EDUCATIONAL TECHNOLOGY INTEGRATION IN TEACHING IN TECHNICAL UNIVERSITIES IN GHANA

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EDUCATIONAL TECHNOLOGY INTEGRATION IN TEACHING IN TECHNICAL UNIVERSITIES IN GHANA

BY

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10636242

THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF PHD IN ADULT EDUCATION AND HUMAN RESOURCE STUDIES DEGREE

AUGUST, 2022

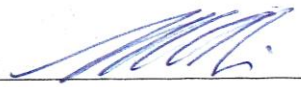
DECLARATION

I, EUGENE OWUSU-ACHEAMPONG, hereby declare that this research "Educational technology integration in teaching in Technical Universities in Ghana" is the result of my research, and it has neither been presented in part nor in whole for another degree, except for references to other people's work, which have been duly acknowledged.

EUGENE OWUSU-ACHEAMPONG — 16th August, 2022

(STUDENT) — DATE

We, the undersigned supervisors, declare that this is an original work by the candidate and we supervised its production. We are also convinced that the thesis meets all the required standards set by the University of Ghana for an award of a Doctor of Philosophy degree.



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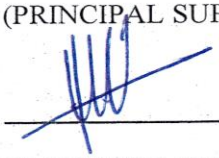

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ABSTRACT

This study aimed to find the educational technology tools frequently used for teaching in selected Ghanaian technical universities and establish whether or not there is any relationship between educational technology use and enhanced instructional delivery. This study was guided by the Diffusion of Innovations Theory (Rogers, 1962; 2003), Technology, Pedagogy and Content Knowledge (TPACK) Model by (Harris et al., 2009), and the Substitution, Argumentation, Modification and Redefinition (SAMR) model (Puentedura, 2006).

This research aligns with the philosophical assumption of pragmatism. The study used the embedded mixed-method design and relied on a questionnaire and semi-structured interviews for data collection from 252 faculty members randomly selected from two Ghanaian technical universities (Koforidua Technical University and Takoradi Technical University). Data were analysed using descriptive and inferential statistics and qualitative thematic analysis. The study found that the effective use of technological tools such as laptop computers, mobile phones and the projector for teaching could make higher education instruction delivery very enjoyable, thereby making teaching outcomes more achievable. The study also revealed that the key factors affecting educational technology integration into teaching are inadequate educational technology tools, inconsistent internet connectivity, insufficient technical support services, and inadequate training, among others. It is therefore recommended that faculty members and the university authorities acquire more educational technologies for teaching. It is also suggested that the universities invest more resources in procuring Information, Communications and Technology infrastructure and ensure consistent internet

connectivity. It is also recommended that the institutions organise continuous in-service training through workshops and seminars to acquaint faculty members with the needed competencies for effective and efficient integration of educational technologies into teaching.

DEDICATION

This thesis is dedicated to my wife, Mrs Theodora Owusu-Acheampong, and my children, Theodora Irene Owusu-Acheampong, Theodore Martin Owusu-Acheampong and Emmanuel Kwadwo Owusu-Acheampong. I am grateful for their love, support and motivation while I pursued this research.

ACKNOWLEDGEMENTS

I wish to express my most profound appreciation to my principal supervisor, Professor Yaw Oheneba-Sakyi, and co-supervisors, Professor Olivia A. T. F. Kwapong and Dr Inusah Salifu of the Department of Adult Education and Human Resource Studies, University of Ghana. They carefully supervised this work despite their busy schedules. Thank you very much for your constructive criticisms, guidance, patience and support. I also wish to thank the management of Takoradi and Koforidua Technical Universities and the faculty members for the permission granted me to carry out the study in their respective institutions. I also thank the management and faculty members of Cape Coast Technical University for the opportunity given to me to pilot my study at their institution.

I am equally grateful to Dr Eugene Okyere Kwakye of Koforidua Technical University, Mr. Jacob Enyan Agabus and especially Mrs. Stella Duncan of Takoradi Technical University for their support during the data collection period. I say God bless you and replenish everything you lost during this period.

I am grateful to all the administrative staff of the Department of Adult Education and Human Resource Studies, for their support through this journey. I am also grateful to Professor Anthony K Adimado of the Department of Chemistry, Kwame Nkrumah University of Science and Technology, and my elder sister, Mrs. Irene Owusu-Acheampong Ampong, for their encouragement. Finally, I am grateful to my wife, Mrs Theodora Owusu-Acheampong, and my children, Theodora Irene Owusu-Acheampong, Theodore Martin Owusu-Acheampong and Emmanuel Kwadwo Owusu-

Acheampong for their patience and encouragement for a successful completion of this thesis.

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LIST OF ABBREVIATIONS

AECT	Association of Educational and Communication Technology
CCTU	Cape Coast Technical University
CIPP	Content Input Process Product
CK	Content Knowledge
DES	Department of Education and Skills
DIT	Diffusion Innovation Theory
EdTech	Educational Technology
FFM	Female Faculty Member
HND	Higher National Diploma
SPSS	Statistical Program for Social Scientists
ICT	Information and Communications Technology
ITU	International Telecommunication Union
KTU	Koforidua Technical University
LCD	Liquid Crystal Display
MFM	Male Faculty Member
NETP	National Education Technology Plan
NMC	New Media Consortium
PCK	Pedagogical Content Knowledge
PK	Pedagogical Knowledge
PhD	Doctor of Philosophy
PNDC	Provisional National Defense Council
SAMR	Substitution Argumentation Modification Redefinition
SD	Standard Deviation
SED	Sequential Explanatory Design

TCK	Technological Content Knowledge
TK	Technological Knowledge
TPACK	Technological Pedagogical Content Knowledge
TPK	Technological Pedagogical Knowledge
TTU	Takoradi Technical University
TUs	Technical Universities

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Rapid technological advancement and globalisation seem to influence significantly, the creation of a new knowledge-based economy (Al Lily, 2014; Bozkurt, 2020). In essence, technology appears to be the critical factor in this knowledge-based economy for many nations across the globe (Latchem, 2017). Most governments in the world have recognised that advancement in technology has an immense influence on the socio-economic development of their citizenry (Jackson & Chapman, 2012; Raza & Naqvi, 2011). Based on this development, some governments have invested heavily in technology developments to build the human resource base to address, and conveniently cope with the demands and pressure of the information and digital age (Boden & Nedeva, 2010).

The concept of "educational technology" has been used since the post-World War II period in the United States of America for integrating equipment like audio tapes, television, and slide projectors in instructional delivery (Delgado, et al., 2015). In our contemporary society, educational technology includes tools integrated into teaching (Kachalov et al., 2015).

To ensure the integration of technology into teaching, the government of the United States of America in 2010, released The National Educational Technology Plan (Office of Educational Technology, 2015). The plan aimed at transforming America's education through teaching powered by technology (Gray & Silver-Pacuilla, 2011). The plan's objective was to influence teaching

by using modern technology to engage and personalize learning experiences for every learner. This intervention necessitates that learners be put at the centre of teaching and encouraged to take complete control of their own learning experiences (Bill & Melinda Gates Foundation, 2012). Although technological tools for teaching keep evolving, the mission of integrating technology to empower independent and self-directed learning remained steady (Jin & Bridges, 2014; Spector et al., 2013). Apart from ensuring technology integration in teaching, the United States government also invested about six (6) billion dollars in providing educational technologies (Capuk, 2015).

Similarly, in Canada, the government invested one hundred and fifty ($150) million dollars for three years to integrate technology into teaching (Ribeiro, 2016). Technologies provided to assist in teaching included cameras, tablets, notebook computers, and other software to improve internet connectivity and teacher development. Also, in the United Kingdom, an education technology strategy was unveiled and an amount of ten (£10) million pounds was invested in supporting innovation in schools, colleges, and universities across London (Department of Education, 2019).

Furthermore, in Ireland, it has been reported that one hundred and ten (€110) million Euros was announced for the third year of funding under the Ireland 2040 project, which is to be spent by all schools on digital strategy technology infrastructure (Department of Education & Skills, 2019). This was to enable schools to purchase key technology, including cloud systems, tablets, and projectors.

Turning attention to Africa, in 2014, the Kenyan government invested about six hundred (600) million dollars in providing laptops to teachers and students. This was an effort to provide educational technology to enhance and transform teaching. According to Piper et al. (2015), the significant investment is geared towards creating a knowledge-based economy that will propel the country towards achieving its vision in 2030. Besides the provision of laptops, the Kenyan government also put adequate measures to equip instructors/teachers with the requisite technology-related competencies for the effective and successful execution of the project (Gikundi, 2016).

In 2003, Ghana's quest to improve access, equity, and quality in education delivery brought into being a policy aimed at integrating technology in education, particularly for teaching and learning (Ghana ICT in Education Policy, 2003). The policy Model recognises the essential role of technology integration in education to create opportunities for teachers and learners (Addy & Ofori-Boateng, 2015). The policy was to ensure the promotion of three key pillars namely (1) seeking to incorporate technology into the teaching process, (2) technology as a vocation for learners and (3) technology as a learning and operating tool (Natia & Al-hassan, 2015).

The Ghana ICT in Education Policy (2003) also emphasised that challenges would characterise education in the years ahead, and that it was expedient for Ghana to integrate technology in the teaching process. It also considered that incorporating technology in the classroom teaching would be critical if Ghana was to succeed in bringing out students who are competent and technically inclined to support the nation's development agenda (Asabere et al., 2016).

Higher educational institutions are noted for the quality of teaching, research and community development activities (Choy et al., 2009). Therefore, higher education institutions must make a conscious effort to integrate educational technology into teaching. When faculty integrate educational technology in teaching, it will improve delivery and motivate students to master skills, learn at their own pace, and track their progress consistently (Koria et al., 2014). Ideally, interactive multimedia course contents would offer a better advantage of modern teaching than traditional teaching methods (Rivers et al., 2015). The use of technology for teaching in higher institutions will provide immediate feedback between instructors and students, which will eventually enhance instructor-student relations (Stošić & Stošić, 2015).

The integration of educational technology in teaching is recognised as a means of bridging the gap in accessing education and improving teaching (Dzobelova et al., 2020; Lazar, 2015; Ramorola, 2013). Many arguments posited for integrating educational technology in the classroom include making teaching more efficient, effective and for transforming and engaging learners in an active process connected to real life (Quaye et al., 2015). The integration of educational technology prepares the young generation for 21st-century jobs (Alper & Gulbahar, 2009; Koc & Bakir, 2010). Besides, Williamson (2017) posits that technology integration in teaching makes instructors resourceful. According to Kachaloy et al. (2015), integrating educational technology in teaching has brought about a robust learning environment that has transformed teaching and learning. Educational technology integration by faculty will enable students to deal with knowledge acquisition in a constructive, active, and independent manner (Al Lily, 2014; Banas & York, 2014).

Singh and Chan (2014) stated that the successful integration of educational technology into the teaching process relies on the teacher's preparation. The usage of educational technology in the instructional process is essential as it provides the chance for instructors to blend instructional delivery and make teaching more collaborative. According to Delgado et al. (2015), and Ramorola (2013), educational technology inspires and encourages teachers to enhance the quality of teaching. The dynamism in the school's environment powered by technology facilitates teaching by providing resources that aid instructors in linking institutions to the outside world (Liao et al., 2017; McKnight et al., 2016).

Nawaz et al. (2011), and Shohel and Kirkwood (2012) posited that knowing how, when, and where to use educational technology appropriately by instructors would develop students critical thinking, assist in applying knowledge to solving new problems, analyse information, communicate effectively, collaborate and make well- informed decisions. In Spector's (2013) perspective, these competencies bring about flexibility and security in this 21st century, characterised by constant change.

Though it is hard to ascertain the extent of educational technology investment in higher education, there has been a tremendous increase in using educational technologies for teaching in the last generation. For instance, the New Media Consortium (NMC) document published in 2018 reported an investment of thirty ($30) billion in educational technologies (Becker et al., 2018). With considerable investment in educational technology, it is expected that educational technology use in institutions by faculty should bring about corresponding improvement in teaching.

According to Falade and Aladesusi (2020), educational technology has been used to support traditional forms of teaching in higher institutions for a very long time. It is observed that lecture halls and seminar rooms are furnished with projectors and computers connected to the internet. Educational technology supports presentations and distribution of lectures notes and reading materials electronically for easy access by students. According to Bates and Sangra (2011), educational technology is mainly used to support existing pedagogical practices but has not necessarily transformed them.

Educational technologies can shape, support, personalise and encourage participation and make teaching more inclusive and flexible. Nkansah et al. (2020) assert that educational technologies use impact teaching at the micro-level, enhance better understanding of the concept, improve the delivery of instruction, and ensure broader dissemination. Higher institutions nowadays take advantage of educational technologies to facilitate time, place, access, reduce cost and enhance quality. According to Rudhumbu et al. (2021), educational technology has transformed teaching and that no field of human endeavour stays immune to it.

It is debated that educational technology use plays a vital part in enhancing the quality of teaching. For example, a person is exposed to many reading and learning materials worldwide using the internet. Additionally, the use of email assists timely and independent teacher-students communication. By incorporating educational technology in the teaching process, the gap between industry and higher institutions is closed, and learners are at an advantage to familiarize themselves with one of the vital tools used globally for work (Northey et al., 2018; Sun et al., 2018).

Another relevance for using educational technology in the teaching process is its flexibility and cost reduction probability. Supporters of this claim hold the view that educational technology supports disseminated teaching for the achievement of instructional goals. In addition, using educational technology in the instructional process saves travel time and some operational costs for the facilitator (Anderson & Rivera-Vargas, 2020).

Gilbert et al. (2020) indicate that the cost-reduction characteristic requires organizational and process restructuring. Educational technology can enhance teaching through a reorganization of the teaching process that relies on the development of technology infrastructure. Nevertheless, using educational technology for teaching in universities is rapidly increasing, putting pressure on higher institutions to restructure their activities to optimize technology in teaching.

The traditional face-to-face teaching model is viewed as not meeting the problems associated with learning in a technology-driven age. The learner is thus passive, limiting their ability to explore and collaborate (Anderson, Barham & Northcote 2013). The introduction of educational technology into the instructional delivery process brings a paradigm shift indicating the end of the instructors being assumed as the sole repository of knowledge, especially with a vast amount of information on the internet. This ends the days when teachers saw themselves as knowledge oracles and sage, which were to deliver information to learners who were considered as tabula rasa (Cabaleiro-Cerviño & Vera, 2020).

The advantages derived from using educational technologies for teaching have been praised by Buabeng-Andoh (2012), who emphasizes the distinctive capabilities of educational technologies in making teaching more accurate, interactive, effective, efficient, and easy to spread information. According to Turugare and Rudhumbu (2020), educational technology is a critical tool in delivering instructions in this information age. They indicate that technology offers various opportunities for supporting quality delivery of instructions, providing high-quality learning resources, increasing teacher's self-efficacy and enhancing instructors' professional development. According to Shen and Ho (2020), the integration of educational technology in teaching provides an inclusive teaching avenue that promotes collaboration and removes passivity.

Correspondingly, Gilbert et al. (2020) asserts that using educational technology in teaching is vital and guarantees unlimited access to crucial information and practical tools that cater to individual differences. The effective use of educational technology in teaching embraces all human interactive competencies used by the facilitator to promote learning, leading to enhanced teacher performance. Instructors can employ and apply a repertoire of teaching methods to effectively interact with students and support their engagement for better outcomes.

In Ghana, The Technical University Act 2016, Act 922 mandates technical universities to equip students with the requisite technical competencies to fill the skill gap in the industry (Technical University Act, 2016). The technical universities are required to incorporate technologies into teaching to provide competency-based training and practical skills to students so that they will be well-equipped for job placement in industry, self-employment, and socio-

economic development of the nation (Technical University Act 2016, Act 922).

However, the technical universities, to some extent, have been unable to fulfill this mandate. Hence, the skill gap between industry and universities keep widening. According to Collet et al. (2015), Jackson and Chapman (2012), Raza and Naqvi (2011), and Boden and Nedeva (2010), the existing skill gap between universities and industry is not a mere acquisition of theoretical concepts but the lack of technical skills in manipulating and working with new technologies in the industry. The use of educational technologies in teaching is identified to bridge the gap in skills between industry and graduates from technical universities. It therefore, becomes necessary to assess the integration of educational technologies in teaching in technical universities in Ghana. This study focuses on assessing educational technology integration at Koforidua Technical University (KTU) and Takoradi Technical University (TTU).

1.2 Problem Statement

Recent developments in the Ghanaian education system appear to suggest that technical and vocational learning at the higher education level has received a major boost. For instance, almost all polytechnics have been upgraded to technical universities, with a view to raising the quality of instructional delivery, and to training highly skilled manpower for the country's industries. The upgrading has a legal backing as enshrined in the Technical University Act 2016; Act 922 amended in 2018. Among other things, the Act requires the Technical Universities to incorporate technological tools into teaching and learning to provide competency-based training and practical skills to students aimed at making them well-equipped for self-employment, and for job

placement in the industry to accelerate socio-economic development of the nation (Asabere et al., 2017).

Extant literature suggests that a lot of research (e.g., Buaben-Andoh, 2012; Sarfo et al., 2017) has been done into the use of technological tools in instructional delivery at the Ghanaian basic and second cycle levels but the same cannot be said to happen at the tertiary level especially in technical universities (Asabere et al., 2017). This situation has created a dearth of information about how technology-mediated teaching and learning can be measured in those institutions, and the extent the use of technology can be integrated in teaching at that level. I considered this to be an apparent gap in the Ghanaian literature on higher education, and the effort in the current research is to fill the knowledge vacuum.

1.3 Purpose of the Study

The purpose of the study was to assess educational technology integration in teaching in Ghanaian technical universities.

1.4 Research Objectives

The specific objectives of the study were to:

1. determine educational technology devices most frequently integrated into teaching in technical universities in Ghana.
2. assess the factors that affect educational technology integration into teaching in technical universities in Ghana.
3. analyse the extent of educational technology integration between male and female faculty members in technical universities in Ghana.

4. measure the relationship between educational technology integration and enhanced teaching in technical universities in Ghana.
5. explore faculty experiences in educational technology integration in teaching in technical universities in Ghana.

1.5 Research Questions

1. What are the most frequently used educational technology devices for teaching in technical universities in Ghana?
2. What are the factors that affect educational technology use for teaching in technical universities in Ghana?
3. What are the differences in educational technology integration between male and female faculty members in technical universities in Ghana?
4. What is the relationship between educational technology integration and enhanced teaching in technical universities in Ghana?
5. What are the experiences of faculty members in educational technology integration in technical universities in Ghana?

1.6 Hypothesis

1. H_0: There is no statistically significant difference in the frequency of use of educational technology between male and female faculty members.

   H_a: There is a statistically significant difference in the frequency of use of educational technology between male and female faculty members.
2. H_0: There is no statistically significant relationship between the use of educational technology and enhanced teaching.

H_a: There is a statistically significant relationship between the use of educational technology and enhanced teaching.

1.7 Significance of the Study

It is important to note that educational technology use abound in all institutions of higher learning in our contemporary society. This paves the way to evaluate their integration in teaching in Ghanaian technical institutions from the faculty perspective. Therefore, it is anticipated that the literature gap on assessing educational technology integration in teaching in technical universities and other higher institutions in Ghana is filled. It is also hoped that the study's findings will help the management of institutions of higher learning appreciate, understand, and identify the necessary strategies to enhance the integration of educational technology in their institutions. The study will also create awareness on the need to use educational technology for teaching in technical universities.

1.8 Scope of the Study

The study focused on assessing the integration of educational technology in teaching at Koforidua Technical University (KTU) and Takoradi Technical University (TTU). The study was restricted to ascertaining educational technology integrated into these two institutions, the extent of integration, the factors that influence the integration, the relationship between educational technology integration and teaching outcomes, and the experiences of faculty on educational technology integration in teaching.

1.9 Organisation of the Study

The study was organised into six (6) chapters. Chapter One focused on the background, research problem, the purpose of the study, research objectives, questions, and hypothesis. The significance of the study, the scope, and the organisation of the study were captured in the chapter. Chapter Two discussed relevant literature associated with the study, theoretical Models, empirical literature, and the conceptual model for the study. In Chapter Three, the methodology of the study was spelled out centering on the study areas and justifications for the sites, the philosophy underpinning the study, the approach, research design, population, sampling techniques and the sample, inclusion and exclusion criteria, instruments, validity and reliability, data analysis, and ethical consideration. Chapter Four presented results of the study, while Chapter Five presented the discussion of the results. Finally, Chapter Six provided the summary, findings, conclusion, recommendations, implication of the study, suggestions for further studies and contributions to knowledge.

1.10 Summary

The chapter introduced the background to the research work by expounding on the relevance of educational technology in the context of teaching in institutions of higher learning. It stressed the need for faculty of higher institutions to deploy educational technologies to enhance and transform pedagogy. Similarly, it highlighted the fact that other researchers have testified on the use of educational technologies in teaching in other settings. Notwithstanding, very limited studies have been done in Ghana to assess the integration of educational technology for instructional delivery in technical

universities. This has left a dearth of the literature of educational technology usage in Ghanaian technical university setting, which this study sought to fill. It is expected that the gap in the literature about the phenomenon would be closed and the findings would also inform policy decision makers to determine mechanism for assessing educational technology integration into teaching. The next chapter introduces the theories that underpinned the study, empirical literature and conceptual model for the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter has three sections. The first section presents the definitions of concepts related to the use of technology in education. The second section focuses on the theory, and the models guiding the study. These are the Diffusion of Innovations Theory (Rogers, 1995; 2003), Technology, Pedagogy and Content Knowledge (TPACK) Model by (Harris et al., 2009), the Substitution, Argumentation, Modification and Redefinition (SAMR) Model by (Puentedura, 2006) and a conceptual model for the study. The third section concentrates on a review of related literature based on four main themes: (1) frequently integrated educational technologies, (2) factors affecting educational technology integration, (3) gender differences in the integration of educational technologies, and (4) the relationship between educational technology and teaching enhancement.

2.1 Operational Definition of Concepts

Educational technology: Popularly referred to as Edutech, is a broad field of study. Given the varied definitions of educational technology, this study adopts the definition given by the Lazar (2015) and Becker et al. (2018), which explains educational technology as using technological tool/devices to enhance instructional delivery.

Technology integration: The study employs Cartwright and Hammond's (2003) definition of technology integration as the continuous use of

technological devices to enhance teaching throughout an instructional programme.

Assessment in education: Various definitions have been found in the literature regarding the definition of assessment in education. Tyler (1950) defines assessment as a process of determining the extent to which educational objectives are achieved. This study explained assessment as the process of critically assessing the extent of integration of educational technology in teaching (Patton, 1987).

