually compare lecturer's lessons to online information					

Emerging Technologies	Never	Hardly	Sometimes	Often	Always
16. I take online courses easily with the aid technological tools					
17. I watch educational movies and play educational games more than I learn with emerging technologies					
18. I use online cloud accounts to backup my educational documents in case of any loss of information					

19. In one sentence, describe the extent to which you use emerging technology to address educational problems.

……

……

……

……..

Section D: Effects of Emerging Technologies on Academic Performance

To the items presented in this section, candidly tick (✓) the one that best corresponds to your degree of acceptance.

Statements	Strongly Disagree	Disagree	Agree	Strongly Agree
20. With the advent of emerging technologies in my studies, I perform better than before.				
21. I perform better in courses that I use more emerging technologies during learning				
22. The use of multimedia in learning helps me to achieve better grades				
23. I get clearer understanding and maximum performance when I use emerging technological tools in learning.				
24. I easily get distracted by adverts when looking for information which makes learning lengthy and not effective leading to poor performance				
25. Emerging technologies influence my learning positively				

26. In two sentences, one for each, state how emerging technologies influenced (affected) your academic performance.

i. ……

……

……

……

ii. ……

……

……

……

Section E: Factors Influencing Emerging Technology Use in Education

To the items presented in this section, candidly tick (✓) the one that best corresponds to your degree of acceptance.

Statements	Strongly Disagree	Disagree	Agree	Strongly Agree
27. Emerging technologies, especially mobile phones, distract me during lectures				
28. Technological resources are expensive to come by and maintain				
29. I find it difficult to locate information I am looking for				
30. I find it difficult operating my devices effectively				
31. I am motivated to use emerging technologies when learning				
32. The use of emerging technologies in learning consumes more time than the traditional way of learning				
33. Enabling facilities such as internet access are expensive				
34. Enabling resources are not always available				
35. Emerging technologies help to understand difficult concepts				
36. Emerging technologies help me to contribute my quota to learning via chat rooms, social media groups and in presentations				
37. Social media and the internet addiction contribute to a decrease in performance				

38. Kindly state one positive effect of emerging technology in your education.

……

……

……

39. Kindly state one negative effect of emerging technology in your education.

……

……

……

Note: Traditional method of learning is a learning in which the learner makes use of textbooks or notes in learning without the help of emerging technologies.

40. Candidly list all factors that distract your learning when you use any of the following methods	
Traditional method of learning	Using emerging technologies

THANK YOU FOR PARTICIPATING IN THIS STUDY

APPENDIX B

Post-Hoc Tests

Crosstab

			Department		Total
			Maths and ICT Education	Biochemistry	
Tablets (Android, iPads)	Yes	Count	65	52	117
		Expected Count	64.6	52.4	117.0
		% within Tablets (Android, iPads)	55.6%	44.4%	100.0%
	No	Count	31	26	57
		Expected Count	31.4	25.6	57.0
		% within Tablets (Android, iPads)	54.4%	45.6%	100.0%
Total		Count	96	78	174
		Expected Count	96.0	78.0	174.0
		% within Tablets (Android, iPads)	55.2%	44.8%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.011	.884
	Cramer's V	.011	.884
N of Valid Cases		174	

Crosstab

			Department		Total
			Maths and ICT Education	Biochemistry	
Free online courses/online learning platforms	Yes	Count	58	32	90
		Expected Count	49.7	40.3	90.0
		% within Free online courses/online learning platforms	64.4%	35.6%	100.0%
	No	Count	38	46	84
		Expected Count	46.3	37.7	84.0
		% within Free online courses/online learning platforms	45.2%	54.8%	100.0%
Total		Count	96	78	174
		Expected Count	96.0	78.0	174.0
		% within Free online courses/online learning platforms	55.2%	44.8%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.193	.011
	Cramer's V	.193	.011
N of Valid Cases		174	

Crosstab

			Department		Total
			Maths and ICT Education	Biochemistry	
Cloud computing	Yes	Count	29	8	37
		Expected Count	20.4	16.6	37.0
		% within Cloud computing	78.4%	21.6%	100.0%
	No	Count	67	70	137
		Expected Count	75.6	61.4	137.0
		% within Cloud computing	48.9%	51.1%	100.0%
Total		Count	96	78	174
		Expected Count	96.0	78.0	174.0
		% within Cloud computing	55.2%	44.8%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.242	.001
	Cramer's V	.242	.001
N of Valid Cases		174	

Crosstab

			Department		Total
			Maths and ICT Education	Biochemistry	
Calculator	Yes	Count	13	0	13
		Expected Count	7.2	5.8	13.0
		% within Calculator	100.0%	0.0%	100.0%
	No	Count	83	78	161
		Expected Count	88.8	72.2	161.0
		% within Calculator	51.6%	48.4%	100.0%
Total		Count	96	78	174
		Expected Count	96.0	78.0	174.0
		% within Calculator	55.2%	44.8%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.256	.001
	Cramer's V	.256	.001
N of Valid Cases		174	

Crosstab

			Department		Total
			Maths and ICT Education	English	
Tablets (Android, iPads)	Yes	Count	65	31	96
		Expected Count	58.7	37.3	96.0
		% within Tablets (Android, iPads)	67.7%	32.3%	100.0%
	No	Count	31	30	61
		Expected Count	37.3	23.7	61.0
		% within Tablets (Android, iPads)	50.8%	49.2%	100.0%
Total		Count	96	61	157
		Expected Count	96.0	61.0	157.0
		% within Tablets (Android, iPads)	61.1%	38.9%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.169	.034
	Cramer's V	.169	.034
N of Valid Cases		157	

Crosstab

			Department		Total
			Maths and ICT Education	English	
Free online courses/online learning platforms	Yes	Count	58	32	90
		Expected Count	55.0	35.0	90.0
		% within Free online courses/online learning platforms	64.4%	35.6%	100.0%
	No	Count	38	29	67
		Expected Count	41.0	26.0	67.0
		% within Free online courses/online learning platforms	56.7%	43.3%	100.0%
Total		Count	96	61	157
		Expected Count	96.0	61.0	157.0
		% within Free online courses/online learning platforms	61.1%	38.9%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.078	.326
	Cramer's V	.078	.326
N of Valid Cases		157	

Crosstab

			Department		Total
			Maths and ICT Education	English	
Cloud computing	Yes	Count	29	10	39
		Expected Count	23.8	15.2	39.0
		% within Cloud computing	74.4%	25.6%	100.0%
	No	Count	67	51	118
		Expected Count	72.2	45.8	118.0
		% within Cloud computing	56.8%	43.2%	100.0%
Total		Count	96	61	157
		Expected Count	96.0	61.0	157.0
		% within Cloud computing	61.1%	38.9%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.156	.051
	Cramer's V	.156	.051
N of Valid Cases		157	

Crosstab

			Department		Total
			Maths and ICT Education	English	
Calculator	Yes	Count	13	2	15
		Expected Count	9.2	5.8	15.0
		% within Calculator	86.7%	13.3%	100.0%
	No	Count	83	59	142
		Expected Count	86.8	55.2	142.0
		% within Calculator	58.5%	41.5%	100.0%
Total		Count	96	61	157
		Expected Count	96.0	61.0	157.0
		% within Calculator	61.1%	38.9%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.170	.033
	Cramer's V	.170	.033
N of Valid Cases		157	

Crosstab

			Department		Total
			Maths and ICT Education	Arts Education	
Tablets (Android, iPads)	Yes	Count	65	46	111
		Expected Count	67.4	43.6	111.0
		% within Tablets (Android, iPads)	58.6%	41.4%	100.0%
	No	Count	31	16	47
		Expected Count	28.6	18.4	47.0
		% within Tablets (Android, iPads)	66.0%	34.0%	100.0%
Total		Count	96	62	158
		Expected Count	96.0	62.0	158.0
		% within Tablets (Android, iPads)	60.8%	39.2%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.069	.384
	Cramer's V	.069	.384
N of Valid Cases		158	

Crosstab

			Department		Total
			Maths and ICT Education	Arts Education	
Free online courses/online learning platforms	Yes	Count	58	37	95
		Expected Count	57.7	37.3	95.0
		% within Free online courses/online learning platforms	61.1%	38.9%	100.0%
	No	Count	38	25	63
		Expected Count	38.3	24.7	63.0
		% within Free online courses/online learning platforms	60.3%	39.7%	100.0%
Total		Count	96	62	158
		Expected Count	96.0	62.0	158.0
		% within Free online courses/online learning platforms	60.8%	39.2%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.007	.926
	Cramer's V	.007	.926
N of Valid Cases		158	

Crosstab

			Department		Total
			Maths and ICT Education	Arts Education	
Cloud computing	Yes	Count	29	14	43
		Expected Count	26.1	16.9	43.0
		% within Cloud computing	67.4%	32.6%	100.0%
	No	Count	67	48	115
		Expected Count	69.9	45.1	115.0
		% within Cloud computing	58.3%	41.7%	100.0%
Total		Count	96	62	158
		Expected Count	96.0	62.0	158.0
		% within Cloud computing	60.8%	39.2%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.084	.293
	Cramer's V	.084	.293
N of Valid Cases		158	

Crosstab

			Department		Total
			Maths and ICT Education	Arts Education	
Calculator	Yes	Count	13	0	13
		Expected Count	7.9	5.1	13.0
		% within Calculator	100.0%	0.0%	100.0%
	No	Count	83	62	145
		Expected Count	88.1	56.9	145.0
		% within Calculator	57.2%	42.8%	100.0%
Total		Count	96	62	158
		Expected Count	96.0	62.0	158.0
		% within Calculator	60.8%	39.2%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.241	.002
	Cramer's V	.241	.002
N of Valid Cases		158	

Crosstab

			Department		Total
			Maths and ICT Education	Business and Social Sciences Education	
Tablets (Android, iPads)	Yes	Count	65	28	93
		Expected Count	57.2	35.8	93.0
		% within Tablets (Android, iPads)	69.9%	30.1%	100.0%
	No	Count	31	32	63
		Expected Count	38.8	24.2	63.0
		% within Tablets (Android, iPads)	49.2%	50.8%	100.0%
Total		Count	96	60	156
		Expected Count	96.0	60.0	156.0
		% within Tablets (Android, iPads)	61.5%	38.5%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.209	.009
	Cramer's V	.209	.009
N of Valid Cases		156	