2.2 Theoretical Perspectives

This study is guided by four theories/models. These are the Diffusion of Innovation Theory, the Technological, Pedagogical Content Knowledge Model the Substitution, Argumentation, Modification and Redefinition Model.

2.2.1 Diffusion of Innovation Theory (DIT)

The Diffusion of Innovation Theory (DIT) stresses the spread of innovation or technology within a particular social system (Biljana & Dragana, 2017; Hoerup, 2001; Lawrence & Tar, 2018; Rogers, 2003). The theory explains how a new technology becomes known and spread within a society through communication (Scott & McGuire, 2017; Miller, 2015; Rogers, 1995). The relevance of the DIT theory is that people, as part of their way of life, tend to have a new way of doing things and over some time, they move away from their old ways to a new way of conducting their affairs with the aim to enhancing their outcomes (Kopcha et al., 2016; Kunnari & Ilomäki, 2016).

According to Rogers (1995), innovation is an idea that is conceived as new for individuals to adopt. Innovation could also be regarded as something concrete,

e.g., new technology and not necessarily an abstract idea (Zhang et al., 2015). The concept 'adoption' emphasizes a person's decision to either accept or refuse to use a particular technology (Rogers, 2003). In other Models, adoption emphasizes the acceptance or rejection of technology and looks at the extent to which a particular technology or innovation is integrated into a specific context (Dibra, 2015). The rate at which an individual or group adopts a technology based on the adoption concept is in parts or pieces but not in whole (Benhabib et al., 2017).

Rogers (2003) is critical to providing a detailed structure for understanding how individuals adopt a particular technology. The theory has influenced many other theories of diffusion and adoption (Boyne et al., 2005; Venkatesh et al., 2016). Besides, Rogers' (1995) diffusion theory has provided a broad basis for understanding the variables that influence people's choice to employ a particular technology or innovation.

Figure 2.2: Technology Adoption Stages
Source: Rogers, E. M. (1995). Diffusion of innovations.

It must be noted that the adoption process cannot be separated from the diffusion process (Rogers, 2003). An individual's decision to adopt a

technology goes through a five-stage level of assessment (Rogers, 1995). The first stage is becoming aware of innovation or technology. This stage is influenced by personal characteristics, social and economic factors, and access to mass media which influences change (Wood & Swait, 2002). The second stage, which is regarded as the persuasion stage, is where a person gets access to knowledge about an innovation that influences him or her to make a personal judgment (Bennett & Bennett, 2003). The consequence of this could be satisfactory or unsatisfactory to the individual. Stage three of the adoption process concerns the outcome of the decision upon which an individual makes judgment either to accept or reject the innovation (Rogers, 2010). The fourth stage concerns implementing the decision, while in the last stage, the individual confirms the decision. This is where an individual reflects and re-assesses his or her decision to continue or end adopting the technology (Braak, 2001).

Rogers' (1995) innovation-decision activities vividly define a Model about how people choose to accept or reject a particular technology. It is asserted that the four key ingredients of the theory concern the innovation, the process it is communicated, the context of the social system, and time. The four key components interrelate to describe how a person's adoption represents diffusion. Beyond these components, Casmar (2001) identified five critical characteristics of adoption decisions. These include the relative merits associated with the adoption of the technology (relative advantage), the complex nature of the technology (complexity), ability to access and try the technology (triability), the availability and visibility of the technology (observability), and compatibility (Surendra, 2001).

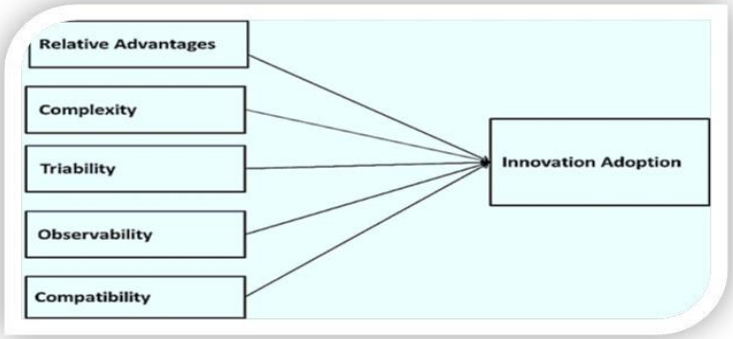

Figure 2.3: Adoption decisions

Source: Rogers, E. M. (1995). Diffusion of innovations.

Adoption refers to the full utilisation of the innovation, whereas rejection concerns the decision not to use the innovation. Adopters are grouped as innovators, early adopters, early majority, late majority, and laggards. Rogers (1995) emphasised that in every adopter category, persons are comparable in terms of innovativeness. Rogers (2003), again, explained innovation as the extent to which a person or a group adopts an innovation compared to others in the social system.

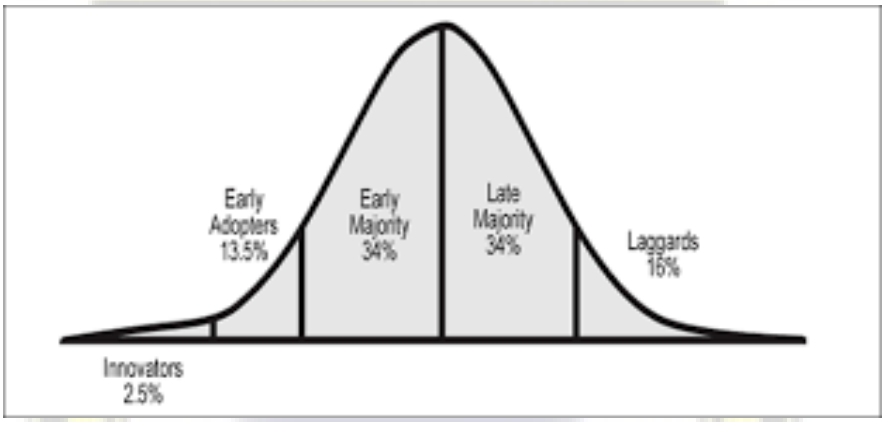

Figure 2.4: Adopters

Source: Adopted from Rogers, E. M. (1995). Diffusion of innovations.

Adopters are of different categories within a population in the social system who have different views about innovation. Rogers (2003) broadly classified adopters into two groups, namely, earlier and later adopters. For Rogers (1995), earlier adopters are the innovators, early adopters, and early majority, while the late adopters are the late majority and the laggards. The difference between the early adopters and late adopters, according to Scott and McGuire (2017), are their respective personal factors, communication behaviours, social and economic status. The innovators/gatekeepers are individuals who are ready and willing to experience innovation. They are the people who bring innovation from outside to the social system. Rogers (1995) and Zhang et al. (2015) argued that early adopters are likely to hold leadership positions, have good interpersonal relationship skills and networks, and perhaps serve as role models. Therefore, people perceive their attitude towards innovation as very essential. The influence of early adopters in the social system reduces doubts and fears about an innovation diffusion process (Scott & McGuire, 2017). Early adopter's approval of an innovation convinces people to adopt the technology or innovation.

The early majority are individuals with good interactive skills within the social systems; however, they do not have the leadership responsibility like early adopters. They influence the diffusion innovation process with their interpersonal skills. They deliberately adopt innovation or technology but are neither the first nor last to adopt it (Rogers, 2003).

The late majority is the category of persons in the social system who adopt an innovation after their colleagues have already adopted it. The laggards are more skeptical about innovations than the late majority (Hariri & Roberts,

2015). They are the class of people who ensure innovation works before they adopt it. Laggards take a very long time to adopt an innovation (Benhabib et al., 2017).

Despite the many uses of the DIT theory, determining the breadth and depth of the theory makes it difficult to situate it in a single study within the Model's structure (Kee, 2017). The theory does not explain how the adoption of an innovation is facilitated but rather how it occurs (Markard et al., 2015).

The use of the DIT theory in this study helps unearth personal and institutional factors that influence educational technology integration in teaching. It also helps assess how educational technology is integrated into the teaching process and assists in determining the type of educational technology integrated into teaching. The DIT theory aids the study to assess the factors that enable faculty members in Ghanaian technical universities to either adopt or reject educational technology for instructional delivery. The next theoretical Model is the Technological Pedagogical Content Knowledge.

2.2.2 The Technological Pedagogical Content Knowledge (TPACK) Model

The Technological Pedagogical Content Knowledge (TPACK) Model, as depicted in figure 2.5, seeks to incorporate technology into teaching (Benson et al., 2015). It aims to imbibe in educators three kinds of knowledge: knowledge about technology, content knowledge, and pedagogical knowledge as an integrated form of knowledge simultaneously applied to teaching (Hilton 2016; Jimoyiannis, 2015). The goal of the model is to make educators understand that these three forms of knowledge intersect and, therefore, are

critical to combine them to ensure effective delivery of lessons (Koehler et al., 2014; Mishra & Koehler, 2006).

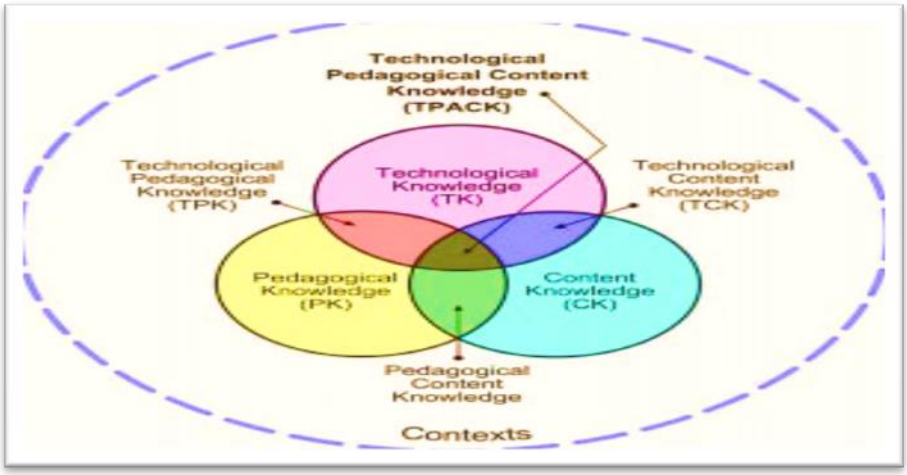

Figure 2.5: Technological Pedagogical Content Knowledge
Source: Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A Model for integrating technology in teachers' knowledge. Teachers College Record, 108 (6), 1017–1054

The TPACK Model, according to Koehler and Mishra (2009), is a theory for integrating technology into the instructional process. This is a procreative theory intended purposively to guide the design and assessment of instructors to plan and incorporate technology in the teaching process (Chai et al., 2011). The TPACK theory provides the basis for integrating the facilitator's technological knowledge into applying principles, theories, and teaching methods in the design of course contents. It brings about an interplay of these three kinds of knowledge rather than seeing them in isolation (Herring et al., 2016).

Content Knowledge (CK) concerns the body of information the instructor has in a particular subject area (Kleickmann et al., 2013), while Pedagogical

Content Knowledge (PCK) refers to the instructor's ability to adapt the contents of the information meant to be taught to the diverse abilities of the students (Ball et al., 2008).

Chai et al. (2011) refers to Technological Knowledge (TK) as the instructor's knowledge in technology, while Technological Content Knowledge (TCK) concerns the ability of the instructor to appropriately use technology to develop and design content of courses. Kleickmann et al. (2013) indicated that Pedagogical Knowledge refers to the knowledge that the instructor possesses in teaching methods, while Technological Pedagogical Knowledge (TPK) implies the instructors' ability to apply technology in lesson delivery to facilitate the instructional process.

Chai et al. (2011) indicated that the TPACK theory is a multiplicative theory that keeps course designers informed in preparing and assessing courses to bring about effective interaction between students and instructors. The deployment of TPACK Model in assessing educational technology integration in teaching will enable the study to explore instructor's technological pedagogical practices and experiences during instructional design, implementation, and assessment processes (Koh et al., 2015). It will also guide in developing a questionnaire and interview guide in ascertaining the extent to which instructors employ technology for teaching. Abbitt (2011) also revealed that instructors TK and CK influence TPACK positively. Benson and Ward (2013) found that PK and TK positively affect Technological Pedagogical Knowledge, which indicates that Technological Pedagogical Knowledge positively influences TPACK.

The Technological Content Knowledge (TCK) emphasises knowing the appropriate time or period to apply specific strategies to direct educational technology to guide course delivery effectively (Ronau et al., 2012). It is noteworthy that the TPACK concepts, namely TK, PK, CK, TPK, TCK, and PCK, form the fundamental idea to explore instructor's integration of educational technology to fine-tune teaching to improve areas in the instructional process that has some challenges (Niess, 2011).

According to Roblyer et al. (2010), the TPACK Model allows instructors to critically assess and address challenges related to technology integration in teaching. However, Brantley-Dias and Ertmer (2013) emphasised that the TPACK Model alone is limited in promoting the pedagogical approach needed. Besides, the fundamental flaw of the TPACK Model is about just adding technology to teaching, which would not necessarily promote effective teaching if a facilitator has not appropriately acquainted himself or herself with the technology and has not duly planned or tested that technology (Pamuk et al., 2015).

Furthermore, it is argued that the TPACK Model is not a theory that can be verified empirically. Besides, there are no defined dependent and independent variables since all the elements are equal (Voogt et al., 2016). The TPACK Model does not empower teachers in educational technology use. The focus is mainly on the instructor's use of technology (Rosenberg & Koehler, 2015). The next theory is the Substitution, Argumentation, Modification and Redefinition theory.

2.2.3. The Substitution, Augmentation, Modification, and Redefinition (SAMR) Model

The Substitution, Augmentation, Modification, and Redefinition Model (SAMR) is a four-stage level model (see Figure 2.6) for applying and assessing technology into teaching (Puentedura, 2006). The first two levels of the model (the substitution and argumentation) are meant to enhance technology for teaching, while the last two levels (modification and redefinition) transform teaching. The model describes teacher's integration of technology for teaching in the classroom (Kimmons & Hall, 2016). It encourages instructors to strive to move up the ladder to higher levels to ensure full utilisation of technology for teaching (Gitonga et al, 2016).

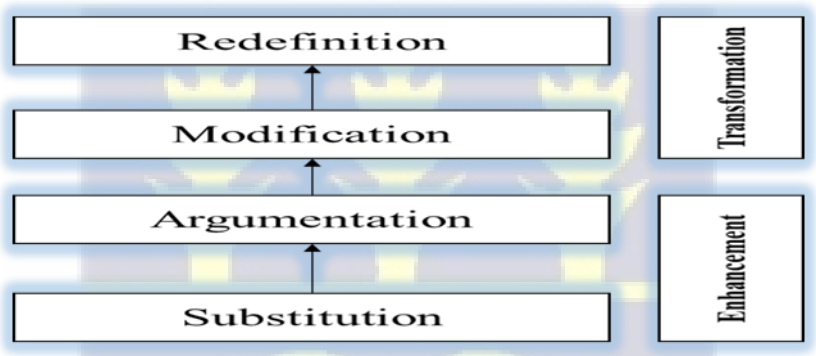

Figure 2.6: SAMR Model

Source: Puentedura, R. U. B. E. N. (2006). Transformation. Technology and Education.

The SAMR model aims to integrate technology by redefining how the instructional process must be undertaken using emerging technology to perform activities that could never have been accomplished without technology (Puentedura, 2012). The main advantage that the SAMR model has on teaching is that it serves as a guide when moving from substituting a

process to redefining tasks while taking advantage of the opportunities that technology offers to enhance and transform teaching (Kriek, 2016; Puentedura, 2012). Another benefit of this model is that it directs the instructors to reason differently when performing an activity in a technology-enabled environment. The Model also provides a technique to enable instructors to see how technology influences instructional delivery (Tucker, 2013).

As pointed out in the SAMR model, the concepts of Substitution and Augmentation signify the integration of technology to enhance the instructional process, whereas the Modification and Redefinition variables lead to transforming teaching (Hudson, 2014). The advantage of using the SAMR model is that it helps in analysing the relationship between the integration of educational technology and enhanced teaching. (Pfaffe, 2017). Another strength associated with using the SAMR model is that it is easy to go by the steps in the model, which provide an excellent example of how to facilitate the integration of technology into teaching. Besides, teachers can decide to select any level they prefer for integration in their teaching (Tsybulsky & Levin, 2016).

Despite the usefulness of the SAMR model as a tool for integrating technology in teaching and for determining the outcome of technology integration and enhanced teaching, it lacks theoretical explanation in the peer-reviewed literature (Kihoza et al, 2016; Savignano, 2017). Consequently, educators using the SAMR model to integrate technology into teaching interpret and represent the model in diverse ways to suit them. In this study, the DIT theory will enable the study to determine the existing and new educational

technologies available for integration into teaching and the factors that influence lecturers to adopt a particular technology for teaching. The TPACK theory will guide the study to assess the extent lecturers integrate technology in designing their lessons and teaching.

The SAMR model becomes the outcome of the integration of educational technology and enhanced teaching. In this study, the SAMR model will serve as the basis for analysing the relationship between educational technology integration and enhanced teaching.

Conceptual Model for Assessing Edtech Integrating in Teaching

The conceptual model was developed from theories and empirical evidence and is linked to the research problem and objectives of the study. The model has four distinct but related parts. The first part of the model looks at the educational technology devices; the second part shows the various factors that affect the educational technology integration in teaching. The third part, the integration stage, relates to the extent of the use of educational technology devices in teaching, while the final part concerns the relationship between educational technology integration and enhanced teaching. Figure 2.8 gives a pictorial representation of the variables.

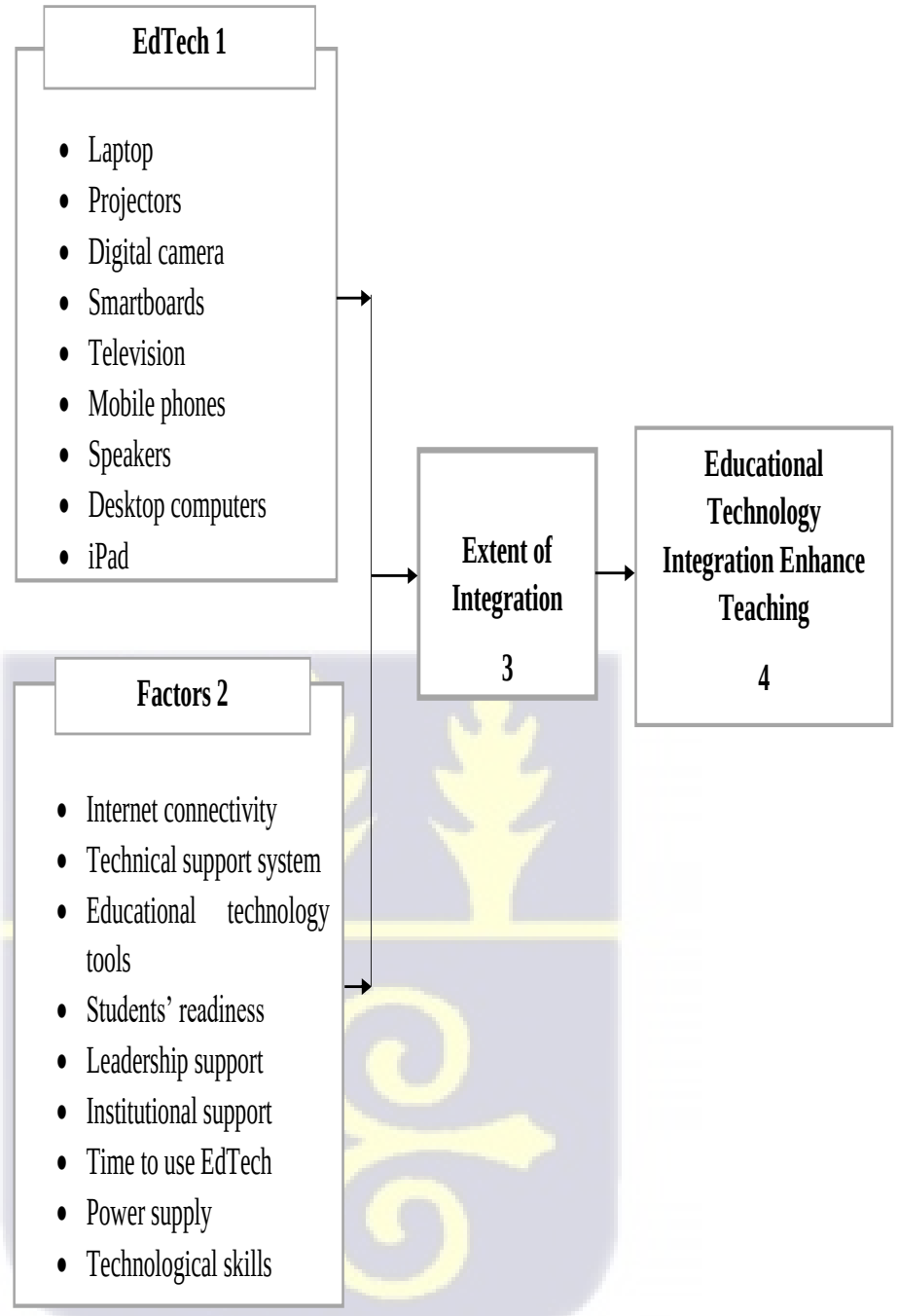

Figure 2.8: Conceptual Model for Assessing EdTech Integration in Teaching Author's Construct (2020)

Educational technology devices used in this study's conceptual model include laptops, mobile phones, projectors, digital cameras, smartboards, desktop

computers, speakers, iPad and television. These technological devices make the teachers resourceful and enable them to use a variety of the devices to enhance teaching in the classroom (Amory, 2014; Shelton, 2017; Kumar & Daniel, 2016).

The first stage is linked to the Diffusion of Innovation Theory and the research question one that seeks to determine the various educational technology devices frequently integrated into teaching. Roger (2003) asserts that technology integration is influenced by certain vital variables (adoption elements), namely; relative advantages, the complexity, ability to try the use of a given technology, the ability to observe the technology being used and the compatibility of the technology, would make an instructor to either integrate and or not to integrate a given technology in teaching. The determination of the frequency of use of a given technology is influenced by these adoption elements (Markard et al., 2015; Scalise, 2018).

The second part of the conceptual model looks at the factors that affect educational technology integration in teaching. Inadequate educational technology devices, inconsistent internet connectivity, power outages, lack of technical support systems, students' readiness, leadership and institutional support, lack of technological skills and inadequate time to plan and integrate educational technology tools in teaching are factors that hinder faculty members to integrate EdTech in teaching (Sahay & Dawson, 2019; Turugare & Rudhumbu, 2020). According to the model, all these factors affect the extent of the integration of EdTech in teaching. This part of the model is also influenced by the Diffusion of Innovation Theory which indicates that several

factors may affect an individual's decision to integrate educational technology into teaching (Rogers, 2003).

Part three, the extent of educational technology integration, is influenced by the type of EdTech being integrated and the factors that affect the integration, as indicated in the first two parts of the conceptual model. It shows that the extent of the use of educational technology would result in enhanced teaching. The extent of educational technology integration is influenced by the TPACK framework Mischra and Koehler (2006), which shows the technological knowledge of the instructor and how it is combined with the content knowledge and pedagogical knowledge in the instructional process to enhance teaching. The final part of the model looks at the relationship between educational technology integration and teaching. The extent faculty members use educational technology deveices either to substitute, augment, modify or redefine teaching, as indicated in the SAMR framework (Puentedura, 2006) influence the connection betweeen Edtech and teaching.

In this study, the Diffusion of Innovation Theory helped to find the educational technology devices used by faculty members in teaching and, at the same time, helped find out the factors that affect educational technology integration in teaching. The Technology, Pedagogy and Content Knowledge Model enabled the study to analyse the extent faculty members use educational technology in teaching. At the same time, the Substitution, Augmentation, Modification, and Redefinition Model (SAMR) supported measuring the relationship between educational technology and enhanced teaching.

2. 3 Empirical Literature

2.3.1 Educational Technology

Educational technology, usually called EdTech, concerns using hardware, software, and educational theories to enhance teaching (Anderson & Vargas, 2020). Educational technology is based on knowledge from different disciplines, including but not limited to sociology, computer science, education, communication, artificial intelligence and psychology. EdTech utilises and manages educational resources and technological processes to enhance teaching and learning (Baydas et al., 2015). The field usually seeks to bring together and use instructors, students and technical processes effectively and efficiently (Hew et al., 2019). The three main domains of educational technology are Edtech as a tutor, Edtech as a teaching tool, and Edtech as a learning tool. It also includes using mobile technologies for computer-based training, online teaching and learning (Ipek & Ziatdinov, 2018; Januszewski & Molenda, 2013). The meaning of Edtech has evolved over the years. The Association for Educational Communications and Technology (AECT) defines educational technology as the study and ethical practices that improve teaching and learning by designing and utilising the right technological tools and processes (Richey et al., 2008).

Lakhana (2014) defines Edtech as an organised process for applying new technologies to enhance the quality of teaching and learning. The concept is also defined as the systematic means of executing and evaluating educational activities, which comprise instructional resources, techniques and their relationship during the instructional period. Due to the diversity in the concept of the term, many authors define it based on their needs. Edtech is not used

sufficiently partly due to a lack of technological devices and inadequate technical skills of instructors for implementation (Januszewski & Molenda, 2013).

Educational technology describes teaching and learning hardware and software used in instructional activities (Johnson et al., 2016). The main goal of the use of EdTech is to boost the teaching and learning environment, enhance teaching and improve students learning outcomes. According to Jones (2019), using educational technology devices such as laptop computers, smartphones, and projectors bring about collaboration between educators and learners and enable educators to create digital quizzes and assessments and get results related to teaching.

Over the years, many researchers have tried to find answers to the merits and demerits associated with traditional and modern teaching powered by educational technology. Authors such as Puentedura (2012) emphasised that educational technology provides the instructors with an array of resources to substitute, modify, augment and redefine instructional activities. Besides, interactive content of educational technology, e.g., interactive multimedia content, gives better opportunities and provides a great advantage to modern teaching compared to traditional teaching (Spector et al., 2014).

The growing demand for educational technology devices makes it a critical issue of concern in institutions of higher learning. While Lazar (2015) agrees that EdTech is helpful under certain circumstances, some researchers (e.g., Gruba & Chau (2019; Rumanyika & Galan, 2015) are unable to build consensus on the type of educational technology that is worth investing in and

the context. Based on design and implementation, EdTech may alleviate the prevailing inequalities in access to education.

It must be noted that educational technology is not limited to computer use; instead, it comprises other digital tools and applications such as the digital camera, projectors, videoconferencing, digital television, digital cameras and whiteboard, among others (Sanders & George (2017). Many researchers agree that there is no right technology or one way of using a particular technology, but the educational technology used should match the instructional goals and be suitable for instructors and students who use them (Selwyn, 2013).

2.3.2 Issues in Assessing Educational Technology in Teaching

Technology integration assessment in teaching encompasses a broad range of issues, and this is usually underestimated when investigations in educational technology integration in teaching are undertaken (Lai & Bower, 2020; Choi, 2018). Among the factors that are critical to assessing educational technology integration in teaching are; the setting in which the teaching occurs, the nature/type of technologies integrated, personal and institutional characteristics (Mwanda et al. 2017), the expected teaching outcomes, the status of technology integration, access to technology, training facilities, methods of teaching among others (Newby et al., 2011). Attention should be paid to these factors to ensure that educational technology integration in teaching brings about the desirable outcomes expected (Adedokun-Shittu & Shittu, 2014).

In Aksal's (2011) perspective, assessing educational technology integration in teaching requires a critical examination of the personal characteristics of

educators. Kankaanranta et al. (2005) stated that reference should be made to instructor's perspectives on the integration, their experiences with technology, and their proficiencies in using technology, self-efficacy, the motivation to integrate technology and the challenges associated with the use of educational technology. Davies (2011) indicated that these personal indicators would, to some extent, justify the returns on investing in educational technology for teaching.

Strecker (2018) reported that assessing educational technology integration helps identify the positive effects of technological tools on teaching and its impact on enhancing pedagogy. Adedokun-Shittu and Shittu (2011) emphasised that in ascertaining the positive impact of educational technology integration in teaching, careful consideration must be given to the processes of implementing educational technology in the instructional delivery

Another vital criterion to look at while assessing the integration of educational technology in teaching is the nature and type of technology to be integrated. Beyond the nature of technology, some institutional factors such as staff motivation, policies, leadership commitment, infrastructure, and resources would have to be looked at to effectively assess the effects of technology integration in teaching (Alemdag et al., 2019; Comiskey, 2018). According to Adedokun-Shittu and Shittu (2011), the motivators that would ensure effective integration of educational technology in teaching by faculty include training in technology usage and the availability of educational technological tools/devices. Likewise, Bobbitt (2018) reiterated the need for developmental training for technological reforms in schools. Hall (2018) indicated that continuous technology integration training and mentoring in institutions are

fundamental for successfully integrating and assessing educational technology in teaching in higher institutions.

Gruba and Chau (2019) pointed out that to effectively assess the integration of educational technology into teaching; there is the need to consider the challenges instructors encounter in their quest to integrate educational technology into teaching. In this study, the benchmarks upon which educational technology integration into teaching are based are on the nature/type of technology, instructors' characteristics in integrating educational technology into teaching, the extent of educational technology integration, and enhancement in teaching.

2.3.3 Educational Technology Integrated into Teaching

Over the years, educational technologies have provided instructors varieties and choices for teaching practices (Lee et al., 2013; Mulyati, 2019; Onwuagboke et al., 2015). Besides, the internet and its related search engines and websites have undoubtedly become indispensable in teaching (Oh & Russell, 2004). Additionally, educational technological tools, e.g., web 2.0 technologies, contribute significantly to improving instructor-students' interactions, collaborations, and information sharing (Nawaz & Kundi, 2010).

The effective integration of educational technology into instructional practices relies on recognising pedagogical goals and subsequently deciding and planning to include technology in teaching (Laurillard, 2013; Scalise, 2018). It must be admitted that developing and putting into effect a strategy to integrate technology in the teaching process is a complex activity (Roblyer & Doering, 2012). It is, therefore, an essential exercise for instructors to assess

instructional process that would require technology integration and organise the appropriate technological resources that would be needed for successful integration (Sahay & Dawson, 2019; Turugare & Rudhumbu, 2020) and instructional practices must be linked to the institutional vision, mission, core values, and its strategy.

The success of any technology integration in the instructional process hinges on clearly identifying pedagogical goals and making the decisions and plans to apply technology as a substitute, to augment, to modify and redefine how teaching should be done (Abaidoo & Arkorful, 2014; Ross et al., 2010; Tondeur et al., 2019). Developing and effecting a strategic plan that incorporates educational technology in the instructional process is complex and somehow difficult (Tsai & Chai, 2012). Instructors, therefore, must pinpoint learning requirements, decide on strategies, and assess areas in the contents that would require educational technology integration for effective delivery.

Wetzel et al. (2014) and Newby et al. (2011) recommended that ensuring effective educational technology integration in the instructional process requires considering the environment in which the instructional activities take place, the technical skills of instructors, their attitude towards technology integration, access to infrastructure and training facilities and tools.

Tondeur et al. (2016) pointed out that the essence of educational technology integration in the instructional process is that technology has assumed a pivotal role in enhancing teaching and cannot be ignored. Therefore, it is obvious the 21st-century teacher expects institutions of higher learning to

procure appropriate infrastructure, logistics, and resources for networking (Preston et al., 2010). This condition necessitates instructors of higher educational institutions to become aware and knowledgeable in using educational technology to meet the ever-changing preferences of learners in the information age (Tuckman & Monetti, 2011). Studies by Atsumbe et al. (2012) and Pinkwart and McLaren (2012) revealed that lecturers had access to computers and could access the internet but do not integrate them into the teaching process.

Lin et al. (2017) found that the application of educational technology for teaching positively impacted instructional delivery. It is worth noting that Lin et al. (2017) study was very detailed, and the methodology was consistent with the analysis. Englund et al. (2017) revealed that educational technology use in teaching permits teachers to be flexible and unrestricted to time and space. Arkorful and Abaidoo (2015) provided evidence that using the educational technology for teaching provides a stream of rich network resources that covers rich information that instructors could obtain for their teaching.

Henderson et al. (2017) posits that educational technology for teaching provides independent and self-paced instructional delivery for teachers. It also provides two-way communication between students and instructors (Dudeney & Hockly, 2012). Furthermore, technologies provide digital files where teaching materials could be stored and referred to anytime for effective teaching (Lin et al., 2017). Moreover, Han and Shin (2016) stressed that educational technology used in teaching promotes teachers' ability to apply and integrate information and communications technology and, therefore, enables instructors to operate and break through the restriction of time and

space for thorough and successful instructional delivery (Wetzel et al., 2014). Alassaf's (2014) study in Jordanian University also found educational technology integration in teaching is beneficial as it saves time and effort of lecturers and helps them gain new knowledge and skills in teaching.

Makewa et al. (2014) emphasised that technology is critical in combating the digital divide in the 21st century. It also provides opportunity and a paradigm shift from a teacher-focused form of teaching to student-centred learning, where the teacher's role is to guide and facilitate learning instead of being considered the only source of knowledge (Alonso et al., 2019; Gilbert et al., 2020). In a like manner, Tuckman and Monetti's (2011) pointed out that the use of computer-mediated class activities resulted significantly in better results than the usual traditional-based techniques for instructional delivery. Furthermore, Sharma et al. (2011) concludes that the integration of educational technology in teaching enhances the capacities of instructors to create live interactions and contact between learners through electronic mails, internet, and e learning. Ishikaku and Joy (2012) indicate that the indispensable role of educational technology in teaching propels educators to build a nation for development through knowledge transfer.

Ismail et al. (2011) study in Malaysia found a strong positive correlation (r=.81) between educational technology integration in lessons and enhanced teaching. It also revealed that the integration of educational technology in teaching had enhanced teacher's delivery skills. Moreover, despite the educator's positive perspectives and orientation towards technology integration in teaching, most instructors do not integrate educational technology into the teaching process (Chen, 2011; Ertmer et al., 2012).

Griffin and Care (2014), and Frota et al. (2013) conclude that integrating educational technology into teaching is inevitable; therefore, institutions of higher learning must necessarily strengthen their systems and infrastructure to broaden technology integration in teaching in the future. Toro and Joshi (2012) also suggest that regardless of the technology resources that higher institutions might have, if educators are not technologically literate to use educational technology every effort to integrate technology in teaching will be fruitless.

Mulyati (2019) indicated that the teaching process is an active process and a reflective activity. It is argued that the practical experiences and exchange of information, ideas, and collective reflection generate an insightful understanding of entirely new knowledge (Scherer & Cator, 2011). It is recommended that the application of most technologies validate the fact that technology-based simulation for teaching and research have an immense advantage of enhancing teaching outcomes (Mehra & Mital, 2007).

In Ng'ambi et al's. (2016) perspective, technology undeniably, positively affects teaching in higher institutions. Oliver (2011) argued that the integration of educational technology in the instructional practice has the likelihood of accelerating, enriching, and deepening students' skills and enable learners to relate school experiences to work practices. In addition, technology integration helps to create socio-economic capabilities for tomorrow's labour force, strengthen teaching and support institutions to embrace changes for development in the future (Hall, 2018). Tondeur et al's. (2017) research found that technology integration in teaching invigorates instructors. Ottenbreit-Leftwich et al. (2018) indicated that conditions that necessitate effective

integration of educational technology in teaching include the belief in the effectiveness of technology, the belief that the integration of technology in a given instruction will not cause harm, and finally, the belief that they have absolute control over the technology.

Isabelle et al. (2017) revealed that most lecturers do not take advantage of educational technology to improve the quality of teaching. Liu's (2011) study, which concerned pedagogical practices in institutions, made known that the immense advantages of technology integration in institutions would be achieved when instructors are keen to explore fresh and alter classroom practices through technology integration. In Yeung et al. (2012), it was suggested that educational technology would enhance the teaching environment and prepare young persons for future careers. The flexibility, time, and space saved through the integration of educational technology in teaching activities significantly increase collaboration and reception of information (Alqurashi, 2019).

Hwang et al. (2015) stated that instructors play a critical role in integrating technology in teaching. The integration of technology into teaching prepares students for the current digital era. This is because technology brings about dynamism and makes students proactive in the teaching process (Finger et al., 2013; Umar et al., 2017). Additionally, the integration of technology in the instructional process contributes significantly, especially in pedagogy, leading to effective learning. López-Pérez et al. (2013) and Lei (2010) also revealed that instructors were highly hopeful that if educational technology resources are integrated into the instructional process, it would streamline teaching practices.

Kumar and Daniel's (2016) study found that about 52% of lecturers indicated that integrating educational technology into teaching makes their work easy. Besides, the study found that the deployment of educational technology for teaching helped to effectively manage their time in lecture delivery. About 54% of respondents held that view. Furthermore, 53% of teaching staff pointed out that the incorporation of educational technology in instructional delivery engages their students and enables them to pay attention and sustain their interest during lesson delivery. In contrast, others, representing 49% and 54%, agreed that they feel confident and are most likely to recommend integrating educational technology to other colleagues.

A study on teaching with educational technology in Malaysia revealed that the integration of technology in teaching is more compared to the traditional approach to teaching (Ghavifekr & Rosdy, 2015). Their results indicated that integrating educational technology into the instructional process makes teaching effective. Ghavifekr et al.'s (2014) and Estelami et al.'s (2012) research revealed that the integration of technology in the instructional process enhanced instructor's collaborative skills and helped them develop transversal skills that stimulate problem-solving, self-reliance, capacity to initiate and ability to reflect on teaching experiences.

Educational technology in the instructional process helps in the effective utilisation of digital technologies to retrieve, access, manipulate, store, organise and present information for teaching (Gay et al. 2006), Additionally, Oh and Russeel's (2004) study provided evidence that educational technology provides instructors flexibility during teaching sessions. Yeung et al. (2012) reported that the availability of varied educational technology and the internet

had made the integration of technology in the instructional process indispensable in higher educational institutions. Ideally, educational use in teaching technology contributes significantly to improving instructional delivery outcomes. For example, video conferencing and electronic mails foster collaboration and improve communication by instructors (Gilakjani, 2013; Hung & Yuen, 2010; Kaye & Rumble, 2018; Laffey & Musser, 2006; Lee & McLoughlin, 2011).

Nawaz and Kundi (2010) revealed that integrating technology into teaching transactions was found to transform from the traditional instructor's role as a knowledge giver to a facilitator. Besides, the student's role as a passive recipient of information also changed to an active participant or partner in the learning process (Mehra & Mital, 2007).

In Adedokun-Shittu and Shittu's (2014) investigation on the impact of technology integration in teaching in Nigerian higher institutions with 593 respondents, it was revealed that technology serves as a task enabler, and for collaboration. Bagheri et al. (2013) and Wright et al. (2007) described the educational technology integration in teaching as providing opportunities for instructors to explore different ways to tech better, communicate effectively provide feedback and participate in online deliberations. Correspondingly, Kim et al. (2013) found that faculty collaboration with students is enhanced by technology-mediated communication such as electronic mailing and teleconferencing. However, Kirkwood and Price (2013) reiterated that the positive effects of technology integration would not come as magic if proper considerations are not put in place to ensure effective integration.

Educational technology integration in teaching has not fully materialised. The regression analysis conducted regarding technology integration in teaching resulted in a negative correlation of -.122 (Adedokun-Shittu & Shittu, 2014). This is an indication that the level of educational technology integration at the university is shallow. Also, Adegun's (2007) investigation found that technology integration in teaching in Nigeria education is at the primitive stage and therefore, recommended for policy considerations for effective technology integration in lesson delivery.

Using a Likert scale, Marinakou and Giousmpasoglou (2014) revealed that integrating mobile technology in the instructional process enabled instructors to access information, allow for flexibility and freedom, and permit easy access to online learning materials and contents. Sung et al's. (2016) quantitative meta-analysis study on the effects of integrating mobile devices in teaching with 110 experimental and quasi-experimental journal articles published during 1993-2013 showed a moderate mean effect for the integration of mobile technologies in teaching. As regards the pedagogical role of the integration of mobile technology, Frohberg et al's. (2009) systematic review of 102 projects discovered that most instructors apply mobile technology as a tool content delivery tool to reinforce teaching, motivate and strengthen engagement among students.

Alqurashi (2019) and Allahawiah and Tarawneh (2015) found a statistically significant relationship between familiarity and proficiency of instructors' ability to use educational technologies and integrate them in teaching. Kumar and Daniel's (2016) comparative study on the technology integration into instructional delivery at Fijian established that 36.67% of the studied

population indicated they were knowledgeable and skillful in incorporating educational technologies in teaching. Cifuentes et al. (2011) pointed out that integrating educational technology in teaching enhances students' creativity and inspires them to explore and learn new things independently. Kirkwood and Price (2013) and Kukulska-Hulme (2012) revealed that a substantial number of lecturers integrate educational technologies into teaching.

2.3.4 Educational Technology Frequently Used in Teaching

Shelton (2017) identified that the most frequently applied technology in teaching are projectors, laptops/computers for presentation. According to Farmery (2014), most instructors integrate blogs, wikis, and podcasts in teaching. Amory (2014), Bagheri et al. (2013), Bates and Sangra (2011), and Cheung and Slavin (2012) reported that instructional technologies would modify how learners and instructors collect and gather information and collaborate.

Makewa et al. (2014) conducted a study to find out instructor's competence in integrating educational technology into teaching, using a scale of 1-5. It found that majority of the study teachers disagreed with being knowledgeable in applying online technological tools such as the podcast, wikis, and blogs. Besides, Montrieux et al. (2015), in their qualitative study, reported that mobile tools such as mobile quizzes, blogs, and podcasts were famous for the integration in classroom teaching. However, lecturers tended to be more confident and knowledgeable in using projectors. Makewa et al's. (2014) report correspond with the findings from Shelton (2017) and Farmery (2014), whose investigation revealed that the most predominantly employed hardware educational technology for teaching are the projectors and computers/laptops

for presentation purpose. Also, Rumble and Harry (2018) and Rashid and Elahi (2012) found that technology-related resources such as the internet, E-mobile, and computers permit teaching to be carried out from a distance away from the instructor.

Murray and Olcese (2011) pointed out that lecturers mostly prefer laptops to IPad. Kumar and Daniel (2016) attributed it to the availability of laptops over iPads. Schaffert (2010) reported that most lecturers were proficient in using the laptops for presentations in the classroom. Cao et al. (2013) and Naciri (2020) found that lecturers use mobile phones for social activities. Therefore, they are familiar with their use, which influences their ability to incorporate the mobile phone in teaching. The mobile phone and the laptops are used to download and share educational resources, collaborate, and discuss various concepts (Starcic, 2010).

Daniel's (2016) revealed that most lecturers incorporate YouTube videos to emphasise critical concepts in their presentations. Cao et al. (2013) and Naciri (2020) found that lecturers use mobile phones for social activities. Therefore, they are familiar with their use, which influences their ability to incorporate the mobile phone in teaching. The mobile phone is used to share educational resources, collaborate, and discuss various concepts (Starcic, 2010).

Alqurashi (2019) reported that instructors and students of the 21st-century use varieties of smartphones and mobile tablets to teach and learn new experiences actively. Shelton (2017) indicated that learners access the library catalogue from their respective homes or anywhere, download course materials, make conference calls and discuss unfinished classroom activities, chat, send

messages, watch YouTube videos on concepts learned to enhance and expand their learning experiences. Besides, Bagheri et al. (2013) stated that integrating mobile phones in the instructional process enables learners to record lectures and revise them later after class. Allahawiah and Tarawneh (2015) and Kirkwood and Price (2013), in their respective studies, established that the availability of technological tools in the institutions for teaching had a significant impact on the lecturer's willingness to incorporate technology in the instructional process.

Fleischer's (2012) narrative research review on 18 empirical studies on the application of laptops into teaching found that students use laptops for long hours in their studies. Marcelo and Yot-Domínguez (2019) found that students had a positive attitude towards using laptops and mostly used them to learn. Additionally, Keengwe et al. (2012) found that integrating laptops in the teaching programmes in institutions positively impacted student learning outcomes.

In Penuel's (2006) systematic review that sought to examine the use of laptops with wireless connectivity with 30 studies, it was reported that students usually use the laptops to perform assignments, take notes, make a presentation and search for information using various search engines on the internet. Similarly, Bebell et al's. (2010) examination of four empirical studies on the integration of laptops in teaching found that most students use their laptops to take note, browse the internet, take tests, make presentations, and do their assignments.

2.3.5 Various Uses of Educational Technology Tools

Higher education is currently facing a period of rapid change. Technology is forcing a re-assessment of many pedagogical methods that have been prevalent in universities for centuries. There are many reasons for integrating educational technologies into teaching. Johnson et al. (2012) and Bozalek et al (2013) identified many areas upon which educational technologies are integrated into teaching. These areas include educational technology for presentation, communication. Research and assessment.