Crosstab

			Department		Total
			Maths and ICT Education	Business and Social Sciences Education	
Free online courses/online learning platforms	Yes	Count	58	21	79
		Expected Count	48.6	30.4	79.0
		% within Free online courses/online learning platforms	73.4%	26.6%	100.0%
	No	Count	38	39	77
		Expected Count	47.4	29.6	77.0
		% within Free online courses/online learning platforms	49.4%	50.6%	100.0%
Total		Count	96	60	156
		Expected Count	96.0	60.0	156.0
		% within Free online courses/online learning platforms	61.5%	38.5%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.247	.002
	Cramer's V	.247	.002
N of Valid Cases		156	

Crosstab

			Department		Total
			Maths and ICT Education	Business and Social Sciences Education	
Cloud computing	Yes	Count	29	12	41
		Expected Count	25.2	15.8	41.0
		% within Cloud computing	70.7%	29.3%	100.0%
	No	Count	67	48	115
		Expected Count	70.8	44.2	115.0
		% within Cloud computing	58.3%	41.7%	100.0%
Total		Count	96	60	156
		Expected Count	96.0	60.0	156.0
		% within Cloud computing	61.5%	38.5%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.113	.159
	Cramer's V	.113	.159
N of Valid Cases		156	

Crosstab

			Department		Total
			Maths and ICT Education	Business and Social Sciences Education	
Calculator	Yes	Count	13	1	14
		Expected Count	8.6	5.4	14.0
		% within Calculator	92.9%	7.1%	100.0%
	No	Count	83	59	142
		Expected Count	87.4	54.6	142.0
		% within Calculator	58.5%	41.5%	100.0%
Total		Count	96	60	156
		Expected Count	96.0	60.0	156.0
		% within Calculator	61.5%	38.5%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.202	.012
	Cramer's V	.202	.012
N of Valid Cases		156	

Crosstab

			Department		Total
			Biochemistry	English	
Free online courses/online learning platforms	Yes	Count	32	32	64
		Expected Count	35.9	28.1	64.0
		% within Free online courses/online learning platforms	50.0%	50.0%	100.0%
	No	Count	46	29	75
		Expected Count	42.1	32.9	75.0
		% within Free online courses/online learning platforms	61.3%	38.7%	100.0%
Total		Count	78	61	139
		Expected Count	78.0	61.0	139.0
		% within Free online courses/online learning platforms	56.1%	43.9%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.114	.180
	Cramer's V	.114	.180
N of Valid Cases		139	

Crosstab

			Department		Total
			Biochemistry	English	
Cloud computing	Yes	Count	8	10	18
		Expected Count	10.1	7.9	18.0
		% within Cloud computing	44.4%	55.6%	100.0%
	No	Count	70	51	121
		Expected Count	67.9	53.1	121.0
		% within Cloud computing	57.9%	42.1%	100.0%
Total		Count	78	61	139
		Expected Count	78.0	61.0	139.0
		% within Cloud computing	56.1%	43.9%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.091	.285
	Cramer's V	.091	.285
N of Valid Cases		139	

Crosstab

			Department		Total
			Biochemistry	English	
Calculator	Yes	Count	0	2	2
		Expected Count	1.1	.9	2.0
		% within Calculator	0.0%	100.0%	100.0%
	No	Count	78	59	137
		Expected Count	76.9	60.1	137.0
		% within Calculator	56.9%	43.1%	100.0%
Total		Count	78	61	139
		Expected Count	78.0	61.0	139.0
		% within Calculator	56.1%	43.9%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.137	.107
	Cramer's V	.137	.107
N of Valid Cases		139	

Crosstab

			Department		Total
			Biochemistry	Arts Education	
Tablets (Android, iPads)	Yes	Count	52	46	98
		Expected Count	54.6	43.4	98.0
		% within Tablets (Android, iPads)	53.1%	46.9%	100.0%
	No	Count	26	16	42
		Expected Count	23.4	18.6	42.0
		% within Tablets (Android, iPads)	61.9%	38.1%	100.0%
Total		Count	78	62	140
		Expected Count	78.0	62.0	140.0
		% within Tablets (Android, iPads)	55.7%	44.3%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.082	.334
	Cramer's V	.082	.334
N of Valid Cases		140	

Crosstab

			Department		Total
			Biochemistry	Arts Education	
Free online courses/online learning platforms	Yes	Count	32	37	69
		Expected Count	38.4	30.6	69.0
		% within Free online courses/online learning platforms	46.4%	53.6%	100.0%
	No	Count	46	25	71
		Expected Count	39.6	31.4	71.0
		% within Free online courses/online learning platforms	64.8%	35.2%	100.0%
Total		Count	78	62	140
		Expected Count	78.0	62.0	140.0
		% within Free online courses/online learning platforms	55.7%	44.3%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.185	.028
	Cramer's V	.185	.028
N of Valid Cases		140	

Crosstab

			Department		Total
			Biochemistry	Arts Education	
Cloud computing	Yes	Count	8	14	22
		Expected Count	12.3	9.7	22.0
		% within Cloud computing	36.4%	63.6%	100.0%
	No	Count	70	48	118
		Expected Count	65.7	52.3	118.0
		% within Cloud computing	59.3%	40.7%	100.0%
Total		Count	78	62	140
		Expected Count	78.0	62.0	140.0
		% within Cloud computing	55.7%	44.3%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.168	.047
	Cramer's V	.168	.047
N of Valid Cases		140	