2.3.5.1 Presentations

The application of presentation software such as Microsoft PowerPoint, zoom, google meet, skype, and other presentation software cannot be over-emphasised in higher educational institutions (Kirkwood & Price, 2014). Though the integration of presentation software makes the delivery of contents effective and offers attractive and dynamic presentations, it is alleged that its frequent use brings about monotony in teaching. However, researchers (e.g., Essel, et al., 2020; Kirkwood & Price, 2013; Kukulska-Hulme, 2012) contend that the deployment of presentation software entertains, improves clarity, and sustains student's interest during teaching. Notwithstanding, Schroeder et al. (2010) argue that this does not necessarily lead to better learning outcomes for students. Besides, Virkus (2008) found no significant association with improvement in students' performance.

According to Akgün et al. (2016), instructors prefer the use of the laptop and the projector for presentations. Many researchers (e.g., Alkash & Al-Dersi, 2017; Jordan & Papp, 2014; Kiss, 2016) argue that PowerPoint presentation improves student recall quickly. Nevertheless, investigators who have

researched the adoption of multimedia presentations into teaching depicted a parallel increase in students' performance (Wanner, 2015).

According to Can et al. (2012), more than 90% of learners indicated that PowerPoint presentation captures their attention, and about 85% showed PowerPoint presentations attract and interest them. Despite the merits, students ascribe to the application of PowerPoint into teaching. Krippel et al. (2010) found a significant correlation between PowerPoint and student performance.

2.3.5.2 Communication

There has been much development in applying communication technologies in higher education since introducing web 2.0 tools (Example, WhatsApp, Facebook, Twitter, Google, etc.), due to their interactive elements. Web 2.0 technologies foster collaboration and social networks among people, and they are vital tools for communication in teaching in higher educational institutions (Tu & Blocher, 2010). Additionally, the conventional teaching methods are giving way to more interactive communication technologies like the internet, and it is gradually transforming teaching and focusing on student-centred learning (Nkansah et al., 2020).

Most teachers interact with students via online tools and social media using technologies like the mobile phone, the iPad and the laptops (Draskovic et al., 2013). Educational technologies support distance teaching in higher education. According to Wiid et al. (2013) and Clayton (2011), distance learning comprises cloud learning, mobile learning, blended learning, and e-learning. The e-learning technologies, e.g., learning management systems and virtual

learning system, enhance the teaching process by facilitating sharing, disseminating information, and improving cooperation (Keser et al., 2012). The concept of web 2.0 technologies implies fostering information sharing, collaborating and interacting between users in a social system. Tu and Blocher's (2010) investigation indicated that the different uses of web 2.0 social media technologies in teaching are critical to ensure effective content delivery.

Selwyn (2011) revealed that WhatsApp and Facebook were employed among teachers in higher educational institutions for communication purposes. In addition, wikis, a web 2.0 technology, fosters student-student and student-teacher interaction as they communicate about course work and assignment. Besides, they found that Facebook and WhatsApp are used commonly by faculty and by students to send educational videos, and other related learning resources easily.

2.3.5.3 Research

The application of educational technologies in research in higher education is overgrowing (Armfield & Armfield, 2018). Teachers and students use online search tools and other web-based archives to access literature and information for their project and publications. Additionally, educational technology means to conduct research is most prevalent in institutions of higher learning. This is primarily due to the wealth of database and available institutional repositories online for quick data search and retrieval. The use of educational technologies in research has caused researchers to revisit traditional methodological tools (Lai & Hong, 2015; Sappleton, 2013).

2.3.5.4 Assessment

Assessment via technology is of great concern to educators since most educators do not know how to assess students work using educational technology (Agarwal (2011). For instance, the employment of educational technology for assessment creates a large volume of feedback for users to reflect, assess and comment (Ifenthaler & Pirnay-Dummer, 2014), which play a critical role in enhancing their learning outcomes. Institutions of higher learning must unlock the opportunities technology offers and deploy educational technologies that are readily available to transform the educational arena. Various technological tools available for assessing students' work include but are not limited to blogs, podcasts, wikis (Albors-Garrigos & Carrasco, 2011; Bani-Salameh & Jeffery, 2011).

2.5 Factors Affecting Educational Technology Integration into Teaching

Many factors have been identified to influence educational technology integration in teaching by researchers. Rogers (2003) found five technological characteristics (high relative advantage, trialability, observability, and compatibility, and low complexity) that affect a person's decision to use technology. Stockdill and Moreshouse (1992), in addition, found individual characteristics, technological characteristics, organisational characteristics and content characteristics to influence a person's ability to adapt and integrate technology into teaching. Moreover, Okaz (2015) revealed that teacher-level, school-level, and system-levelsystem-level factors affect the adoption and integration of technology into teaching. Teacher's ability to use educational technology successfully is affected by their attitude towards technology and organisational factors.

Further, Porter and Graham (2016) and Mercader (2020) emphasised that institutional, individual, technological and organisational factors should be looked at when determining the use of educational technology integration into teaching. According to Neyland (2011), institutional support and micro factors such as teacher capability influence the decision to adopt and use technology for teaching. In institutions of higher learning, it is necessary to recognise and understand the conditions that necessitate lecturers to welcome new technologies into teaching. It has also been identified that economic, social-political, lack of pedagogical skills are some of the challenges that confront instructors to integrate technology into teaching (Shohel & Kirkwood, 2012). Besides, Bonsu et al. (2013) and Buabeng-Andoh's (2012) review suggest technical issues, instructors' competencies, concern for pedagogy, privacy, safety, leadership, and inadequate finances as crucial challenges that obstruct instructors from using technology in teaching. Furthermore, Adedokun-Shittu and Shittu (2014) found technology integration training for instructors, adequate technological tools, equipment, and machines and their compatibility with teaching needs, easy use of technology, and its usefulness for teaching as significant motivating factors to technology integration in higher education.

In Makewa et al.'s (2014) study, a test for difference in technology integration in the instructional process based on the level of training among instructors showed no significant difference; Oliver (2011) found a strong positive correlation between educational technology integration and instructors' competence. This suggests that the more competent an instructor is in technology, the possibility of that instructor integrating technology into the instructional process. Meifeng et al. (2010) revealed that instructors integrate

educational technologies into teaching for reading, note taking, and presentation and management of student's assessment records. The results from Budiman et al. (2018), who applied the qualitative research approach to study technology integration in teaching using the SAMR model, found that 50% of the participants substituting reading with technology, 35% augment reading with technology, 10% also use technology to modify reading while 5% use technology to redefine reading.

Buabeng-Andoh (2012) and Marwan and Sweeney's (2010) investigations pointed that barriers to the lecturer's ability to integrate technology in the instructional process could be attributable to instructor's level barriers, systemic barriers, and institutional level barriers. In a similar vein, Kopcha (2012) found a lack of technological skills, lack of suitable educational software, lack of internet connectivity, restrictive curricula, and lack of pedagogical teacher training in educational technology integration as crucial inhibiting factors restraining instructors from integrating technology into teaching. Using a scale of 1-5, Asabere et al. (2017) revealed a lack of internet bandwidth (mean value: 4.02, SD = 1.26) and lack of technology infrastructure (M = 3.92, SD = 1.26) as factors that make technology integration difficult for instructors.

Gikundi's (2016) quantitative investigation revealed that students prefer learning with educational technology of different kinds. Though students like working with educational technologies, e.g., computers, only 29% could confidently operate the computer with ease. It was also found that most students did not use computers for academic purposes, e.g., researching; instead, they use them for non-academic purposes such as sending and

receiving mail from friends and for interaction with friends on social media. In the same study, participants perceived the use of computers to be technically challenging to operate. Lim et al. (2013), on the contrary, found that most educators feel comfortable using the computer but have inadequate technical skills to integrate it fully in the teaching process.

Conversely, Henderson et al. (2017) found that though students use the computer to interact with friends on social media, they equally use it to research and write their assignments. However, Gukundi (2016) reported that 70% of respondents hardly get internet connectivity access, which possibly hinders their ability to integrate computers into instructional activities. Through observations, Agyei, (2013) found the ratio of computer to the student to be 1:54, thus reporting of high student-computer ratio.

Gilakjani (2013) and Balash et al. (2011) indicated inadequate infrastructures such as lack of computers, the intermittent supply of electricity, inappropriate soft and hardware, and discontinuous internet connectivity as critical challenges confronting teachers to embrace technology in instructional delivery. Alqurashi (2019) also found an inadequate support system and continuous computer breakdowns to be challenges confronting instructor's capacity to adapt the technology for teaching.

In a quantitative investigation conducted on the effective means of incorporating technology into instructional delivery in Bangladesh by Shamim, and Raihan (2016), it was revealed that instructors lacked technological skills, lacked technology-based teaching aids, and lacked the motivation to integrate educational technologies in the instructional process.

Conversely, other researchers (e.g., Abrahams, 2010; AlAmmary, 2012; Alonso et al., 2019; Alqurashi, 2019) posit that instructors regarded as active users of educational technologies had good Technological Knowledge and Technological Content Knowledge. Besides, Shamim and Raihan (2016) argued that having sufficient knowledge in technology and content does not necessarily warrant its integration in the instructional process. Benson and Ward (2013) reported that most instructors were unaware of integrating educational technologies pedagogically. Therefore, technology-based teaching activities were not thought of for specific content objectives (Abbitt, 2011).

Hall (2018), Buabeng-Andoh (2012), and Doering and Roblyer (2010) revealed that faculty members perceived that there is a comparative advantage in blending educational technologies in teaching over the traditional-based teacher-led method. Besides, Hung and Jeng (2013), Joseph (2012), and Holden and Rada (2011) reported that faculty members were willing to integrate educational technologies in lesson delivery but were constrained as a result of insufficient training in technology use, inadequate technical support systems and inadequate materials. Also, Atchley (2019) and Abbitt (2011) exposed factors such as the level of TK and skill level of instructors and lack of educational technology-related policies within the institution as other forms of impediments to integrating educational technologies in teaching.

Abubakar et al. (2016) applied the mixed method to assess educational institutions' educational technologies in teaching in Nigeria, and their study disclosed that instructors lack technological skills, inadequate technology-related resources in the institutions. In Farmery's (2014) qualitative study, it was revealed that if educational technologies are utilised effectively, it could

increase the pace at which students learn, generate desirable outcomes and enable learners to engage in various learning. Besides, López-Pérez et al. (2013) and Martin et al. (2010) confirm that integrating educational technologies in the instructional process enhances students learning outcomes.

Adnan and Tondeur (2018) and Lee and Tsai (2010) found that teaching are associated with instructor's self-efficacy. Venkatesh et al. (2016) indicated that instructor's positive attitude toward educational technology integration from the institution's technology integration-related policies encourages encouragement within the institution culture, implementation, and supervision. According to Holden and Rada (2011), these variables have a strong positive correlation with self-efficacy. In a related investigation, Abbitt (2011) and Lee and Tsai (2010) commented that having adequate pedagogical goals on when, where, and how to integrate technology in teaching are critical in developing higher levels of self-efficacy in instructors.

Furthermore, Selwyn (2013) and Teo (2011) revealed that technology alone does not change teaching but rather would require employing appropriate teaching strategies. Also, change in the delivery of teaching does not necessarily occur by lecturers merely coming into contact with technology. There is limited integration of technology by using web 2.0 technology even when learners show readiness to use them (Roblyer et al., 2010; Hamid et al., 2009). The study on the frequency of technology integration into teaching by Marcelo-Garcia et al. (2015) showed that only 16.7% of lecturers could integrate educational technology into teaching.

Technology integration in teaching concerns are developing the human resources with the requisite competencies through technology for effective performance and participation in the development agendas of a nation (Barefah & McKay, 2018; Hameed, 2007). It is, therefore, important for learners and instructors to have equal access to technological tools and resources for their regular teaching activities (Devlin & McKay, 2016; Nawaz & Kundi, 2010).

Kirkwood and Price (2014) indicate that in this digital era, technology is speedily changing and bringing about flexible and compatible ways of doing things differently. Kohl (2019) opines that educational technology integration in teaching in universities is not acknowledged generally by some scholars and educators. Besides, researchers (e.g. De Freitas & Veletsianos, 2010; Ottenbreit-Leftwich, et al., 2018) have pointed out that the dangers associated with integrating educational technology in teaching could limit the diverse approaches to imparting knowledge and skills. Likewise, Nawaz, Awan, and Ahmad (2011) stated that providing technology-related training would not necessarily ensure that instructors integrate technology in instructional practices. Cao et al. (2013) and Cagiltay et al. (2006) suggest that human resource and technical support systems as critical ingredients for the continuous incorporation of technology in teaching activities.

2.5.1 Personal Characteristics

Personal characteristics like age, educational level, gender, previous experience with technology for teaching and attitude affect the use of technology (Allahawiah & Tarawneh, 2015; Buabeng-Andoh, 2012; Kim, et al., 2013; Marwan & Sweeney, 2010; Venkatesh et al., 2014). Using a scale of 1-5, Venkatesh et al (2014) results showed personal characteristic positively affects learners and instructors' technology integration in teaching at the university level. The test done at 95 per cent significance level proved that gender had mean 3.62 and sig value 0.000, age mean 3.61 and sig value 0.000, experience mean 3.67 and sig value 0.00, and educational level means 3.64 and sig value 0.000. Instructors are entreated to integrate educational technology into teaching; however, their willingness and preparedness to use technology in instructional delivery determines the effectiveness of a given technology and not necessarily by its availability in the classroom (Englund et al., 2017). Teachers' attitude toward educational technology greatly influences their use of technology in teaching. Bond and Bedenlier (2019) noted that educators' unwillingness to use technology for teaching is due to their lack of skills and knowledge, fear, and lack of confidence, which usually indicates that technology takes the back seat of conventional teaching. Hence, an understanding of the factors that affect teachers to use of technology in teaching is very relevant.

2.5.1.1 Teachers' attitudes

The use of educational technology for teaching in higher institutions is dependent strongly on instructor's support and attitudes. It is believed that educators assumed technology intervention programmes as not meeting their

need or students need. They may hesitate to deploy educational technology to teach. Kopcha et al. (2016) and John (2015) and Rudhumbu et al. (2021) revealed that among the reasons that influence educational technology use in teaching are instructor's beliefs and attitude towards technology. When educators have positive beliefs and attitudes to technology, they may support technology integration and use it in their instructional activities.

A study on instructors' attitude towards the use of educational technology by Demirci (2009) in Turkey revealed that although hurdles like inadequate software and hardware technologies existed, teachers' positive attitudes towards technology were an essential feature for integrating technology into teaching. Related to this finding is Teo et al (2008) survey on teachers' attitudes towards technology use in Singapore, where 139 teachers were sampled to assess their technology attitudes using a semi-structured questionnaire with factors such as their likes, perceived control, perceived usefulness and intention to use technology. It was revealed that teachers had a positive attitude and good behavioural intentions to employ technology for teaching. Drent and Meelissen (2008), in a study in the Netherlands, established that student's positive attitude towards technology, student-oriented pedagogical approach and teachers' direct technology-related experience influence their use of technology.

Shah (2012) found that teachers' use of educational technology for teaching was very important as it enhances teaching. However, evidence suggests that a small number of teachers believe that the benefits of technology are not seen. Furthermore, Becta's (2008, p.45) study of teachers in the UK showed that teachers' positive attitude to technology makes essential contributions towards

the possible use of technology in teaching. Educator's technology experience correlates positively with their technology use attitude. The more experienced teachers have with technology, the likelihood of showing a positive attitude towards technology use (Kirkwood & Price, 2013). It must be noted that positive technology use attitudes foster the integration of technology in the classroom (Al-Emran & Shaalan, 2015). For a successful transformation in educational practice, users need to develop positive attitudes towards using technology (Rana, 2016).

Kirkwood and Price's (2014) research revealed that about 50% of instructors apply technology without changing the teaching methods. Hue and Jalil (2013) showed that the extent to which lecturers integrate technology in the instructional process is essential, based on their attitudes. It was revealed that the lecturer's ability to integrate technology is based on their knowledge and skills associated with that technology. Notwithstanding, Ertmer and Ottenbeit-Leftwich (2010) indicated that though technological knowledge acquisition is ideal, it is not adequate to make lecturers confident to integrate technology in teaching.

Alkharusi et al. (2010) commented that instructors are unwilling to give up and change from many years of conventional teaching strategies and experiences. Also, instructors are hesitant that their professional experience would be assessed based on their ability to integrate technology in the instructional process. Notwithstanding, Venkatesh, et al. (2014) and Buabeng-Andoh's (2012) investigation on factors that influence instructor's readiness and willingness to adopt technology in the instructional process found that the critical militating factors confronting technology incorporation into teaching

included instructor's attitude, lack of technological knowledge and skills, ability to operate computers, sex, years of teaching and level of education. However, Brum and Hinostroza (2014) revealed a lack of exposure to technology, pedagogical technology-related competencies, and lack of confidence as factors inhibiting lecturers from integrating technology into teaching. According to Asiri et al. (2012), the internal factors that influence lecturers' ability to integrate technology in teaching comprise faculty member's attitude, pedagogical beliefs, and level of competence in technology usage.

Surej's (2015) quantitative investigations in higher institutions in India and Thailand exposed that factor such as computer self-efficacy, computer anxiety, compatibility, previous computer experience, perceived ease of use, and attitude influence instructors and learners to integrate technology in teaching. The study further indicated that in the academic field, factors such as respondent's age, tenure, promotion policies, disciplines, and workload, and time constraints could affect the instructor's ability to integrate technology into teaching. A related study by Edumadze and Owusu (2013) in a Ghanaian University with a sample of 237, respondents provided evidence that the University provides some technology resources; however, those resources are inadequate to enable lecturers to integrate educational technology in teaching and to learn thoroughly. The study further exposed that the lecturer's prior knowledge and skills in educational technology best predicted the extent to which they integrate technology into teaching. The study found a statistically significant relationship between the lecturer's prior technical knowledge and the effective integration of technology in teaching. Similarly, Abbitt (2011)

also found a strong correlation between the lecturer's prior knowledge in technology and their ability to integrate technology in their teaching.

According to Moran et al. (2011), a person's attitude is of critical importance to the use of any innovation or technology. This study also sought to understand teachers' experiences (e.g., anxieties and beliefs, conceptions, misconceptions, and perspectives, challenges, motivation and readiness, preparedness, and willingness) toward educational technology integration into teaching.

According to Englund et al. (2017), attitude is the total of a person's preference and feelings, biases and preconception, predetermined notions, philosophies, uncertainties, fears, and opinions about a phenomenon. It is affirmed that attitude is about like or dislike of positive or negative beliefs towards a psychological object. Inclinations such as experience and selective view may influence an individual's behaviour towards technology (Rogers, 1995). A teacher's concept and philosophy of teaching influence how that person uses technology (Zhou et al., 2005).

Many studies have revealed factors that influence teachers' attitudes towards educational technology integration into teaching. These include workload and inadequate time (Abuhmaid, 2011; Cullen & Greene, 2011; Dong et al., 2015; Lee & McLoughlin, 2011), inadequate knowledge and skills, anxiety and belief anxiety (Buabeng-Andoh, 2012), teaching experience, access to technology and lack of institutional support systems (Yilmaz, 2011).

Regardless of these factors, teacher attitude towards educational technology integration into teaching plays a significant role in ensuring successful

integration for effective educational technology integration. Chigona et al. (2014) revealed that successful educational technology integration in teaching largely depends on the attitude of instructors who determine when and how to employ educational technology in the teaching process. According to Salehi and Salehi (2012), attitudes of teachers influence their acceptance and incorporation of educational technology into teaching. Therefore, understanding the teacher's attitude in terms of belief and anxiety is fundamental for appraising educational technology integration into teaching.

Finger et al. (2015) stated that irrespective of the availability of educational technologies in institutions, most teachers still resist integrating those technologies into teaching. Ertmer et al. (2012) attributed teachers' resistance to deploy educational technologies to teach their negative attitude towards technology. Rienties et al. (2013) also attributed teachers' reluctance to integrate educational technologies to their level of competence in using the technologies. It is argued that the negative attitude of teachers causes them to disbelief the usefulness of educational technologies, and they may decline integrating technology into teaching (Hennessy et al., 2010). Many past studies (e.g., Cullen & Greene, 2011; Mercader, 2020) have shown that educational technologies have not been fully utilised to realise the needed benefits because the users have failed to acknowledge the immense contributions result of teacher’s negligence and negative attitude.

Rogers (1995) acknowledged that a cheerful disposition towards educational technology is a critical success factor for integrating educational technology in teaching. It is further elaborated that teachers’ attitude towards a particular technology is fundamental to its adoption. Similarly, the diffusion innovation

theory and the technology acceptance model indicate that a positive attitude towards a particular technology is the key driving factor to its integration. Kim et al. (2013) found that successful integration of educational technology does not depend on either the quality or the complexity of available technologies but instead on teacher's attitude and positive disposition. However, entry of technologies into institutions of higher learning and subsequent demands has not paid prominent attention to the teacher's attitude, hence teacher's passive attitude towards educational technology into teaching (Abbitt, 2011).

2.5.1.2 Technology Competence

Technology competence can use a wide range of technological tools for various purposes (Spante et al., 2018). Teacher's technical competence is a significant predictor of using technology in the classroom for teaching. According to Bordbar (2010), teachers' computer competence is a significant predictor of integrating technology in teaching. Research suggests that most teachers who showed a negative attitude towards using educational technology in teaching lacked the skills and knowledge towards technology integration in teaching (Rana & Rana, 2020; Uerz et al., 2018). Peralta and Costa (2007), in their qualitative multiple case study on teacher's competence in five European countries, found that technical competence affects Italian teacher’s use of technology in teaching.

Notwithstanding, instructors pinpointed pedagogical competence as a key factor that affects effective and efficient use of educational technology for teaching. The report from the study in Portugal varied. In Portugal, most instructors stressed the urgent need for the provision of technical skills and attitude. Teachers with more experience with technology have greater ability

and confidence to use technology to teach the classroom (John, 2015). It is also reported that teacher's competence is associated with their confidence and teachers' confidence relates to their perceptions and ability to use technological tools in the classroom.

Anthony et al. (2019) argues that though technologies have the potential to make the instructional process more interactive and exciting, however, it beholds on the instructors to learn, prepare, produce and utilise appropriate technology in the teaching process. Ertmer et al. (2012) found an association between instructor technology usage and its integration in teaching. In a like manner, Alazam et al. (2013), and Kumar and Daniel (2016) pointed out that an instructor's ability to integrate technology effectively is dependent mainly on the technical skill instructor possess. Notwithstanding, Alazam et al.'s (2013) investigation proved that the instructor's lack of technical skill resulted from limited in-service training. In a related study by Bonsu et al. (2013), lack of infrastructure, high cost of IT related training, and poor technological competency was acknowledged as critical barriers to technology integration in teaching.

According to Kazley et al. (2013), Han and Wang (2010), and Hsu (2010), the issue of closing the existing gap between instructor's skills and technology rests on instructors themselves. Additionally, Rumble and Harry (2018) opine that the forces within higher institutions hinder any implementation of the change of using technology as a supplement or a replacement for the conventional teaching strategies.

Despite the increased access to educational technology in higher institutions, some instructors are usually portrayed as hesitant users. They are used to the traditional teaching method, making it difficult to move away and use 21st-century technological devices. They perceive that the effort needed to learn new technology is challenging and stressful and therefore have no inclination to use it (Mac Callum et al., 2014). Additionally, many instructors perceive technology integration negatively because of the amount of time required to deploy it into the curriculum. Integrating educational technology involves adequate preparation, classroom management and requires attention. Therefore, it is easier to remain in the status quo (MIS., 2017).

In Nawaz et al.'s (2015) systematic review, which aimed at unearthing and juxtaposing the significant factors that affect e-learning incorporation in institutions of higher learning, they reported that major factors affecting instructors to integrate technologies into the teaching process included instructor's perceptual diversities. According to Kopcha et al. (2016), the decision about integrating technology in teaching must be based on an understanding of best practices and awareness of cost and benefits associated with it.

2.5.1.3 Computer self-efficacy

Most researchers have conducted studies on teachers' self-efficacy and reported that teachers' self-efficacy have a more significant effect on their use of technology. Self-efficacy is the belief in one's capabilities to perform an activity necessary to achieve a goal Li et al. (2015). It is the confidence that individuals have in their ability to do the things they aspire to do. Thus, teachers' confidence refers to the teachers' perceived likelihood of success in

deploying educational technology for teaching purposes (Karatas et al., 2017). Some researchers (e.g., Horvitz et al., 2015; Kent & Giles, 2017) have predicted that digital classroom, which requires many technological tools; enhance teaching outcomes. However, without teachers' ability to use technology, it may be difficult to achieve this goal (Ozerbas & Erdogan, 2016).

Turel (2014) revealed that instructor's self-efficacy affects their use of technology in teaching. Similarly, Yuen and Ma (2008) revealed that Hong Kong teachers' technology implementation was largely dependent on apparent teacher self-efficacy. According to Yerdelen-Damar et al. (2017), teachers' competence with technology is an essential factor for effective technology use in instructional delivery. Peralta and Costa's (2007) study on teacher's competencies and confidence regarding technology use among twenty teachers identified that in Italy, educators' technical skills and knowledge in technology are a factor for improving higher confidence in the use of technology in teaching. Further, in Greece, teachers reported personal and pedagogical factors as those contributing to their ability and confidence to use technology for teaching. Teachers feel unwilling to deploy technology in teaching if they lack confidence.

According to Al-Emran et al. (2016), lack of knowledge and skills and the fear of failure are cited as some of the main reasons for educators' lack of confidence in integrating educational technology into teaching. In a related development, Tondeur et al. (2016) reported that approximately 21% of educators reported that lack of confidence affects their use of educational technology in teaching. It was also emphasised that most teachers do not

consider themselves well skilled in using technology and feel anxious about using it in front of the classroom since the students perhaps may know more than they do. Li et al. (2015) found a significant relationship between teachers' self-efficacy and their use of educational technology in teaching. They claim that if faculty members felt that the use of technology had positive effects on students learning outcomes, then they are more likely to practice the use of technology in the classroom. However, where they felt it would not enhance students' academic performance, they will not use it.

2.5.1.4 Teaching Experience

Although Niederhauser and Stoddart (2001) reported that faculty experience did not influence their use of technology in teaching, most researches indicated that teachers teaching experience impacts the successful integration of technology in the classroom (Giordano, 2007; Hernandez-Ramos, 2005; Wong & Li, 2008). According to Gorder (2008), faculty experience has a significant correlation with the use of educational technology in teaching. Furthermore, Baek et al. (2008) claimed long-serving instructors are less likely to integrate technology into teaching. Likewise, it is reported that instructors with less experience in teaching are more likely to use technology in instructional delivery (Granger et al., 2002). According to the report, educators with three years of teaching experience spend about 48% of their time using technology, and teachers with teaching experience between 4-9 years spend 45% of their time using technology but teachers with more than 20 years of teaching experience spend about 33% of their time integrating technology into teaching. What may account for these disparities could be that those newly appointed teachers are more experienced and zealous in using

technology. In Lau and Sim's (2008) study on the extent of use of technology in Malaysia, it was reported that more experienced or older teachers frequently use technology in teaching in the classroom more than the less experienced teachers do. The fundamental reason could be that older teachers have many years of experience in teaching and classroom management and skillful in the use of technology for teaching.

In a related investigation, Russell et al. (2003) revealed that new teachers who had technology use competencies more than the experienced one hardly integrated technology into instructional delivery. The main reason for this difference was that new teachers have challenges adjusting to their new environment and, therefore, spend most of their time trying to familiarise themselves with their new environment, classroom management techniques and the curriculum. Nevertheless, in their survey of about 3000 teaching staff, Russell et al. (2007) found that the quality of technology integration was associated with years of experience. However, in Granger et al.'s (2002) qualitative study on the factors affecting technology integration into teaching in Canada, there was no relationship between teachers experience and the use of technology for teaching. The implication is that teacher's technology-related skills is not a good predictor of successful educational technology integration into teaching.

In their study on technology integration practices, Ertmer et al. (2012) revealed that institutional support, technical assistance, lack of teacher competence in technology integration into teaching, and high students-computer ratio were regarded as impediments to successful integration other than teacher's belief. In Ertmer et al.'s (2015) study, teachers' belief was the

fundamental reason for their choice to integrate educational technology. According to Cakir (2012), the majority of instructors in higher institutions do not integrate educational technology frequently into teaching though the teaching staff was found to be innovative and well educated and proficient in the use of technologies. It was suggested that the teaching staff require additional planning hours for lessons that require educational technology integration. Furthermore, it was found that instructor's perceptions and attitude to technology integration need further investigations.

Sang et al. (2010) observed that instructor's anxiety and perceived hurdles, inadequate educational technology resources, lack of internet connectivity, and self-efficacy are fundamental issues that affect the degree of the level of integration into teaching. It was also found that the instructor's attitude to educational technology integration is a critical deciding factor in the success of how technologies are integrated into teaching. Taylor and Newton (2013) revealed a discrepancy in the instructor's attitude and institutional change to educational technology integration into teaching. The study also identified a disconnection between policy on technology integration and implementation and recommended effective participation of faculty in technology integration policy. Gorder (2008), also found that lecturers' experience in teaching had no influence on their use of educational technology in teaching. On the contrary, it has been reported that faculty members' teaching experience influences their use of educational technology for teaching (Giordano, 2007; Gorder, 2008; Hernandez-Ramos, 2005; Wong & Li, 2008). Their study found a statistically significant correlation between teaching experience and actual use of educational technology.

Also, Baek et al. (2008) found that experienced faculty members are less ready to use educational technology for teaching. Zellweger (2007) reported that faculty who have less experience in teaching were more likely to use educational technology for teaching than more experienced faculty members.

2.5.1.5 Teacher Workload

Several studies have shown that the workload of faculty members affect their acceptance to use technology in teaching. For instance, Samarawickrema and Stacey's (2007) case study on the factors associated with using learning management systems in universities in Australia with 22 participants found that increased workload was a significant impediment to technology integration into teaching. Some of the issues relating to increased workload were constant staff upgrade leaving less staff to teach, and continuous search for sustainable strategies for teaching. Similarly, Neyland's (2011) mixed-method research on factors affecting technology integration in Sydney revealed that increased workload on teachers was alarming due to overcrowded curriculum, and hectic schedules of teachers make it impossible for a teacher to use technology for teaching. Further, Abuhmaid (2011) on the effectiveness of technology training in the Jordan education system with 115 teachers and 12 school principals found that teachers are already overloaded and could not cope with the pressure related to using technology for teaching.

2.5.2 Institutional Factors

According to Asiri et al. (2012), institutional factors refer to factors at the institutional or school level that influence technology integration in teaching. Obiri-Yeboah et al. (2013) identified leadership support as institutional

characteristics or factors. Besides, breakdown of technologies and inadequate sitting place for wireless services, limited time for integration in lessons, unreliable internet speed, lack of computers, and inadequate accessibility to technological tools for effective integration were some institutional factors affecting educational technology integration in teaching (Forsyth, 2014).

Brum and Hinostroza (2014) used forty-six (46) teacher education institutions in Chile and classified barriers to technology integration into personal and institutional factors. Intuitional factors comprised insufficient digital learning resources, insufficient pedagogical support, lack of institutional policies for technology integration, insufficient technology equipment, poor connectivity, insufficient technical support, and institutional interest in technology integration. Adedokun-Shittu and Shittu (2014) and Jimoh et al. (2012), who surveyed the challenges associated with technology integration, found technical problems and constraints such as power failure, internet interruption, and inadequate training for instructors as some of the critical challenges confronting technology integration in teaching. Also, Bagheri et al. (2013) found inadequate human resource capacity, low bandwidth for internet connectivity, and poor penetration of technology in higher institutions as some challenges impeding technology integration in teaching in institutions of higher learning (Newby et al., 2011). Ali et al. (2013) found an association between an instructor's self-efficacy and leadership with technology integration in teaching.

According to Vannatta and Fordham (2004), institutional characteristics contribute to teacher's use of educational technology for teaching. It is believed that the time teachers use to integrate educational technology in

instructional delivery is a critical factor for successful integration. Norris et al. (2003) stated that the importance of access to educational technology for teaching influences the use of educational technology by teachers. Hence, an appreciation and understanding of institutional factors that influence teachers' use of educational technology in teaching are very relevant. According to Buabeng-Andoh (2012) and Schrum et al. (2011), inadequate professional development, accessibility to infrastructure, lack of technical support, lack of leadership support, the pressure to use technology, government technology-related policies in education, computer/technology literacy and technological characteristics are some institutional factors that hinder successful integration of technologies into teaching. In Marcelo et al.'s (2015) quantitative investigation into university teaching with digital technologies, it was brought to bear that lecturers integrate technologies that aid teaching strategies of content using different media.

Anderson and Dexter (2005) agreed that even though infrastructure support is essential, technology leadership is a crucial predictor of educators' use of technology. It is believed that a leader who shares a shared vision and implements technology plans with their instructors stimulates the use of technology in teaching among teachers. Lawrence and Tar (2018) believe that a leader who implements technology plans and shares a shared vision with the teachers stimulates them to use technology. For effective use of educational technology by faculty, Bennett et al. (2018) suggests there is the need for solid leadership to drive and design technology plans in institutions. Becta (2004), in his study in the United Kingdom, stressed the significance of good leadership to drive technology use in teaching in institutions.

Even though instructors in the classroom typically provide technology opportunities, the quality of management and leadership in institutions is fundamental for technology integration. Wong and Li (2008) studied the factors that influenced the transformational integration of technology in Hong Kong and Singapore; it was reported that leaders promote collaboration and support the experimentation of technology to aid instructors in using technology to transform teaching effectively. Ng's (2008) quantitative study on transformational leadership with 80 instructors in Singapore found that transformational leadership with qualities such as articulating a vision, offering intellectual stimulation, creating, providing individualised support, and strengthening school culture influence educational technology for teaching. Obiri-Yeboah et al.'s (2013) concurrent mixed-method study on the factors affecting technology integration in teaching using 212 respondents provided evidence that leadership support encourages faculty members to employ technology in teaching. Adedokun-Shittu and Shittu (2011) and Ghanaian (2018) revealed that leadership support for technology integration was inadequate to encourage learners and instructors to integrate technology in teaching.

2.5.2.1 Professional Development

Faculty professional development programmes are a major contributory factor to successful educational technology use in teaching. Many studies have found that regardless of the experiences of faculty members, technology-associated training programmes equip teachers with the requisite technology competencies to integrate educational technology into teaching effectively (Lidolf & Pasco, 2020; Murthy, Iyer & Warriem, 2015). Training faculty to

use educational technology influences their attitude and perception toward technology and enables them to reorganise using technology and appreciate how technology tools play a significant role in students learning (Medina, 2018).

Murthy et al.'s (2015) study of about 400 participants revealed that professional development was among the key determinants of successful technology integration in teaching. They emphasised that faculty technology knowledge and skills are a significant determinant for teaching technology. They argued that technology-related training programmes that concentrate on pedagogical training rather than technical issues enable faculty to use technologies in teaching. Several studies have shown that teachers' quality of professional training enables them to integrate technology and change teaching practices (Albion et al., 2015). Lawless and Pellegrino (2007) indicate that if the training programmes are of high quality, teachers develop interest, change their orientation about technology and are helped to develop a positive attitude to use technology for teaching.

Correspondingly, Bernhardt (2015) claims that teachers would need technology experts to show, direct and guide them to use educational technology to teach and facilitate students learning. Teachers' understanding of content and technological knowledge enables them to use technology to support students learning. Instructors who implement educational technology through professional training can change students' performance (Sousa & Rocha, 2019). Professional training courses must assist in identifying beliefs about successful teaching and policies for enhanced teaching in the classroom (Murthy et al., 2015). It is believed that educators who receive professional

development training programmes gain knowledge and become committed to integrating technology in teaching (Ekanayake & Wishart, 2015). It is essential to permit faculty to use educational technology to enhance and argue their teaching. When provided with adequate time to practice with technology, faculty members can learn, share, and collaborate with peers and students, making it possible to integrate technology into teaching. Educational technology training programmes that inculcate educational practices and strategies to deal with teacher's belief, skill gaps, and attitude towards technology improve awareness and help them develop insights for better classroom technology integration and management (Baran & Uygun, 2016).

Chapelle (2011) revealed infrastructure, computer laboratories, and technology-related equipment as critical ingredients necessary for integrating technology in teaching. Besides, Turel and Johnson (2012) reported a lack of computers, inadequate infrastructural development, technical problems, and insufficient technology-related tools as crucial barriers to instructor's ability to integrate technology in the teaching process. Furthermore, Finger et al. (2013) identified technical difficulties as a significant problem that frustrates instructor's ability to integrate technology into the instructional process. According to Turel and Johnson (2012), some of the technical problems include low connectivity, virus attacks, and malfunctioning printers.

Roebuck et al. (2013) found that technology integration depends on personal and institutional factors. In Murray and Olcese's (2011) investigation, it was reported that factors such as lack of technology integration policy, inadequate hardware and software, instructor readiness, and lack of instructor technology skills are significant factors that militate against instructor's ability to integrate

educational technology into the pedagogical processes. The study, however, advocated for continuous professional development and training in educational technology for instructors. Alexander and Vladislav (2016) exposed that instructors who have had training in technology courses effectively integrate technology in the instructional process instead of those who have not had training experiences in technology. Likewise, Baran and Uygun (2016) reported that instructors who have not had training in technology integration for teaching are reluctant and hardly integrate technology in the instructional process.

Wilkerson et al. (2016) claim that even with access to adequate educational, technological tools, effective professional development for faculty members remains crucial for most faculty members integrating educational technology in the classroom. Several studies (e.g., Spante et al., 2018; Germaine et al., 2016) show that simply providing faculty with technology training opportunities does not necessarily translate into its usage in the classroom. It is only if faculty members are provided with the knowledge, skills, technological tools and necessary support services that they will use technology in teaching.

2.5.2.2 Accessibility to Technology

Plomp and Voogt (2009) emphasised that access to educational technology in institutions is essential for assessing technology integration in teaching. The use of technology in teaching in the classroom depends mainly on educational technology resources such as hardware and software. If faculty members cannot access educational technology, then they cannot use them. Therefore, access to educational technology tools is a vital ingredient for the successful use of educational technology in the classroom. Yildirim and Göktas (2007)

revealed that faculty access to educational technology tools is key to faculty pedagogical use of technology in teaching. Besides, Usluel et al.'s (2008) study of 814 participants in Turkey reported that participants (i.e., 82.5% and 81.2%, of the faculty members respectively) had access to computers and the internet.

Albirini's (2006) study of about 364 participants on the views on computer attributes, cultural perceptions, computer competence, computer access, and personal characteristics found that most (57%) instructors had computers at home and few (33%) had access to computers at their institutions. This shows instructors' inadequate access to computers in their institution. Further, Afshari et al. (2009) reported that over 50% of instructors used computers for lesson preparation and research. Most of the participants (78%) complained of inadequate access to computers in the classroom. According to Tondeur et al. (2008), access to hardware and software is essential and the use of suitable technological tools and programmes to support teaching. Accessibility to suitable educational technology means that it should be affordable, and constraints of a technological tool need to be considered integrating such tools in the teaching processes (Chen, 2010).

2.5.2.3 Technical Support

The breakdown of technological tools in teaching causes interruptions and irritation. Whenever there is a lack of technical assistance, it is vital that regular repairs and maintenance are carried out, necessitating that teachers use technological tools in the teaching process (Ghanaian, 2018; Goktas et al. 2009; Porter et al., 2016). On the contrary, educators will be discouraged from using educational technology for fear of equipment failure since it would be

challenging to have technical support in case of a technical problem. Al Gamdi and Samarji (2016) reported a lack of technical support services in institutions. This indicates that constant technical repairs and maintenance will likely not be carried out frequently, resulting in a higher risk of a technical breakdown of technological tools. In a similar investigation, Yilmaz (2011) asserted that in the Turkish education system, in providing institutions with hardware and internet services, it is also essential to provide institutions with technical support services in repairs and maintenance for the continued use of technology by institutions. Hence, if there are no technical support services, faculty members become frustrated and hesitant to use educational technology for teaching (Porter & Graham, 2016). Although lack of technical support services discourages educators from deploying educational technology in the instructional delivery process, Korte and Husing (2007) reported that in Britain and the Netherlands, institutions had embraced the need to provide technical support services to enable teachers to use technology in teaching. They emphasised that technology support services in institutions influence educators to use technology in the teaching process without wasting time troubleshooting hardware and software problems.

2.5.2.4 Technological Characteristics

According to Rogers (2003), technology characteristics influence technology diffusion, and it is a crucial factor affecting the adoption and innovation/technology. Research suggests that innovation-associated attributes such as the relative advantage of using a given technology, compatibility, complexity, trialability and observability as perceived by people influence their use of a given innovation or technology. It is necessary to understand the

perception of individuals to innovation as this has the power to make a person adopt or decline to use technology. Understanding faculty perception of innovation is critical to successful integration in instructional delivery. Porter and Graham (2016) and Nelson et al. (2019) believe that instructors become innovators when integrating technology into teaching.

Several investigations have been done on technological characteristics in higher education (e.g., Porter & Graham., 2016). In all these studies, observability and trialability were identified as the two most significant elements of faculty technology use. Further, Duţă and Martínez-Rivera (2015) reported that relative merits, compatibility, ease of use, visibility, and triability are crucial if institutions want to maximise the use of technology. Adding to it, Scott and McGuire (2017) affirmed that perceived ease of use and perceived usefulness were predictors of faculty acceptance of educational technology.

Marzilli et al. (2014) found that most teachers perceived the use of educational technology as functional as it makes teaching effective. Further, Askar et al.'s (2006) study, which examined teachers' task-related usage and perceptions concerning technology among 416 teachers in Turkey, found that ease of use of technology was a common perceived technology characteristic for teaching in institutions. Further, they revealed that observability was a perceived characteristic in teaching specific tasks while compatibility and relative advantage were for teaching preparation tasks.

A study with 213 faculty members from seven (7) faculties and one (1) institute at the National University of Lesotho by Ntemana and Olatokun (2012) reported that relative advantage complexity, observability, and image

were the most critical factors that predicted faculty members' intentions to integrate educational technology into teaching. Benhabib et al. (2017) asserted that innovation that offers relative advantages, compatibility with prevailing practices and beliefs, less complex and provide for triability and observability would have a broader and fast rate of usage.

In a survey study that sought to investigate the factors influencing the effectiveness of the integration of educational technology in teaching in higher institutions in Uganda, Ali et al. (2013) found that teaching staff had a strong desire to integrate technology into the instructional process. Schrum et al. (2011) revealed that institutional factors confronting technology integration were lack of policy, lack of internet bandwidth, and leadership commitment. Sife et al. (2007) identified poor infrastructure and inequitable distribution of technology-related equipment as critical challenges that lecturers in developing nations face in their quest to integrate educational technology in teaching. Similarly, Nawaz and Kundi (2010) and Mehra and Mital's (2007) investigations on factors impeding technology integration indicated that despite the numerous research about the relevance of technology used by faculty in the instructional process, its diffusion in the teaching process has not been widespread neither has it become deeply integrated into teaching. Duffy and Jonassen (2013) cited lecturer's preference for print over virtual forms of presentation and concluded that such preference limits student's participation in the instructional process.

Jimoh et al. (2012) identified frequent power interruption, lack of internet connectivity, and inadequate technologically based training as critical challenges inhibiting educational technology integration in teaching. Doherty

(2011) identified that lack of experience in using technology, inadequate technology infrastructure, inadequate syllabus for technology training, and power problems as factors that militate against teachers to integrate educational technology in teaching.

Studies have revealed lack of equipment, lack of institutional support, and unbelief in the benefits associated with technology integration as some militating blocks to educational technology integration (Buabeng-Andoh, 2012; Shohel & Kirkwood, 2012) and resistance to technology adoption, uncertainties, and misconceptions surrounding the perceived merits and demerits associated with technology, adversely affects its integration by instructors. Moreover, inadequate time allotted to faculty to teach also accounts for the lack of integration (Amanortsu et al., 2014). However, using a scale of 1-5, Alazam et al. (2013) indicated that inadequate IT facilities in lecture theatres, insufficient IT infrastructure, and lack of skills were critical factors impeding lecturers and students' integration of technology into teaching.

2.6 Gender Differences in the Use of Educational Technology for Teaching

Gender disparities in the use of educational technology have been reported in many studies. Gender gaps in educational technology integration in instructional delivery has caught the attention of many researchers and as such, many studies have been done to investigate the scope of the gap (Shashaani & Khalili, 2001). Researchers in the early 1980's reported that women had negative opinions and perceptions about the use of educational technologies than men (Dambrot et al., 1985; Koohang, 1987). Investigations

reported in literature indicated that gender has had intervening effect on the perceptions and attitude about educational technology (Mitra et al., 2000).