Crosstab

			Department		Total
			Biochemistry	Business and Social Sciences Education	
Tablets (Android, iPads)	Yes	Count	52	28	80
		Expected Count	45.2	34.8	80.0
		% within Tablets (Android, iPads)	65.0%	35.0%	100.0%
	No	Count	26	32	58
		Expected Count	32.8	25.2	58.0
		% within Tablets (Android, iPads)	44.8%	55.2%	100.0%
Total		Count	78	60	138
		Expected Count	78.0	60.0	138.0
		% within Tablets (Android, iPads)	56.5%	43.5%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.201	.018
	Cramer's V	.201	.018
N of Valid Cases		138	

Crosstab

			Department		Total
			Biochemistry	Business and Social Sciences Education	
Free online courses/online learning platforms	Yes	Count	32	21	53
		Expected Count	30.0	23.0	53.0
		% within Free online courses/online learning platforms	60.4%	39.6%	100.0%
	No	Count	46	39	85
		Expected Count	48.0	37.0	85.0
		% within Free online courses/online learning platforms	54.1%	45.9%	100.0%
Total		Count	78	60	138
		Expected Count	78.0	60.0	138.0
		% within Free online courses/online learning platforms	56.5%	43.5%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.061	.471
	Cramer's V	.061	.471
N of Valid Cases		138	

Crosstab

			Department		Total
			Biochemistry	Business and Social Sciences Education	
Cloud computing	Yes	Count	8	12	20
		Expected Count	11.3	8.7	20.0
		% within Cloud computing	40.0%	60.0%	100.0%
	No	Count	70	48	118
		Expected Count	66.7	51.3	118.0
		% within Cloud computing	59.3%	40.7%	100.0%
Total		Count	78	60	138
		Expected Count	78.0	60.0	138.0
		% within Cloud computing	56.5%	43.5%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.137	.107
	Cramer's V	.137	.107
N of Valid Cases		138	

Crosstab

			Department		Total
			Biochemistry	Business and Social Sciences Education	
Calculator	Yes	Count	0	1	1
		Expected Count	.6	.4	1.0
		% within Calculator	0.0%	100.0%	100.0%
	No	Count	78	59	137
		Expected Count	77.4	59.6	137.0
		% within Calculator	56.9%	43.1%	100.0%
Total		Count	78	60	138
		Expected Count	78.0	60.0	138.0
		% within Calculator	56.5%	43.5%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.097	.252
	Cramer's V	.097	.252
N of Valid Cases		138	

Crosstab

			Department		Total
			English	Arts Education	
Tablets (Android, iPads)	Yes	Count	31	46	77
		Expected Count	38.2	38.8	77.0
		% within Tablets (Android, iPads)	40.3%	59.7%	100.0%
	No	Count	30	16	46
		Expected Count	22.8	23.2	46.0
		% within Tablets (Android, iPads)	65.2%	34.8%	100.0%
Total		Count	61	62	123
		Expected Count	61.0	62.0	123.0
		% within Tablets (Android, iPads)	49.6%	50.4%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.242	.007
	Cramer's V	.242	.007
N of Valid Cases		123	

Crosstab

			Department		Total
			English	Arts Education	
Free online courses/online learning platforms	Yes	Count	32	37	69
		Expected Count	34.2	34.8	69.0
		% within Free online courses/online learning platforms	46.4%	53.6%	100.0%
	No	Count	29	25	54
		Expected Count	26.8	27.2	54.0
		% within Free online courses/online learning platforms	53.7%	46.3%	100.0%
Total		Count	61	62	123
		Expected Count	61.0	62.0	123.0
		% within Free online courses/online learning platforms	49.6%	50.4%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.073	.420
	Cramer's V	.073	.420
N of Valid Cases		123	

Crosstab

			Department		Total
			English	Arts Education	
Cloud computing	Yes	Count	10	14	24
		Expected Count	11.9	12.1	24.0
		% within Cloud computing	41.7%	58.3%	100.0%
	No	Count	51	48	99
		Expected Count	49.1	49.9	99.0
		% within Cloud computing	51.5%	48.5%	100.0%
Total		Count	61	62	123
		Expected Count	61.0	62.0	123.0
		% within Cloud computing	49.6%	50.4%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.078	.387
	Cramer's V	.078	.387
N of Valid Cases		123	

Crosstab

			Department		Total
			English	Arts Education	
Calculator	Yes	Count	2	0	2
		Expected Count	1.0	1.0	2.0
		% within Calculator	100.0%	0.0%	100.0%
	No	Count	59	62	121
		Expected Count	60.0	61.0	121.0
		% within Calculator	48.8%	51.2%	100.0%
Total		Count	61	62	123
		Expected Count	61.0	62.0	123.0
		% within Calculator	49.6%	50.4%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.130	.151
	Cramer's V	.130	.151
N of Valid Cases		123	