In recent years, the integration of educational technology in teaching have immensely affected the mindset of faculty members towards educational technology. Although, there is widespread literature related to male and female attitudes and extent of use of educational technology over the years, such findings may not be relevant contemporarily due to the ever-increasing nature and development in educational technology (Chevers & Whyte, 2015).

The argument about gender differences in educational technology use in teaching begun since the 1980s, and still exists in our society today. Many investigators have revisited the issue on gender difference in technology integration and are continuing to do so. For instance, Houtz and Gupta (2001) found gender disparity on how male and female rated their technology skill. Though both genders expressed positive abilities towards their mastery of technological skills, females rated themselves lower than males. It was also reported in Shashaani and Khalili (2001) that males had significantly higher confidence than females when it comes to their ability to use the computer, even though both genders perceived technology as useful tool for teaching.

Previous studies (e.g., Broos, 2005; Shashaani & Khalili, 2001) showed significant difference that favoured male when it comes to attitudes, extent of use and experience in educational technology than females. While females assumed to be competent in deploying educational technology, they indicated higher anxiety and nervousness levels different from their male counterpart. This is however not surprising as Liaw (2002) had already showed that

females had fewer positive perceptions towards educational technology use than males.

Great proportion of early investigations found that technology experience had great role in lessening gender discrepancy. Meanwhile, other researchers indicated that such technology-related experience might be gender-based. For example, Broos (2005) found that previous technology related experience had favourable effect on males. It was shown that females with a similar technology experience indicated anxiety towards technology while males showed positive attitude towards technology. Todman (2000) found reduction in the technology anxiety in males over time as compared to females.

Notwithstanding, research works regarding gender use of educational technology in teaching have cited female faculty members' low levels of use of educational technology due to low level of skills and lack of interest (Volman & van Eck, 2001). Studies on differences in the use of educational technology for teaching proved that male faculty members utilise educational technology frequently than female faculty members (Kay, 2006; Wozney et al., 2006). Similarly, Markauskaite (2006) found significant inequalities among male and female faculty members in educational technologies for teaching. Males obtained a higher mean score than their female counterpart. Jamieson-Proctor et al.'s (2006) study on teacher integration of educational technology with 929 faculty members found that female faculty members use educational technology more than male faculty members. Nevertheless, Norris et al. (2003) found that gender variable did not predict the use of educational technology among males and females.

Makewa et al.'s (2014) study results showed that both male and female instructors disagreed using technology in the instructional process. Although the mean obtained for males was higher than that of the females, the independent sample t-test result of 0.673 connotes no significant differences between the genders in integrating educational technology in the instructional process. Furthermore, Sahay and Dawson (2019) found no significant differences between genders on integrating technologies in teaching. In Cheers and Whyte (2015), it was revealed that male faculty members (62%) use more educational technology for teaching than females (38%). It was also found that males' level of use of educational technology was statistically higher than females. Besides, some researchers (e.g., Al-Emran et al., 2016; Lewis et al., 2013) found a significant difference between the use of educational technology between males and females. Studies on technology use by males and females in the workplace environment and household have had similar story. Either of these studies showed that men tend to have less experience with technologies and are less competent using technology (Harrison & Rainer, 1992).

Furthermore, females are seen to suffer higher levels of technology anxiety (Igbaria & Chakrabarti, 1990). Morris et al. (2005) found that influence in a person to adopt and use technology differed based on age. Specifically, gender disparity in perceptions towards technology are more among older workers, notwithstanding, a unisex trend of results arose among younger workers. Ono and Zavodny's (2005) comparative study in Japan and USA found significant gender disparities in technology usage in both countries during the 1990s. In 2001, there was no significant difference among the genders in the USA.

However, it persisted in Japan. Some studies have documented noticeable gender disparities. For example, Schumacher and MorahanMartin (2001) found that males have more positive attitude towards technology.

Ong and Lai's (2006) quantitative study on 156 workers of six multinational companies in Taiwan revealed that male's rating of technology self-efficacy, perceived relative advantage and perceived ease of use and intention to employ technology for organizational activities are greater than females. While most investigations have dealt with possible gender disparities among teachers about technology use and adults in the workplace and household settings, few researchers have addressed gender gaps related to faculty usage of educational technology in teaching in higher institutions. The existing studies have showed a contradictory picture. In Spotts et al. (1997), it was reported that male faculty members had greater knowledge and experience in technology use for teaching. The gap was also evident in their responses towards the factors that influence educational technology use for teaching. In their report, female faculty members rated ease of use, limited time to learn and training as key inhibiting factors than male faculty members.

Thompson and Lynch (2003) reported that male teachers were more likely to show confidence in their competence to teach with technology than females. Nevertheless, Anduwa-Ogiegbaen and Isah (2005) did not establish any significant gap between male and female faculty members in their use of technology to teach.

Gerlich (2005) revealed that gender influence faculty perception in technology use in teaching. Parry and Wharton (1995) established that there is gender

disparity in the use of technology. Cockburn and Ormond (1993) argued that the use of technology has traditionally, played a role in our societies. They claim that in the information age, men are the key designers and technology developers. This obviously has caused a gap between female's learning, living styles and on their work. For instance, Wilson (1992) posits that the language used for technology fields is tailored towards males. This possibly isolate females and hinder them from engaging in these fields of learning.

Campbell and Varnhagen (2002) reiterate that some computer applications in education is self-paced and hence tutorials may not be idle for the benefit of women who are more relational learners than men. Besides, gender stereotype in using technology does not favour women. Some researchers (e.g., Okebukola, 1993; Wozney et al., 2006) suggest that higher technology anxiety for women is associated with the sex prejudice of teachers who were found to make various eye contact with male students when discussing technology related issues. Mitchem et al. (2003) indicated that since higher institutions may have been influenced by persistent report on gender related impediment with technology usage, it might be assumed that male faculty members are better than female faculty members when it comes to their perceptions, skills and use of technology. This aspect of the study on gender differences in educational technology use in teaching is important because it has the potential to contribute to the debate on gender differences among faculty members in higher education.

Some existing studies on faculty pedagogy show that female faculty members are more likely to embed instructional decisions in learner's personal experiences and understanding. Female faculty members were described to

like student-centered teaching approaches such as class discussion, student-developed activities and fieldwork compared to male faculty members (Park, 1996).

Since most existing literature have shown gender disparity in technology use for teaching, it is hypothesized males and females have different perceptions and approaches. This difference compared to competencies of technology use is elusive, therefore, difficult to search. Campbell and Varnhagen (2002) posit that women are likely to prefer collaborative and interactive instructional teaching strategies and therefore may prefer the use of technologies that support interaction and participatory teaching.

Falade and Aladesusi (2020) found that about 92 percent males and 87 percent female teachers used technology in teaching. However, a chi-square test showed no significant difference between the genders. As regards the comfortability in the use of educational technologies for teaching, an approximately 77 percent males and 64 percent females were comfortable using educational technology to teach. The independent sample t-test results showed that male faculty members reported a significant higher comfort level of using educational technology to teach. In terms of rating the use of educational technology to teach, the male faculty members tended to rate their technology use higher than females; however, this gender difference was not significant.

Wong and Hanafi (2021) revealed that both males and female faculty members use technology in teaching and that their inspiration to use technology did not have significant differences. Meanwhile, Bowman et al.

(1997) reported a significant difference in lack of time to the use educational technology. In their study, females rated lack of time as a barrier to technology use than their male counterpart. Zhou and Xu (2007) found that gender disparities were significant in three areas namely, unstable hardware or software, inadequate training and limited studies. In terms of motivation to use educational technology in teaching, female faculty members were likely to admit failing behind their male faculty members. According to Campbell and Varnhagen (2002), male and female faculty members approach technology use through different routes. Male faculty members are likely to adopt technology first and apply it in teaching while the females would want to start with instructional needs. Alternatively, female faculty emphasise more on pedagogy than technology integration while the male faculty members emphasise more on technology. Based on the differences in using technology between males and females, they recommend varied models for professional development programmes for males and females faculty members. While male faculty may prefer training emphasising on featuring technology where teaching methods are addressed, females may want pedagogical training where relevant educational technology tools are used. The differences in educational technology use for teaching between genders cannot be neglected. For educational technology to be properly applied in higher institutions, it is suggested that both genders must be afforded equal chance for the use of technology in teaching.

Heafner (2014) concluded that male and female faculty members have the same perception of the variables that affect effective integration of technology in instructional delivery. Male and female teachers in higher institutions

contribute significantly to teaching; therefore, they should have equal opportunities for professional development to equip them with the knowledge and skills to use educational technology to teach.

2.7 Relationships between objectives, theories and conceptual Model

According to Rogers (1995), innovation is used interchangeably with new technology. The DIT theory, as applied in the study, helps to ascertain the educational technology tools/devices available for integration into teaching. The context assessment stage in the conceptual Model supports assessing the nature/types of educational technology tools/devices for teaching. Knowing the nature of technologies and understanding the factors that facilitate their adoption influence their continuous use in instructional delivery (Rogers, 2003). This assumption under DIT theory guides the study to assess the technologies teachers prefer to teach with and their associated factors.

Assessing educational technologies and the factors that influence integration is addressed in the conceptual Model under the context assessment stage. The Diffusion Innovation Theory (DIT) goal as used in the study is to guide the study to unearth educational technology tools or devices frequently used for teaching and the factors that influence technical university faculty members to either embrace and or not use a particular educational technology for teaching as indicated in objectives one and two.

The DIT theory is also helpful in assessing the extent of educational technology integration into teaching. The key tenents of the theory have it that the ability to continuously use a given technology is characterised by five key elements, namely, the associated benefits of the technology, its compatibility,

the complexity of the technology, the ability to access it, and the availability of the technology for use. As used in the study, these elements are assessed based on the context of institutions as clearly spelled out in the conceptual Model. The Model assists in understanding the background characteristics of faculty members and the number of times faculty would use educational technology for teaching.

The TPACK Model by Koehler and Mishra (2009) provides the basis for exploring the technological knowledge of the teaching staff into the application of the principles, theories, and methods of teaching and the design of course contents. The TPACK Model helps to explore teaching staff experiences and attitudes towards integrating the three sets of knowledge for teaching. The SAMR model by Puentedura (2006) guides the study to assess educational technology integration into teaching outcomes. The ability to substitute and augment existing teaching practices enhance teaching in the classroom. It is used to assess the outcomes of educational technology integration into teaching.

The context assessment, which defines the goals of the assessment, helps to assess the needs and opportunities within a defined context (Stufflebeam & Shinkfield, 2007). The objectives of context assessment are defining, identifying, assessing, and addressing the needs of the target population. It also identifies the problems, resources needed, the environmental and institutional factors, and whether the goals are responsive to the desired needs (Stufflebeam, 2001). The use of context assessment as applied to assessing educational technology integration in teaching is to assess the nature and type of educational technologies needed for teaching. It also assesses the factors

associated with educational technology integration in teaching. Additionally, Gruba and Chau (2019) and Schrum et al. (2011) pointed out the need to assess challenges/problems that are likely to obstruct an effective integration of educational technology. An appreciation of the challenges associated with educational technology integration would serve as a baseline upon which final assessment of outcomes could be ascertained to determine the effectiveness and the extent to which educational technology is incorporated into the teaching process (Alazam et al., 2013).

The input assessment stage provides information for determining the experiences, characteristics of teachers and their strategies. The stakeholder assessment applied to integrating educational technology integration involves assessing lecturer's experiences, characteristics about their attitudes and perceptions in integrating educational technology in teaching. The strategies indicated in the input assessment include an assessment of the existing pedagogical practices and teachers' teaching philosophy.

According to Choi (2018), variables upon which an assessment of educational technology integration in teaching is measured include the characteristics of the teacher and their teaching methods. Adedokun-Shittu and Shittu (2014) pointed out that teachers play a significant role in ensuring effective implementation and assessment of technology integration. Shohel and Kirkwood (2012) posit that the extent and effectiveness of technology integration in teaching are mainly dependent on the teacher attitude or characteristics.

The process assessment refers to the actions for implementing, monitoring, and soliciting feedback for improvement. This is where technology is integrated into teaching to enhance pedagogy. To ascertain the effectiveness of integrating educational technology in teaching, it is expedient to assess the extent it enhances teaching, research, communication, presentation, and assessment (López-Pérez et al., 2013). Besides, an assessment of educational technology integration could also be compared against the extent it improves faculty-teaching outcomes by exploring, interacting, creating, innovating, and developing critical thinking and problem-solving skills (Ghavifekr & Rosdy, 2015).

The focus of the product assessment is not only limited to improvements it brings in teaching but the improvement in skills, change in attitudes and enhancement of knowledge (Stufflebeam & Shinkfield, 2007). It is in the product stage where the enhancement of educational technology integration in teaching is measured to ascertain the improvements it has on teaching outcomes. For this study, the number of times faculty members employ educational technology to substitute and augment teaching as indicated in the SAMR model is used to measure the relationship between educational technology and enhance teaching.

Figure 2.9 shows the relationship between the study objectives, theories, conceptual model and research approach.

The Relationship between Research Objectives, Theory and Conceptual Model

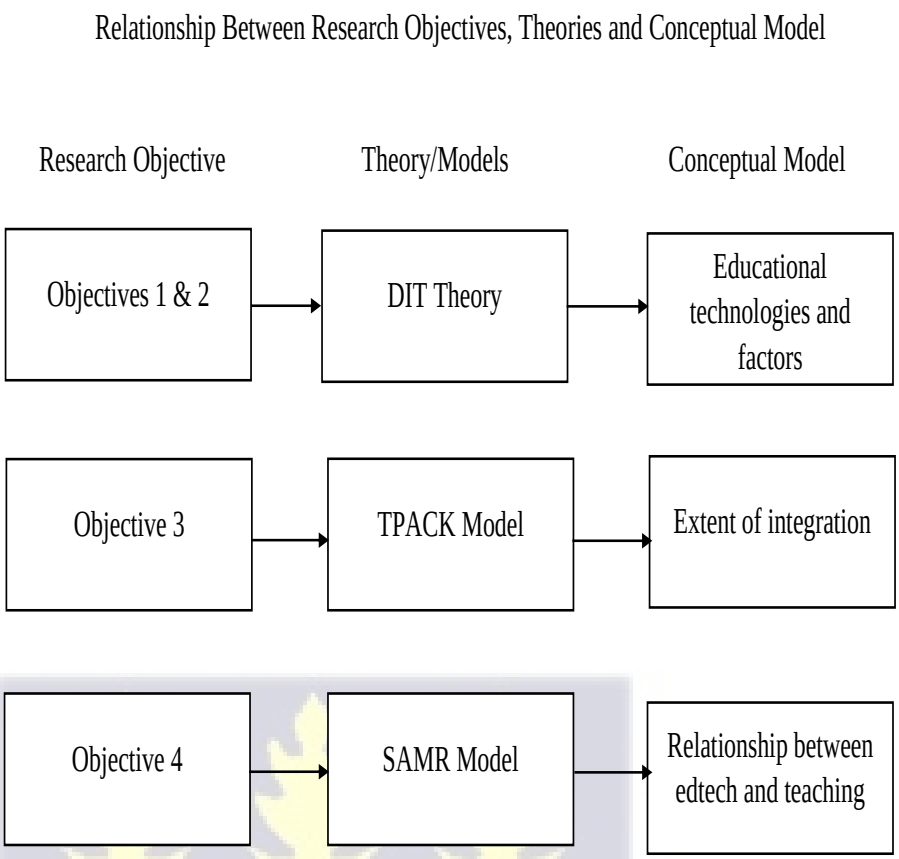

Figure 2.9: The Relationship between Study Objectives, Theory and Conceptual Model

2.8 Summary

The chapter introduced the theories (DIT, TPACK, SAMR and CIPP) and the conceptual model that guided the study. It also revealed empirical evidence based on the themes in the objectives in chapter one. Further, it illustrated the relationship between the theories, study objectives, conceptual models, and research approach.

Although a number of research have been done in Ghana on educational technology integration into teaching in institutions of higher learning, little is known about how the integration is assessed in the country's technical

universities. The chapter revealed literature on the nature of educational technology tools or devices used for teaching, the frequency of use of the educational technology devices for teaching and the factors that facilitate or inhibit the continuous use of educational technology in teaching. The final part of the literature review was on the extent of use of educational technology for teaching among male and female faculty members and the relationship between the continuous use of educational technology to enhance teaching. The next chapter describes the research methodology used for conducting the study.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter presents the methodological processes informing this research. Areas covered include a description of research settings, philosophical assumption, approach, design, population, sampling techniques, sample size, inclusion and exclusion criteria, data collection, method, pre-testing, validity and reliability, data cleaning, data analysis, ethical consideration, and summary.

3.1 Research Settings

This research was conducted in two settings. First is the Takoradi Technical University (TTU), formerly called Takoradi Polytechnic, a public tertiary institution in Ghana. The institution was established in 1954 as a Technical Institute. The institution is located in Sekondi-Takoradi Metropolis, the capital city of the Western Region of Ghana, one of the country's industrial hub. In its early days, the institution was mandated to train people as artisans and technicians for industry. The City of Guilds in the United Kingdom awarded certificates to graduates. In the early 1990s, the award and certification of the institute's graduates were taken over by the Ghana Education Service (TTU Website, 2019). The coming into being of the Provisional National Defense Council Law (PNDCL) 321 upgraded the institution to the status of Polytechnic by the Polytechnic Act (Act 745). This reform enabled the institution to run tertiary programmes to complement the universities' efforts in the country. In 2016, Takoradi Polytechnic was elevated to the status of a

Technical University by the Technical University Act of 2016 Act 922, hence the name Takoradi Technical University (TTU website, 2019).

Takoradi Technical University has three campuses. The New Site campus, which is the main campus located at New Site, a suburb of Takoradi. The other two campuses, one is located at Botumagybu, popularly referred to as BU, and the other campus is at Akatakyi in the Agona Nkwanta, in the Agona West District of the Western Region (TTU website, 2019). The University presently has five (5) faculties, namely: The Faculty of Applied Sciences, the Faculty of Business, the Faculty of Applied Arts and Technology, the Faculty of Engineering, and the Faculty of Built and Natural Environment. Alongside the faculties, the institution has several departments and centres that run different programmes. Currently, the institution runs both tertiary and non-tertiary programmes, e.g., Higher National Diploma, Bachelor of Technology, and Master of Technology programmes (TTU's Congregation Brochure, 2018). The teaching staff population of TTU is three hundred and eighty-four (384).

The second setting for this research was the Koforidua Technical University. It is also a public institution and among the first six polytechnics in Ghana upgraded to university status by the Technical University Act of 2016, Act 922. The Koforidua Polytechnic, now Koforidua Technical University, was established in 1997. The University was created to produce high-level career-oriented and skilled human resources for industries and the sustained growth and development of the economy. The institution, since its establishment, has produced thousands of human resources with degrees, Higher National

Diploma (HND), and certificate programmes in several disciplines in areas such as Engineering, Arts, and Business (KTU Website, 2019).

Presently, the University has five (5) faculties with several departments. These faculties include the Allied and Health Science Faculty, the Faculty of Business and Management Studies, the Faculty of Applied Science, the Engineering Faculty, and the Faculty of Built and Natural Environment. Besides, the University also has the Open and Distance Learning Institute. With two academic programmes from the institutions' inception in 1997, it has grown in several programmes, and currently, it has twenty (20) HND programmes and about thirteen (13) Bachelor of Technology programmes. In addition, the institution has a teaching staff of about two hundred and ninety-seven (297) and a student population of close to ten thousand (Ghana Web, 2019).

Takoradi Technical University and Koforidua Technical University were purposively chosen for the study due to the similar characteristics the two institutions possess in terms of their core mandates to train human resources with the requisite technological competencies for the industry. Also, as part of the institutions' effort to make educational technology integration a center to teaching, they have procured the necessary logistics and instituted policy Models to ensure adequate educational technology integration in the instructional process. Furthermore, through their industrial attachment programmes, the institutions have established collaborations and links with industry to provide their students with hands-on technical training and skills. Besides, these institutions continue to put in relentless effort to make educational technology integration an integral part of the teaching process and

to equip students with the necessary job-related technology-based skills for the industry.

3.2 Research Paradigm

This research aligns with the philosophical assumption of pragmatism, which ascribes ontologically to both universality of reality and multiplicity of it for research to serve a functional purpose. It also has to hold epistemologically both objectivity and subjectivity in the research process (Tashakkori & Teddlie, 2010). According to Guetterman et al. (2015), pragmatism refutes the positivist and constructivist standpoints about truth and reality and concentrates on what is best as an ideal approach to investigating a phenomenon integrating research views. Thus, the pragmatism perspective of research focuses on the importance of the research questions and employs several data collection techniques for a study (Creswell, 2013). In addition, pragmatism requires inductive and deductive critical analysis to have a varied perspective on reality (Creswell & Clark, 2011).

In Tashakkori and Teddlie's (2012) view, the specialty of pragmatic research is its ability to unravel the inquiry process in the most practical way. The essence of situating this research within the pragmatist philosophy was to enable the researcher to have a broader perspective of the underlying issues affecting the assessment of educational technology use in teaching. It was also to bring together the two extreme paradigms of positivism and interpretivism/social constructivism. The purpose was to forestall any weaknesses that might occur due to relying on one or the other of the paradigms (Creswell & Clark, 2017; Mayoh & Onwuegbuzie, 2015).

3.3 The Research Approach

Researchers' philosophical stance influence the approach they use in their research (Creswell & Clark, 2017). Influenced by the pragmatist philosophy, this research combined both quantitative and qualitative inquiries into a single mixed-method approach. According to Tashakkori and Teddlie (2010), the mixed-method approach involves collecting both numeric and data expressed in words. The two data sets are incorporated to give a holistic picture and broader perspective of a phenomenon. Therefore, the mixed-method approach is ideal for this research as it allows the capturing of trends and facts about the research problem.

In this research, the quantitative approach was used to collect the numerical data, which was subjected to statistical analysis to determine averages, and to establish relationships and differences among variables under investigation (Hoe & Hoare, 2012). It employs the positivist view, which supports testing theories and assumptions (Arghode, 2012). The qualitative approach underpinned by the constructivist view was also used to elicit detailed non-numerical information that could not be obtained via the quantitative approach. The qualitative data helped give a comprehensive picture of the phenomenon investigated (Palinkas et al., 2015).