Crosstab

			Department		Total
			English	Business and Social Sciences Education	
Tablets (Android, iPads)	Yes	Count	31	28	59
		Expected Count	29.7	29.3	59.0
		% within Tablets (Android, iPads)	52.5%	47.5%	100.0%
	No	Count	30	32	62
		Expected Count	31.3	30.7	62.0
		% within Tablets (Android, iPads)	48.4%	51.6%	100.0%
Total		Count	61	60	121
		Expected Count	61.0	60.0	121.0
		% within Tablets (Android, iPads)	50.4%	49.6%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.042	.648
	Cramer's V	.042	.648
N of Valid Cases		121	

Crosstab

			Department		Total
			English	Business and Social Sciences Education	
Free online courses/online learning platforms	Yes	Count	32	21	53
		Expected Count	26.7	26.3	53.0
		% within Free online courses/online learning platforms	60.4%	39.6%	100.0%
	No	Count	29	39	68
		Expected Count	34.3	33.7	68.0
		% within Free online courses/online learning platforms	42.6%	57.4%	100.0%
Total		Count	61	60	121
		Expected Count	61.0	60.0	121.0
		% within Free online courses/online learning platforms	50.4%	49.6%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.176	.053
	Cramer's V	.176	.053
N of Valid Cases		121	

Crosstab

			Department		Total
			English	Business and Social Sciences Education	
Cloud computing	Yes	Count	10	12	22
		Expected Count	11.1	10.9	22.0
		% within Cloud computing	45.5%	54.5%	100.0%
	No	Count	51	48	99
		Expected Count	49.9	49.1	99.0
		% within Cloud computing	51.5%	48.5%	100.0%
Total		Count	61	60	121
		Expected Count	61.0	60.0	121.0
		% within Cloud computing	50.4%	49.6%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.047	.607
	Cramer's V	.047	.607
N of Valid Cases		121	

Crosstab

			Department		Total
			English	Business and Social Sciences Education	
Calculator	Yes	Count	2	1	3
		Expected Count	1.5	1.5	3.0
		% within Calculator	66.7%	33.3%	100.0%
	No	Count	59	59	118
		Expected Count	59.5	58.5	118.0
		% within Calculator	50.0%	50.0%	100.0%
Total		Count	61	60	121
		Expected Count	61.0	60.0	121.0
		% within Calculator	50.4%	49.6%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.052	.569
	Cramer's V	.052	.569
N of Valid Cases		121	

Crosstab

			Department		Total
			Arts Education	Business and Social Sciences Education	
Tablets (Android, iPads)	Yes	Count	46	28	74
		Expected Count	37.6	36.4	74.0
		% within Tablets (Android, iPads)	62.2%	37.8%	100.0%
	No	Count	16	32	48
		Expected Count	24.4	23.6	48.0
		% within Tablets (Android, iPads)	33.3%	66.7%	100.0%
Total		Count	62	60	122
		Expected Count	62.0	60.0	122.0
		% within Tablets (Android, iPads)	50.8%	49.2%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.282	.002
	Cramer's V	.282	.002
N of Valid Cases		122	

Crosstab

			Department		Total
			Arts Education	Business and Social Sciences Education	
Cloud computing	Yes	Count	14	12	26
		Expected Count	13.2	12.8	26.0
		% within Cloud computing	53.8%	46.2%	100.0%
	No	Count	48	48	96
		Expected Count	48.8	47.2	96.0
		% within Cloud computing	50.0%	50.0%	100.0%
Total		Count	62	60	122
		Expected Count	62.0	60.0	122.0
		% within Cloud computing	50.8%	49.2%	100.0%

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.032	.728
	Cramer's V	.032	.728
N of Valid Cases		122	

Crosstab

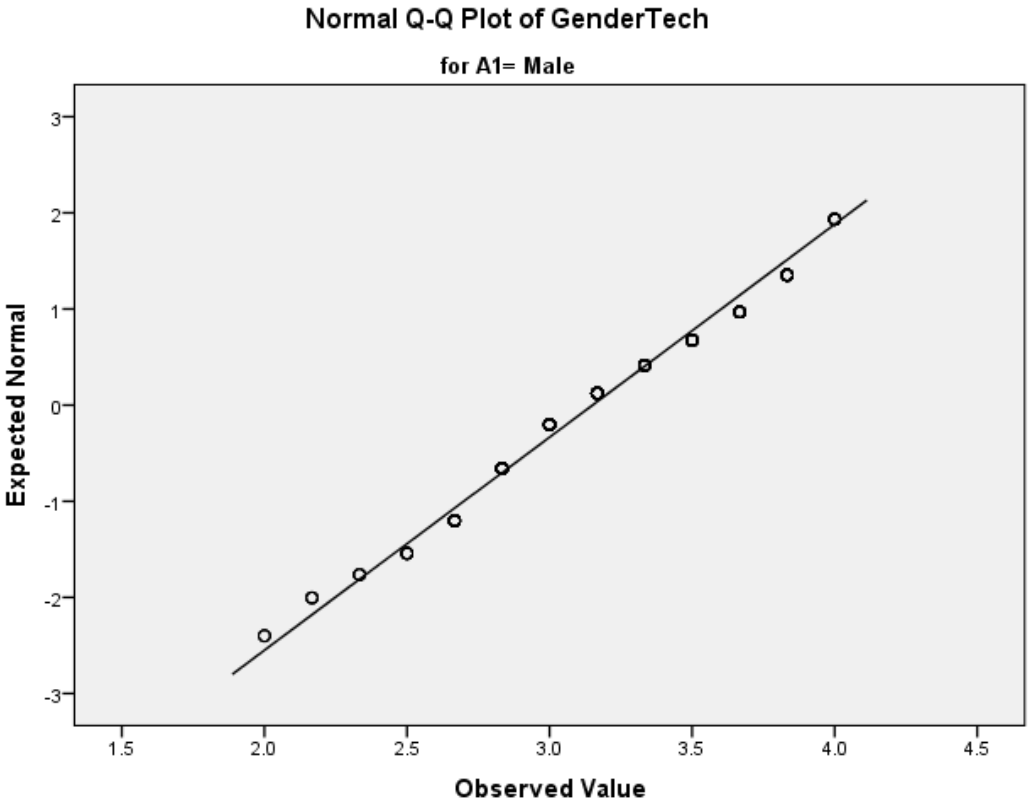
			Department		Total
			Arts Education	Business and Social Sciences Education	
Calculator	Yes	Count	0	1	1
		Expected Count	.5	.5	1.0
		% within Calculator	0.0%	100.0%	100.0%
	No	Count	62	59	121
		Expected Count	61.5	59.5	121.0
		% within Calculator	51.2%	48.8%	100.0%
Total		Count	62	60	122
		Expected Count	62.0	60.0	122.0
		% within Calculator	50.8%	49.2%	100.0%

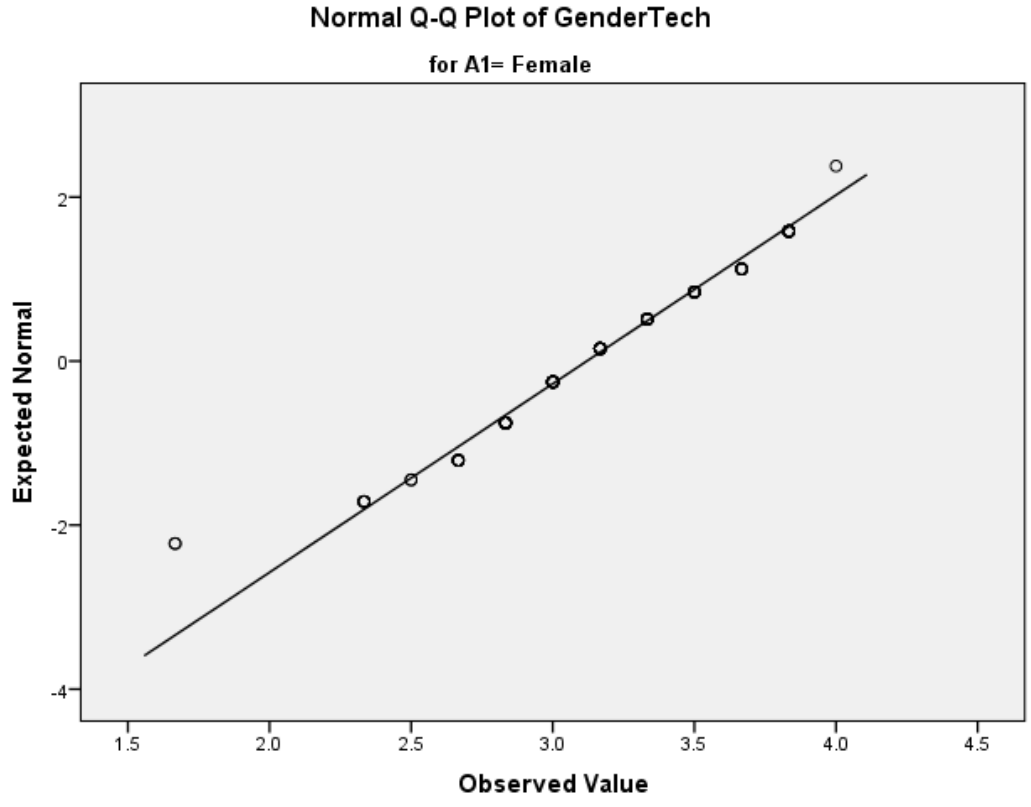
Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	-.092	.307
	Cramer's V	.092	.307
N of Valid Cases		122	