3.4 Research Design

This study used the Embedded Mixed Method Design (EMM). Creswell and Clark (2010) described EMM as a kind of design that combines the collection and analysis of quantitative and qualitative data within a traditional qualitative or quantitative research approach. Collection and analysis of secondary data may occur before or after the traditionally related approach. Accordingly, this

study belongs to the EMM research design strategy, where a complementary qualitative study is embedded within a primarily quantitative study (Creswell & Clark, 2010; Johnson & Onwuegbuzie, 2004; Johnson et al., 2007). In this design, mingling the qualitative aspect within the primacy of a quantitative approach occurs after data collection and analysis of the quantitative data (Creswell & Clarke, 2017).

The choice of the design enabled me to give a holistic picture and broader perspective of the extent to which university teachers used educational technology to enhance instructional delivery. One unique feature about the embedded mixed method design for the study was that the overall investigation was guided by the quantitative method, which gives direction to the research (Creswell, 2014). The complementary data set helped to heighten the overall study (Creswell & Plano, 2007).

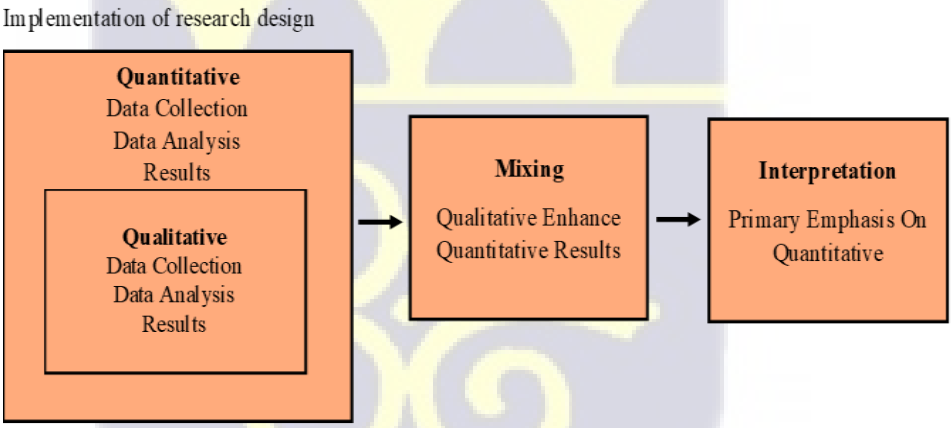

Figure 3.1: Implementation of Research Design

Source: Creswell, J. W., & Plano Clark, V. L. (2007). Designing and conducting mixed methods research. Thousand Oaks, CA: Sage.

3.5 The Population

Acharya et al. (2013) describe the population for a research study as collecting persons or objects who constitute the primary focus for an investigation. According to Knipe & Makkenzie (2006), the population is classified as a well-defined collection of objects or people with similar features. Kotrlik and Higgins (2001) define an accessible population as the population in which investigators can relate their conclusions. For this study, the population was all teaching staff in technical universities in Ghana. The sample population was obtained from the teaching staff of the Koforidua and Takoradi Technical Universities. The total population of teaching staff in the universities was 681. This comprised 384 from TTU (Office of Human Resource Division, 2019) and 297 from KTU (Office of Human Resource Division, 2019).

3.6 Research Approaches

Quantitative

Rovai et al., (2014) describe quantitative research as a deductive approach towards an investigation. Quantitative researchers see the world as being outside of themselves and that there is an objective view or reality autonomous or independent of any observation. Quantitative researchers are ascribed to the positivist school that contend that by subdividing this reality into manageable pieces, reality can be understood. They argue that it is within these subdivisions that observation can be made and that hypothesis can be tested to establish relationships and differences among variables. The quantitative approach is characterized by using a theory that is exemplified within a particular hypothesis which is subsequently tested, conclusions made and inferences drawn with reference to the hypothesis following series of

observations and data analysis. One characteristic of this research approach is that, data collection and analysis are conducted using mathematically based techniques (Aliaga & Gunderson, 2000; cited in Muijs, 2011, p. 1) which focus on polls or survey aimed at collecting numerical data and generalizing it across larger group of people (Babbie, 2010).

Qualitative

Qualitative research aims at exploring and understanding the lived experiences of persons or groups of persons within a social setting (Creswell, 2014). This strategy to research is described by Denzin and Lincoln (2005) an approach to understanding a perspective of issues by investigating peoples own experiences based on specific context or situation and deriving meaning. Qualitative research approach is usually described as an inductive with fundamental assumption being that reality and knowledge is socially constructed and that variables are hard to measure, interwoven and complex and that this is primacy subject matter and that solicited data will be of an insider's viewpoint (Rovai et al., 2014). This approach to an investigation emphasis of social justice, culture and individuality which provides broad and rich context and content information. Though the information is subjective in nature but it is current (Tracy, 2013).

3.7 Designs

Quantitative

A cross-sectional survey was used for the study. The survey was used to determine certain practices, which helped identify and describe relationships among and between variables (Arghode, 2012). Almalki (2016) asserts that surveys are ideal designs to be used when an investigator is interested in

collecting numerical data from a large group of research participants. It is also less expensive to use. Additionally, surveys provide an opportunity to reach many study participants quickly (Arghode, 2012; Goddard & Villanova, 2006).

Wilkinson & Birmingham (2003) emphasised that the survey instrument is an effective tool to collect a vast amount of data with less effort from the vast majority of respondents. Besides, the survey is structured and manageable (Kothari 2004). Another critical merit of using the survey is that it requires a limited amount of training to develop, and the results obtained could be analysed easily. Hoe and Hoare (2012) indicate that data collected through the survey helps identify associations and relationships among quantifiable data. Furthermore, the anonymity of study participants is protected (Lampard & Pole, 2015).

Qualitative

The case study design was used for the qualitative part of this study. A case study is an in-depth study of a specific phenomenon. Creswell and Clark (2017) described a case study as a detailed, intensive, systematic study of a person, group, community or other units in which an investigator explores in-depth data associated with several variables. Case studies are good for exploring, describing, evaluating, comparing and understanding various aspects of a research problem. A case study research design was used in this study because it helped to gain concrete, contextual, in-depth knowledge about educational technology integration in teaching. It helped to explore the key characteristics, meanings, and implications of the study phenomenon. This research design usually focusses on a neglected, unusual and cases which

would throw more light on a phenomenon. In this study it focused on the lived experiences of teaching experiences of technical university teachers in educational technology integration in teaching.

3.8 Sampling techniques

Quantitative

The study used the simple random sampling technique to select university teachers for the study. The simple random sampling technique offered each participant of the various faculties in the two institutions (Koforidua and Takoradi Technical Universities) an equal chance of being selected for the study (Cooper & Schindler, 2014).

Qualitative

The homogeneous purposive sampling technique was used to select participants for the qualitative study. This aimed to achieve homogeneous sample i.e., sample whose units share the same or very similar characteristics or traits (Creswell & Clark, 2011) and provide adequate information on the subject matter (Etikan et al., 2016).

3.9 Sample size

Quantitative

Dworkin (2012) and Mason (2010) advocate that any sample chosen for a study must be representative to permit statistical analysis, draw conclusions, and make inferences. For the quantitative part of this study, Yamane's (1967) formula for sample size determination was used to calculate a sample size of 252 from a population of 681 (TTU=384, KTU=297) from the two institutions. Based on the population distribution of the two institutions and

their faculties, a simple proportion was used to determine the number of participants from each institution and faculty to participate in the study. Table 3.1 presents the sample size distribution of the two institutions.

Total population

KTU teaching staff =297

TTU teaching staff =384

Total 681

$$n = \frac{N}{1+N(e)^2}$$

Where:

n= sample size

N=population

e=margin of error (0.05)

$$n = \frac{681}{1+681(0.05)^2} = \frac{681}{1+1.7025} = \frac{681}{2.7025} = 252$$

Teaching Staff KTU

$$n = \frac{297}{681} \times 252 = 110$$

Teaching Staff TTU

$$n = \frac{384}{681} \times 252 = 142$$

Table 3.1: Sample size

Institution	Population	Sample size
KTU	297	110
TTU	384	142
Total	681	252

Source: Fieldwork (2020)

Qualitative

Lune and Berg (2017) recommend that to support the depth analysis, which is central to qualitative research, the sample size in qualitative inquiry should be small. Creswell (2002) suggested a sample range of 10-20 for qualitative research. For this study, a sample size of 14 respondents was used. This comprised the two (2) Pro Vice-Chancellors of the two technical universities, and ten (12) faculty members (6 from each University).

3.10 Reliability and validity

Quantitative

Both numeric and narrative instruments were piloted at Cape Coast Technical University (CCTU). CCTU was chosen for the pilot exercise because the teaching staff have similar characteristics as those in KTU and TTU. The questionnaire was given to twenty-six (26) teaching staff, which constituted about 10% of the sampled population, to gather their responses from the research subjects. The aim was to correct errors and inconsistencies in the instrument. Ambiguous questions were rephrased to give clarity before the central administration was done. The comments of the participants were also

inserted before the actual administration of the instrument. After designing the semi-structured interview, it was also pre-tested at the same institution in late May 2020, with some teaching staff who had the chance to respond to the pre-tested questionnaire.

The Cronbach's Alpha reliability coefficient was used to test the internal consistency of the quantitative instrument. For a test to be internally consistent, reliability estimates are based on the average inter-correlations among all the single items within a test. The author calculated the internal consistency coefficient for each dimension using the Statistical Package for Social Sciences (SPSS) version 21 software. According to the test results, the Cronbach Alpha internal consistency coefficient was found to be 0.80 for the attitude dimension, 0.72 for the educational technology dimension, 0.75 for the extent of integration, 0.85 for the factor dimension, 0.90 for the social media dimension, and 0.66 for outcome dimension. This is an indication that the instrument was reliable. Table 3.2 shows the reliability test of the items in the instrument.

Table 3.2: Instrument Reliability

Variable	Items	Cronbach alpha
Educational technologies	14	0.72
Extent of integration	10	0.75
Factors	12	0.85
Outcomes	6	0.66
Attitude	9	0.80

Source: field survey (2020)

Qualitative

Several definitions and criteria for trustworthiness exist, but the best-known criteria are credibility, transferability, dependability, and confirmability, as defined by Lincoln and Guba (1985). To ensure the credibility of the data, strategies like the member check were used. Regarding the use of member check, all transcripts of the interviews were sent to the participants for feedback. In addition, a meeting was held with interviewees to assess the interpretation and resolve what they perceived to be 'wrong' interpretations. Finally, the findings were presented to the participants for confirmation.

To ensure transferability, thick description and purposive sampling were used. Detailed description promoted credibility as it helped convey the actual situations investigated and, to an extent, the contexts surrounding them. To ensure dependability, peer scrutiny of research findings was done. Opportunities for scrutiny of the research by colleagues, peers, and academics were welcomed. The questions and observations enabled the researcher to refine and develop a good explanation of the research design, and strengthen arguments in the light of the comments made. Audit trail was used to ensure the confirmability of the narrative data.

3.11 Data collection method

Quantitative

The methods for collecting data for the quantitative part of this study was the questionnaire. A questionnaire is a research instrument usually used for a survey study. It consists of series of questions and possible options, printed or typed in sequence on a form used to specifically to solicit specific information from used from research participants. The set of questions on a questionnaire

contain both closed-ended or multiple choice and open-ended questions. It is used to collect data from a very large group subjects on a particular research topic. The use of questionnaire has several advantages which include its uniformity. All study participants respond to the same set of questions. It is less expensive method, free from bias of the investigator. It also offers study subject adequate time to think and respond to the questions in their own words. Because of its large coverage, study participants residing in distant areas can easily be reached.

Qualitative

Among the various data collection methods used in qualitative research, this study used interviewing. Interviews consist of soliciting data by asking question either by face-to-face or via telephone or by video conference. Data can also be obtained by listening to study respondents, filming and by recording or both. This data collection method is usually used to gather data either from a small group of study participants on a broad range of topics. Interviewing is more personal and it allows the researcher to obtain a higher response rate. It also allows for the control over the order and flow of questions. Using interviews allows an investigator to make necessary changes in and ask probing questions to solicit a more detailed response from research participants.

3.12 Instrumentation

Quantitative

A self-developed structured questionnaire was used for this research. The questionnaire had eight sections. The first section ("A") was on the demographic background of respondents. The second section ("B") elicited

responses on the university teacher's attitude towards educational technology. The third section ("C") dealt with kinds of educational technology tools university teachers often applied in their instructional delivery. The fourth section ("D") collected information on the extent university teachers deploy educational technology in instructional delivery. The fifth section ("E") solicited information on the factors that affect university teachers to integrate educational technology in teaching. The sixth section ("F") sought for information concerning the outcomes of educational technology use for teaching. All the items on the questionnaire were designed according to the authoritative views expressed in the reviewed literature. The items were put on a five-point Likert scale in all the sections as follows: Section "B":1-strongly disagree; 2-disagee; 3-neutral; 4-agree; and 5-strongly agree. Section "C": 1–never used; 2–rarely used; 3–occasionally used; 4– frequently used; and 5–more frequently used. Section "D": 1–very little extent; 2–little extent; 3–some extent; 4–great extent and 5–very great extent. Section ("F") 1–strongly disagree; 2–Disagree; 3–Unsure; 4–Agree; and 5–Strongly agree.

Qualitative

The semi-structured interview guide was used to collect the narrative data. The semi-structured interview for teaching staff was made of 18 questions. The merit associated with using semi-structured interviews is that it allowed the investigator to probe further to elicit detailed responses from participants. It also gave the researcher the freedom to refine and pose more enhanced questions than initially planned ones (Phellas et al., 2011). The semi-structured interview aimed at collecting detailed description of teaching staff experiences on educational technology integration in teaching. Some of the

significant questions included: What is your view on incorporating educational technology into teaching? How often do you integrate educational technology into your teaching? What specific educational technology devices do you usually integrate into your teaching? Which activities do you employ these technologies to perform in your teaching? What challenges do you encounter in your quest to integrate the identified educational technologies into your teaching? Since you started working in the institution, have you had any training in educational technology? If yes, how many times and in which specific area? Do you think you would need further training in educational technology? How has the integration of educational technologies in teaching helped your teaching?

3.13 Administration of Instrument

Quantitative

Data collection exercise was done using the self-constructed questionnaire and it took between May 28 and July 30, 2020. The questionnaires were first administered to the faculty members of TTU and then KTU staff. Out of the one hundred and ten (110) questionnaires administered to university teachers at KTU, 101 were retrieved representing 92% response rate. Besides, out of the one hundred and forty-two (142) questionnaires administered to lecturers at TTU, 124 were obtained indicating 87% retrieval rate. Due to the break of the COVID 19 pandemic that led to the closure of all institutions in the country, data collection for staff in TTU was done online. When the institutions reopened, later in June, the researcher visited KTU to collect the data from the teaching staff personally with the support of the research assistant.

Qualitative

The interviews were held soon after the quantitative analysis had ended. The interviews with the teaching staff at KTU were held before the teaching staff at TTU. All the interviews held with the teaching staff were by telephone conversation. Meeting teaching staff face-to-face was impossible due to the fear of contracting COVID 19. Besides, all the participants preferred the telephone interview. The interview was done with teaching staff who took part in the quantitative study. The interview with the teaching staff took between 40-45 minutes. The interview with the teaching staff of the two universities was done from July 16 to July 30, 2020.

The last part of the interviews was with the Pro Vice-Chancellors of the two universities. This was also done via telephone interactions. As stated earlier, the choice of telephone interview was ideal due to the outbreak of the COVID 19 pandemic. The duration with the Pro Vice-Chancellors lasted between 40-50 minutes.

3.14 Data analysis

Quantitative

Based on the design used for the study, the quantitative data were first analysed (Tashakkori & Creswell, 2007; Onwuegbuzie & Leech, 2006). The numeric data were analysed using descriptive and inferential statistics. The SPSS software version 21 was used to analyse the numeric data. Finally, the frequency of educational technology integration and factors that affect educational technology integration were analysed using descriptive statistics while inferential statistics (independent samples t-test and Pearson Product Moment Correlation) were used to analyse the differences in the educational

technology integration between the genders and the relationship between educational technology and enhancement in teaching respectively.

Qualitative

In this study, Braun and Clarke's (2006) thematic analysis model was used to guide the analysis of the narrative data. The model is a flexible and a beneficial technique in analysing narrative data. The stages involve proper and adequate familiarisation with the data, generating code, developing themes, defining and refining themes, and writing the report. The data were analysed manually. The analysis involved organised and systematic processes that required recording data, transcribing the recorded interview, familiarising with the data, selecting data set from the volume of data collected, coding the ideas, assigning codes to the themes, categorising the themes and lastly, describing and explaining based on the themes. All the categories were carefully labelled based on the literature.

A mobile phone recorder was used to record the interview. The audio recordings were transferred onto laptop and saved both on CD and USB drive, and kept in a secured place. The written note was also taken as a backup. It also provided the context of the interview. Word for word transcriptions of the recorded information collected from faculty members were done. I spent time to read carefully the transcription to get accustomed to the data to analyse and interpret it correctly.

Further, I read the transcribed text many times to identify repeated phrases, relationships, patterns, keywords and ideas that captured the core of the research question. The next stage was to code the data. This involves

highlighting part of the text mostly phrases and or sentences and coming out with codes or labels to attribute their content. Some of the phrases were highlighted in various colours relating to different codes. Each of the codes described an idea or feeling articulated in the part of the text. I read through the transcripts repeatedly of every interview and highlighted every information that cropped up as relevant to the discussion. All phrases and sentences that match a particular code were also highlighted. New codes were added as I kept reading through the text. After having gone through the text several times, I collated the data and grouped them into their identified codes. Codes that were interconnected were listed in groups based on a model from the empirical evidence (Punch, 2013). The codes helped to gain an understanding of the key points and common meanings that recur in the data. The next activity was to come up with the themes. The themes were generated by looking over the codes created, identify patterns between and among them and begun coming up with the themes. Because themes are generally broader than codes, many codes were integrated into single theme(s).

The various codes were assessed for relevance to the aims of the research. The associated units of importance or meaning from the notes were assigned to the last categories. Furthermore, a short introduction of the main components that involved verbatim responses/quotes as in illustration or examples that were considered appropriate was made to improve study participants' main views. Participants' transcripts were thoroughly read several times to help understand the data and tailor the focus of the analysis to the relevant construct. Reading and re-reading participants' transcripts helped understand the data and helped to focus the analysis on appropriate constructs.

The data from the transcripts were compared for differences and similarities before assigning codes. Lastly, narrations were done to describe and connect the themes that answer the research question. Finally, the qualitative analysis ended with a description of thematic patterns and associations relevant to the study. These thematic relationships and patterns identified aided in the interpretation process and supported the whole analysis of the research findings.

Inclusion and exclusion criteria

Inclusion and exclusion criteria in research are predefined characteristics used to group study subjects who are to participate in the study and those to be exempted from the study. According to Johnson (2004), inclusion and exclusion criteria in research comprise selecting participants eligible or ineligible for a particular study. Careful selection of participants in a study enhances internal and external validity and minimises ethical concerns. For this study, the inclusion criteria were all teaching staff who have continuously used educational technology to teach for at least a semester. This was based on the assertion that they might have gained experiences and knowledge in educational technology used for teaching and therefore could speak to the issues in the research instrument. Newly recruited faculty members who had not taught at for least a semester were excluded from the study during the data collection.

3.15 Research Assistant Training

One research assistant who was a teaching assistant at CCTU was trained to support the researcher in the data collection exercise. The research assistant

had a background in management studies. The nature of the research and the guidelines were explained to the research assistant. The orientation was to brief him on the study's objectives and acquaint him with the instrument. The necessary clarifications were spelt out to him. Besides, he was taken through the ethical issues in the research. The orientation was to ensure that the data collected is reliable, valid and meets standards. The research assistant worked with the researcher until data about the two institutions were collected.

3.16 Data Cleaning

Firstly, basic frequencies were run for each code variable. The sections in the dataset which were wrongly inputted were identified and corrected. For example, in the data view in the SPSS, a code was entered as 23 instead of 3. There were no missing values. Cells with irregular values like 23 were cross-checked and corrected by tracing their respective questionnaire numbers for the proper responses. Besides, the questionnaire was sampled and cross-checked to ascertain if the responses were correctly entered. Finally, all the datasets were checked alongside the real answers from the survey. The online survey was carefully checked to ensure rows and columns align with the ones in the SPSS.

3.17 Ethical Consideration

Ethics in research is about treating research participants in a manner that will not infringe on their human rights and fundamental freedom (MacColl et al., 2005). Furthermore, it is about respectfully treating study participants considering their likes and dislikes in the research process (Banks et al., 2013).

Research ethics was ensured throughout the study. An account of how ethics was ensured is presented below.

The title of the research proposal was subjected to rigorous review, defended at a faculty seminar and subsequently approved. Besides, two technical universities for the study gave written permission for the study to be carried out in their institutions. An implied consent form was used for the web-based questionnaire survey. The implied consent form was used when the researcher nor the intended participants could not meet to sign the consent form (Tracy, 2010).

Even though the research did not involve any risks to research participants, a written consent form was obtained before their involvement in the study. Ethical clearance was sought from the University of Ghana Ethics Committee to ensure confidentiality and to check that the participants' rights were not disregarded and abused. The participants were given consent forms on which the purpose of the investigation was explained to them. In addition, participation in the research process was voluntary, and participants could withdraw whenever they felt so.

Investigators use various techniques to keep the identity of research subjects confidential. In this study, data gathered was kept confidential using password-protected files, locked doors, and drawers. Codes were ascribed to data, so it would be impossible to track and trace study participants' responses with identifying information. In addition, aggregate findings and not person-level data were reported in the study. Notwithstanding, confidentiality issues were also addressed during data collection. During this stage, study subjects

were assured confidentiality using the consent forms. For example, the study participants were informed that identifying features like occupation, place of work, ethnic background and units or departments would be changed. The issue of secrecy of data agreement was presented at the initial stage of the data collection process. Discussing confidentiality of data at the beginning of data collection enabled the study to obtain informed consent and build trust and confidence with participants. Again, during data cleaning, confidentiality issues were addressed. Any identifier was removed to create a clean data set. The data set did not have any trace of information that may identify study subjects. For instance, the names of study subjects were replaced with pseudonyms. Female Faculty Member (FFM) and Male Faculty Member (MFM).

3.18 Summary

This chapter discussed the methodology of the study. The philosophy that underpinned the study was Pragmatism. The approach was the mixed method and the design, embedded mixed method. The chapter also described the settings for the research and justification for their selections for the study. It further described the instruments for data collection and the need for their use. The study settings were Koforidua and Takoradi Technical Universities.