APPENDIX C

Normality and Homogeneity Assumptions' Tests



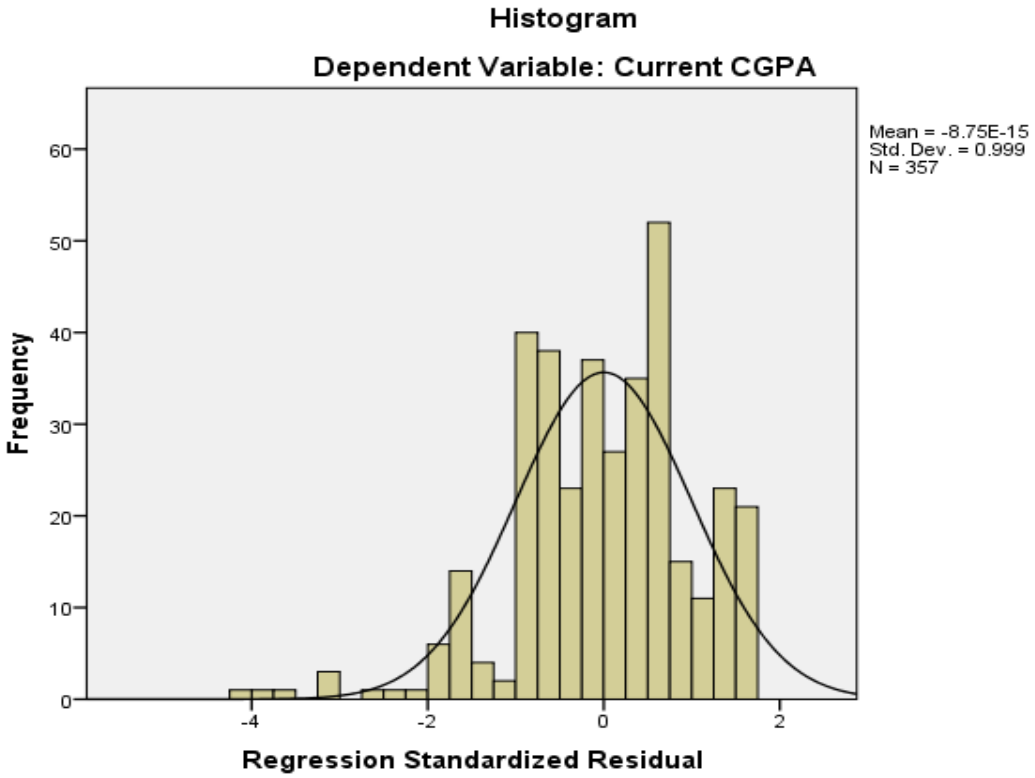


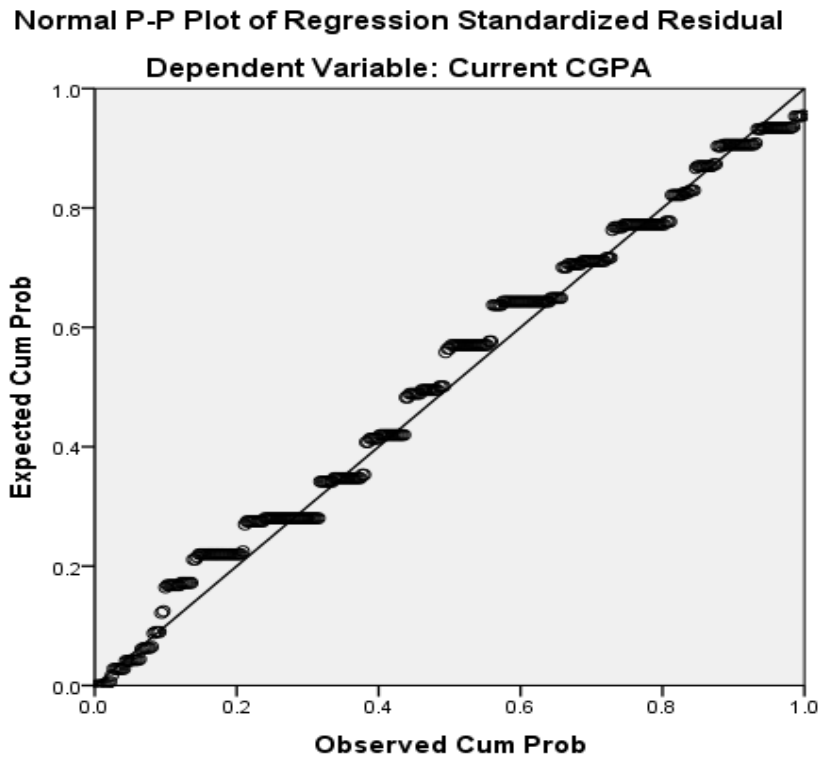
Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
GenderTech	Equal variances assumed	1.122	.290	.612	355	.541	.0310	.0506	-.0686	.1306
	Equal variances not assumed			.621	228.830	.535	.0310	.0500	-.0674	.1295

APPENDIX D

Normality and Homoscedasticity Assumptions' Tests





APPENDIX E

Ethical Clearance Letter

UNIVERSITY OF CAPE COAST

INSTITUTIONAL REVIEW BOARD SECRETARIAT

TEL: 03321-33172/3 / 0207355653/ 0244207814
E-MAIL: irb@ucc.edu.gh
C/O Directorate of Research, Innovation and Consultancy

OUR REF: UCC/IRB/A/2016/204
YOUR REF:
OMB NO: 0990-0279
IORG #: IORG0009096

7TH FEBRUARY, 2018

Mr. Desire Mawuko Komla Ayite
College of Distance Education
University of Cape Coast

Dear Mr. Ayite,

ETHICAL CLEARANCE –ID: (UCCIRB/CoDE/2017/01)

The University of Cape Coast Institutional Review Board (UCCIRB) has granted **Provisional Approval** for the implementation of your research protocol titled ***'Effect of emerging technology on academic achievement of students in the University of Cape Coast'.*** This approval requires that you submit periodic review of the protocol to the Board and a final full review to the UCCIRB on completion of the research. The UCCIRB may observe or cause to be observed procedures and records of the research during and after implementation.

Please note that any modification of the project must be submitted to the UCCIRB for review and approval before its implementation.

You are also required to report all serious adverse events related to this study to the UCCIRB within seven days verbally and fourteen days in writing.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

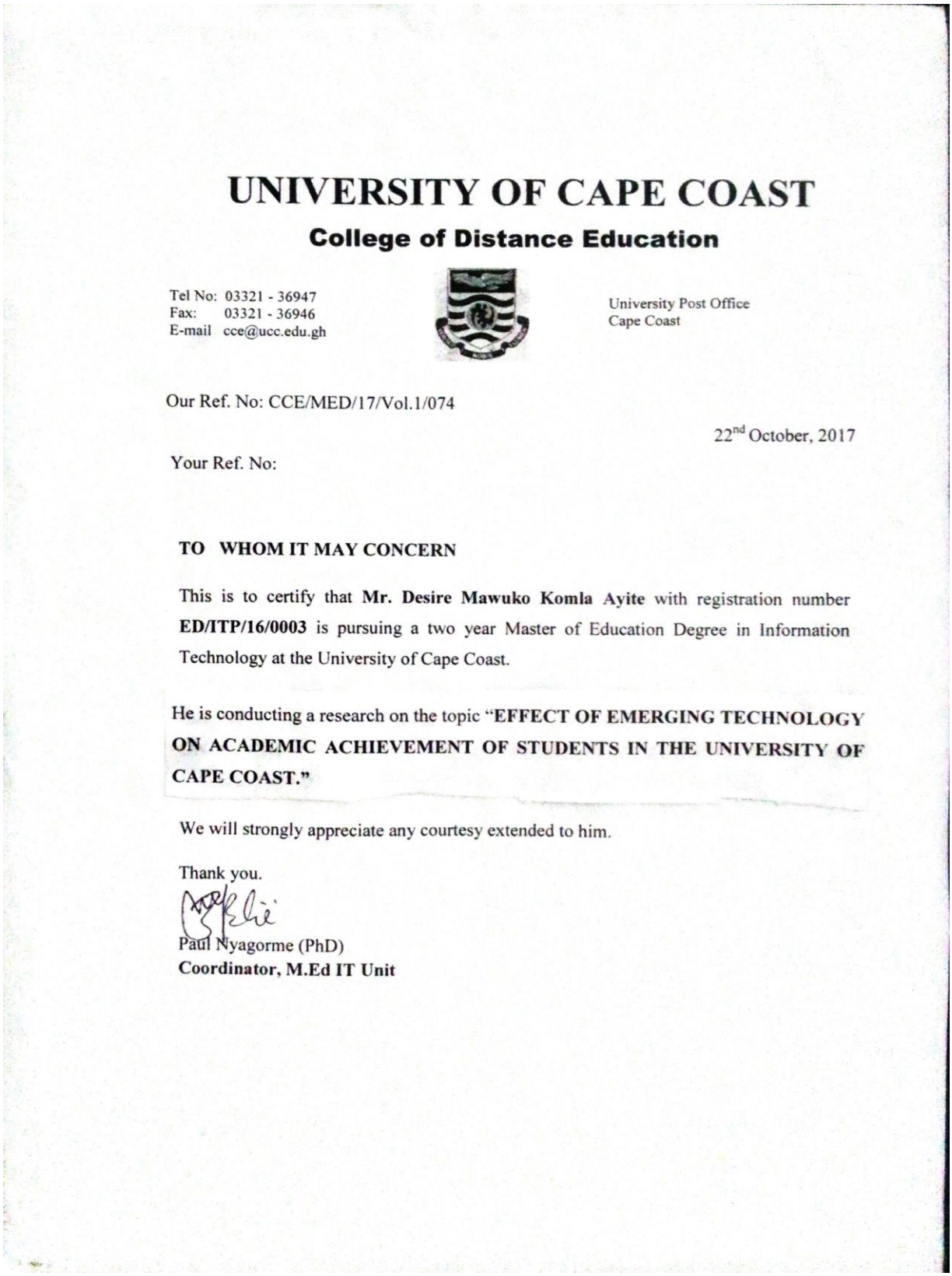
Yours faithfully,

Samuel Asiedu Owusu (PhD)
UCCIRB Administrator

ADMINISTRATOR
INSTITUTIONAL REVIEW BOARD
UNIVERSITY OF CAPE COAST
Date: 08/02/2018

APPENDIX F

Introductory Letter



UNIVERSITY OF CAPE COAST

College of Distance Education

Tel No: 03321 - 36947
Fax: 03321 - 36946
E-mail cce@ucc.edu.gh

University Post Office
Cape Coast

Our Ref. No: CCE/MED/17/Vol.1/074

22nd October, 2017

Your Ref. No:

TO WHOM IT MAY CONCERN

This is to certify that **Mr. Desire Mawuko Komla Ayite** with registration number **ED/ITP/16/0003** is pursuing a two year Master of Education Degree in Information Technology at the University of Cape Coast.

He is conducting a research on the topic "**EFFECT OF EMERGING TECHNOLOGY ON ACADEMIC ACHIEVEMENT OF STUDENTS IN THE UNIVERSITY OF CAPE COAST.**"

We will strongly appreciate any courtesy extended to him.

Thank you.

Paul Nyagorme (PhD)
Coordinator, M.Ed IT Unit