In addition, the chapter provided a detail account on the techniques for selecting participants, the sample of the study and the justification for inclusion and non-inclusion of certain participants for the study. It provided account of how the instrument was validated to ensure that it was credible and therefore able to collect the information required for the study. It also provided evidence of anonymity and confidentiality of information obtained, and

explained how data obtained were analysed to reflect the objectives of the study. The next chapter presents the analysed data obtained from research participants in accordance with the objectives of the study.

CHAPTER FOUR

PRESENTATION OF RESULTS

4.0 Introduction

This chapter presents the results based on the research questions and hypothesis of the study.

Quantitative Results

4.1 Demographic Information of Respondents

Table 4.1 presents the background information of respondents. Out of the 225 respondents on which the data analysis was based, 101 (i.e., 44.9%) were from Koforidua Technical University, whilst 124 (i.e., 55.1%) were from Takoradi Technical University. The majority (82.7%) were males, whilst 39 (17.3%) were females. The majority (50.2%) of respondents were between the ages of 41 – 50 years; about 37.3 per cent of the respondents were between the ages of 21 – 40 years. About 69.8 per cent of the respondents had obtained masters' degree honours, whereas about 23.5 per cent (i.e., .22.2% + 1.3%) had their PhD or Post-doctoral degree. About the teaching experience of the respondents, the results revealed that about 49.3 per cent (i.e., 16.4% + 32.9%) had taught for between 1 – 10 years, whilst the majority (50.7%) had between 11 – 16 or more years of teaching experience. Given these levels of teaching experience, it is expected that the teachers would be in a better position to integrate technology in teaching at the tertiary level of education.

Table 4.1: *Background information of respondents*

Variables	Categories	Frequency	Percentage (%)
Institution	KTU	101	44.9
	TTU	124	55.1
Gender	Male	186	82.7
	Female	39	17.3
Age	21-30	14	6.2
	31-40	70	31.1
	41-50	113	50.2
	51-60	28	12.4
Qualification	First degree	15	6.7
	Masters' degree	157	69.8
	PhD	50	22.2
	Post-doctoral	3	1.3
Years of experience	1-5 years	37	16.4
	6-10 years	74	32.9
	11-15 years	76	33.8
	Above 15 years	38	16.9

Source: Field Work (2020)

The next session presents the results of the research questions of the study.

Research Question 1

What are the educational technology devices most frequently used for teaching in Ghanaian technical universities?

4.2 Educational technology devices most frequently used for teaching in Ghanaian Technical Universities

Table 4.2 presents the results of educational technology devices used for teaching in Ghanaian technical universities.

Table 4.2: *Results on educational technology devices frequently used for teaching.*

Educational technologies	N	M	SD	Mean Rank
Laptops	225	4.28	1.32	1
Mobile phones	225	3.94	1.42	2
Projectors	225	3.75	1.27	3
Desktop computers	225	3.03	1.48	4
Television sets	225	2.99	1.63	5
IPads	225	2.10	1.57	6
Smartboard	225	1.81	1.19	8
Digital cameras	225	1.61	1.08	7
Speakers	225	1.52	1.11	9

Scale: 1 never used, 2 rarely used, 3 occasionally used, 4 frequently used, 5 more frequently used

Source: Field Work (2020)

Table 4.2 presents the means and standard deviations of the various educational technology devices used for teaching in Ghanaian technical universities. The results in the table indicate that the laptop was the frequently used educational technology device for teaching by the faculty members (M=4.28, SD=1.32), followed by the mobile phone (M=3.94, SD=1.42). A standard deviation of 1.32 indicated that most responses were not clustered

around the mean and that the responses were not homogeneous. The 'speaker' was the least used educational technology device for teaching (M=1.52, SD=1.11).

Research Question 2

What factors affect educational technology used for teaching in Ghanaian technical universities?

4.3 Factors that Affect Educational Technology Use in Teaching

Table 4.3 presents a summary of the field data on what respondents' thought were the factors that influenced their use of technology in instructional delivery.

Table 4.3: *Results on the factors that affect educational technology used for teaching*

Factors	N	Mean	SD	Mean Rank
Inadequate educational technology devices	225	4.00	1.08	1
Inconsistent internet connectivity	225	3.99	1.89	2
Lack of technical support system	225	3.90	0.99	3
Lack of institutional support for using educational technology	225	3.87	1.19	4
Frequent power outages	225	3.48	1.30	5
Poor students' attitude towards the use of educational technology	225	3.05	1.30	6
Lack of time to plan and use educational technology in teaching	225	2.97	1.24	7
Difficulty in learning using educational technology	225	2.92	1.40	8
Lack of leadership support	225	2.77	1.55	9

N=225, 1=strongly disagree, 2 disagree, 3=uncertain, 4=agree, 5=strongly agree

Source: Fieldwork (2020)

From Table 4.3, the mean and standard deviation scores for inadequate educational technology resources for teaching obtained the highest values (M=4.00, SD=1.08). A standard deviation of 1.08 indicates little variability in the responses and that most responses were not clustered around the mean. The second factor that militated against educational technology for Ghanaian technical universities was the lack of internet connectivity (M=3.99, SD=1.89). Even though the mean score for the lack of internet connectivity was high, a high standard deviation of 1.89 indicates how scattered the responses were to the mean. The most negligible factor affecting educational technology integration was a lack of leadership support (M=2.77, SD=1.55).

Hypothesis 1

H_0*:* There is no statistically significant difference in the frequency of use of educational technology between male and female faculty members.

H_a*:* There is a statistically significant difference in educational technology frequency between male and female faculty members.

4.4 Differences in the Frequency of Educational Technology Use Between Male and Female Faculty Members.

Table 4.4 presents the results of educational technology devices used for teaching in Ghanaian technical universities.

Table 4.4*: Gender differences in frequency of educational technology use*

	Gender	*N*	*M*	*SD*	*SE*	*T*	*df*	*p*
Educational technology	Male	186	2.92	0.62	0.04	2.15	223	0.032
	Female	39	2.69	0.51	0.08			

Source: Fieldwork (2020) ***significant at p=0.05*

Table 4.4 shows the difference in means in the usage of educational technology between males and females. The usage of educational technology between males and females was analysed to ascertain the differences in the average educational technology usage between the two groups. From the results analysed, the frequent usage of educational technology among males was significantly higher (M=2.92 SD=0.62) than the frequent usage of educational technology among their female counterparts (M=2.69 SD=0.51), t =2.15, p=0.032. Therefore, the null hypothesis is rejected, and the conclusion is that there is a statistically significant difference between male and female faculty members' use of educational technology in teaching.

Hypothesis 2

H_0: There is no statistically significant relationship between the use of educational technology and enhanced teaching.

H_a: There is a statistically significant relationship between the use of educational technology and enhanced teaching.

4.5 Relationship between the Use of Educational Technology and Enhanced Teaching

Table 4.5: *Correlation between educational technology and enhanced teaching*

Variable	M	SD	R
1. Enhanced teaching	2.88	0.62	0.301**
2. Educational technology	2.85	0.47	

**p<0.01(2-tailed) *p<0.05, N=225; Educational technology

Source: Fieldwork (2020)

A correlation analysis was done to ascertain the direction and strength of the linear relationship between educational technology usage and enhanced teaching measured by the number of times educational technology is used to substitute and augment teaching as reflected in the SAMR model. From the data analysed, as depicted in Table 4.5, there was a weak (R = 0.301) positive linear correlation between educational technology usage and enhanced teaching. However, at a 0.05 % significance level, the results showed a statistically significant relationship between educational technology and enhanced teaching (p = 0.000). This finding suggests that a high level of educational technology usage is associated with enhanced teaching.

Qualitative Data

Six (6) main themes came out about the educational technology integration in teaching. These themes are the frequently used EdTech devices, factors affecting EdTech integration, difference among gender use, relationship with enhanced teaching and the perception of the use of EdTech devices in teaching and the motivation for the use of EdTech devices in teaching. Participants responses were represented with pseudonyms. For example, Female Faculty Member is represented FFM and Male Faculty Member is represented as MFM.

4.6 Educational technology devices frequently used for teaching

From the qualitative study, three sub-themes emerged on the frequently educational technology devices used for teaching. These technological devices are the laptops, mobile phones and projectors for teaching.

Eight faculty members indicated that they use educational technology to teach. Some of their expressions include:

> *"I use the laptop computer, the projector and the Microsoft PowerPoint to make presentations in the lecture hall" [MFM 1].*

Another respondent narrated:

> "*I download YouTube videos with my laptops and sometimes my mobile and send them to students" [MFM 5].*

Also, a study participant stated:

> *"I mostly use my laptop to type my lecture notes, make my presentations and teach in the lecture halls" [FFM 7].*

Some faculty members, MFM3 and MFM2, expressed that:

> *"PowerPoint is the leading software technology all of us lecturers here mostly use for teaching. I, for instance, present my lesson using PowerPoint application on my laptop. You know something, it takes time to prepare and apply designs and slide shows, but it makes my students pay attention and concentrate during my classes. Anytime I do not integrate the PowerPoint, I realise the class becomes boring, making it difficult for me to finish my lessons. One thing I have observed is that using PowerPoint presentation makes my delivery very effective" [MFM3].*

> *"I send the notes/course outlines/reading materials online to students using my mobile phone, I upload the notes online, and I follow it up with video lecture presentation" [MFM2].*

Another faculty member narrated:

> *"I don't even border printing out course outline for my students anymore. I have created a WhatsApp platform on my mobile phone for each class, and I use the platforms to communicate with the students. I put every information for teaching on the WhatsApp group for the students" [FFM9].*

Besides, another faculty member indicated that:

> *"I teach a course that is so practical and using the laptop computer is so important." [FFM5].*

Further, a female senior lecturer in the Secretaryship and Management Studies Department under the School of Business and teaches secretarial practice course stated that:

> *"For instance, in my course, I teach students how to design letterheads. You can only use the laptop computer to design a letterhead and it has been so helpful. When I use the laptop computer, students can design their letterheads and other important business documents, e.g., prepare their business invitation cards. They only need to get the hard cards and a good printer to print on them. I use the laptop computer and the projector very often and the students practice using the computers in our computer laboratory" [FFM9].*

All the ten faculty members indicated that they employ educational technologies, especially mobile phones and the laptop computers to search for information. Some of the respondents narrated that:

"I always go online to search for information to prepare my lecture notes I usually use my laptop to do that" [FFM11].

Furthermore, a participant indicated:

"It is impossible these days to prepare notes without searching for information on the internet. Searching for information online is fast and sometimes easy. You can copy, paste, and edit without writing. Yes! I search for information with my mobile phone and laptop anytime I need some information for my teaching and research" [MFM5].

Regarding the frequently used educational technology devices to assess students' work, three faculty members indicated they use their mobile phones and laptops. A lecturer in the Computer Science Department expressed that:

"I use google forms to prepare my assignments, quizzes, and mid-semester examinations. Though it takes time to prepare, it is easy. I mostly do that on my laptop" [MFM2].

Another participant also expressed that:

"The students send their project works for assessment online. I give comments to and send it back to them via the use of my laptop and mobile phones" [MFM6].

The respondents indicated that they use educational technology devices to communicate with their students. They emphasised that:

"Sometimes, I use either my laptop or the mobile phones to do online discussion and to present a lecture to my students" [MFM 2].

Another faculty member also stated that:

> *"I use my laptop and the mobile phone very often to teach and communicate with my students. It is convenient and very easy to do that. It makes me communicate anywhere and anytime. It also enables me to send educational resources and assignments to the students" [MFM8].*

Another participant narrated that:

> *"I can reach out to my students with the use of educational technologies like mobile phones. In COVID 19, we need educational technologies to reach out to our students less we may stay in the house for the whole year without any teaching" [MFM3].*

All ten faculty members stated that they use their mobile phones and laptops to send course outlines and reading materials to students. Some of the views expressed are:

> *"It is not always the case that you can be with the students to explain every point on the slide to them. When I am busy, I send notes to my students either on their WhatsApp or email using my laptop or mobile phone. In the notes, they have examples, so without my presence, they can them. I normally use the Microsoft Word document to prepare my lecture notes, but I do not present lessons with it. My students always present their assignments for the assessment using MS Word" [MFM 1].*

Another respondent stated that:

> *"I use my mobile phones to discuss teaching issues and send messages and announcements to my students outside the normal class hours" [FFM 7].*

4.6.1 Summary

Educational technology devices are used frequently in teaching. Three main technological devices used are the laptops, mobile phones and the projectors. They are usually used to communicate, send assignments, conduct assessment and for practical works in the lecture halls.

4.7 Factors Affecting Educational Technology Integration

Regarding the factors affecting educational technology integration into teaching, eight sub-themes emerged. These sub-themes are inadequate educational technologies, inconsistent internet connectivity, lack of training in educational technologies, occasional power outages, the high cost of data for a bundle, student's readiness and preparedness to use educational technology, addiction to technology, and lack of motivation.

4.7.1 Inadequate educational technologies

The first theme related to the challenges on educational technology was inadequate educational technology resources. Most faculty members spoke negatively about this challenge. Only three faculty members out of the twelve stated that the educational technologies provided were adequate. For instance, participant FFM7 stated:

> "*Sometimes the problem is the machine you will need to work with, I remember when I needed a scanner, and people did not understand*

why I will need a scanner to teach the students. Meanwhile, when they go out, they will be using the scanning machine to work in the office. I struggled, and finally, they understood and bought one for the computer lab, and we are using it. Sometimes, our projectors, when the projectors are spoilt, it is so difficult to get a new one". [FFM7].

Another faculty member expressed a similar view.

"*For example, getting access to a projector to teach is sometimes difficult. Our faculty has only two projectors" [MFM3].*

Besides, a faculty member expressed:

"The main challenge is the limited number of computer laboratories. The University has only two computer laboratories, and the labs are always booked. Besides, there are only a few projectors installed in the lecture halls. The student population outweighs the number of computers" [FFM5].

4.7.2 Inconsistent Internet Connectivity.

The second theme related to the challenges of educational technology integration was inconsistent internet connectivity. All the faculty members indicated they had a challenge with the speed of internet connections in their institutions. One faculty member said:

"We have Wi-Fi service. Nevertheless, sometimes we have to move to some particular corner on campus to access the university Wi-Fi. When school is in session, the load on the server becomes huge, and it runs slowly"[MFM4].

Another faculty member indicated that:

> "*The challenge that I encounter is the network. The internet is a huge problem. Because sometimes, the link is very slow to the extent that you cannot use it. Sometimes, you have to go to some vantage points before you can get access to the Wi-Fi. Sometimes, even if you are connected, it does not come. It is a difficult issue" [MFM 6].*

Also, a faculty member stated that:

> "*Let me say that getting access to frequent internet for research and to download educational resources for lesson note preparation and teaching is not easy. Sometimes, it takes a very long for the internet to respond. It wastes time and energy. It is very frustrating when you need the internet to work, and it is either slow or is not coming at all. If nothing is done to improve internet connectivity, it may discourage us from using technology for teaching [FFM9].*

In a like manner, a participant expressed that:

> *"It is difficult to access the internet since it is usually off. Even when it is on, it is slow. The university must work hard with the telecommunication companies who provide us with the internet to ensure a consistent network. It is a worry to my colleagues and me when you need the internet to send emails and educational resources to your students, and the internet is not responding [FFM12].*

4.7.3 Lack of training in using educational technology.

The third theme relates to the training faculty receive in educational technology use for teaching. Only two faculty members indicated they had had adequate training. For one faculty member, the training he had was self-

sponsored training and not from the institution. A faculty member felt he lacked training in educational technology use:

> *"I have been in this institution for about six (6) years, but I have not had any training in the use of technology for teaching. This, to me, is a major challenge [MFM4].*

Another participant narrated a similar view:

> *"I have not had any training in educational technology since I started work three years ago in this university" [FFM7].*

Further, a respondent stated:

> *I have not received training in educational technologies, but I have had only one training in using Information and Communications Technology for teaching. I had this training about four years ago. [MFM1].*

More so, a faculty member indicated that:

> *"I received training in using technology to teach when we had COVID 19. The university organised a two-day training on using the learning management system to teach the students" [FFM10].*

Additionally, a participant narrated that:

> *"I think there should be a programme to provide educational technology training to faculty members on how to use technology for teaching and how to integrate educational technology in their teaching. I need to know how to integrate educational technology to teach my course. If I have proper training on how to use most of the*

features on the computer, I will be able to search relevant materials for my students" [MFM 6].

Besides, a respondent indicated that:

"Since I started working in the university thirteen (13) years ago, I have had the opportunity to attend about five training programmes on how to use technology for teaching" [FFM8].

A participant further narrated that:

I think COVID has exposed some of us. We have to use the zoom and other technologies available, but it seems we have limited training in using these technologies. I am not fully into technology, so I do not know much, but I think we need some training in educational technology to enhance our teaching [FFM10].

Further, male teaching staff from the Computer Science Department narrated that:

"*I had the opportunity to do some training with the Commonwealth of Learning. However, it has been long about four (4) years that I had the training in technology [MFM3]*

On the contrary, one faculty member expressed that he has had some training:

"I attended ICT training programmes almost every year. I have had training with UNESCO, and training was in ICT. I also had training from the Common Wealth of Learning. The training was on PowerPoint presentation, I had training with New Zealand Hope University and other institutions because we have this collaboration

with them, it makes it easier for me to have access to this training" [MFM4].

4.7.4 Occasional power outages.

The interview revealed that the occasional power cut was one of the challenges that hinder the successful integration of educational technology in teaching. Seven faculty members expressed the challenges they experience with power outages in their institutions. One faculty member expressed that:

"The first challenge has to do with power instability or unavailability of power. Sometimes the lecture halls go off, so the challenge has to do with power instability, internet instability" [MFM2].

4.7.5 The High cost of data for a bundle.

Another theme that came forth was the high cost of recharge cards for data bundles. Ten faculty members asserted that the high cost of internet data bundles affects educational technology use in teaching. A participant who had different view on the cost of data bundle expressed that:

"*My major problem of using educational technologies for teaching is the buying of credit for the bundle and for downloading educational resources for my students. The University's internet or Wi-Fi is not reliable. Usually, I do most of my lesson preparation in the house. I usually buy credit on my phone and use my hotspot to link the internet to download any teaching video and search for information. Sometimes, I buy books online, and it is costly. Downloading some of these resources takes many data. I must say it is not easy. The University does not give us an allowance for buying credit for the*

internet. I always use my own money to buy the credits for the internet bundle" [MFM4].

Another faculty member stated that:

"My brother, it is hard. I spend between ₵60 to ₵100 to buy recharge credit every week to bundle and use online teaching with my students" [MFM6].

Besides, another participant expressed:

"In this COVID period, I buy about 100 cedis Vodafone credit for internet bundle every week for online teaching with my students on zoom and google classroom. Data has now become a serious problem, so that is it" [MFM5].

4.7.6 Students' readiness to use educational technology.

The interviews also provided evidence that most faculty members are ready and willing to integrate educational technology into teaching. However, the challenge had to with student's readiness and willingness to use educational technology. A faculty member expressed the view that:

"Some of my students don't have the appropriate mobile phones that support the installation of specific applications for teaching. This makes it difficult for me to use technology to teach them" [FFM8].

Similarly, a faculty member asserted that:

"Some of the students do not have mobile phones or laptops at all. Some do not have the money to buy an internet bundle to download educational resources I send to them" [MFM2].

In a related interaction with a faculty member, he expressed that:

> *"When the COVID 19 outbreak came, and I needed to teach my students using the zoom app, most of the students could not come on the zoom platform because most students did not own laptops. Most students who own mobile phones could not participate in online teaching because their mobile phones could not support the installation of the zoom app. This is teaching with educational technology sometimes extremely difficult because most of these students would be disadvantaged" [FFM9].*

Lastly, a respondent emphasised that:

> **"***It is difficult to teach with educational technology when about 50% of the students do not have the technologies that support the use of certain learning applications" [MFM4].*

4.7.8 Addiction to technology.

Lecturers stated that the use of educational technologies most of the time makes them addictive. They tend to use their devices when they are less busy and not necessarily for educational purposes but for social media activities such as watching videos. One faculty member expressed that:

> *"Sometimes, I stay glued to the mobile phone for chatting with friends via WhatsApp to the extent that I forget I have some important matters to attend to. I have that challenge. I have also observed that my students have that same challenge. They use their mobiles to chat while lectures are ongoing. There are occasions where I have to cease a student's mobile phone in class. While I was doing a presentation in class, she was busily chatting on WhatsApp. The issue is worrying*

because it is not just one or two students who are addicted, almost all the students who have android phones have that addictive problem" [MFM3].

Another faculty member indicated that:

"*I use my mobile phone often. Sometimes for non-educational purposes. At times, some social discussions on our WhatsApp platform catch my attention, and I tend to spend more time chatting than attending to some important issues. I must admit that using technologies such as mobile phones is very addictive" [FFM9]*

4.7.9 Lack of motivation.

Faculty members indicated that they are not motivated to use educational technology to teach. Nineteen out of the twenty interviewed faculty members expressed similar opinions; only one faculty member had a contrasting view:

"*Nobody supports or motivate me to use educational technologies to teach. I use educational technology when I see the need to do it" [FFM7].*

Further, a faculty member indicated that**:**

"*The use of educational technology to teach is not motivating. The challenges usually keep me of their use. There is no incentive or package for us. I have to use my laptop and iPad to teach. When there are spoilt, I have to repair them myself. I also have to buy my credit for the data bundle. The use of the devices, though, is good, but there is no motivation. The motivation I think lecturers need is that the university must give us either iPad or laptop to encourage us to use technology to*

teach. We also need some money to buy data for our bundles" [FFM8].

Besides, a faculty member from the school of business stated:

"*To me, I cannot say there is the motivation for lecturers to use technology. I only enjoy using technology to work and to teach when I have access to the internet" [MFM3].*

A different faculty member emphasised that**:**

"*Talking about motivation, I think we are not motivated to use technology. There is no reward or incentive for us. If we are given some allowance to buy data for the bundle, it will boost our morale to use technology to teach" [MFM5].*

Finally, a respondent narrated expressed:

"*Using technology to teach is difficult. So, some training and provision of laptops for lecturers by the university will encourage them to use technology to teach" [FFM9].*

4.7.10 Summary

Educational technology integration in teaching is affected by several factors. These factors which include but not limited to inadequate educational technology devices, inconsistent internet connectivity, lack of technical support systems among others hinder faculty members ability to use educational technology tools or devices in the instructional deliver process.

4.8 Measures to Ensure Educational Technology Integration

All the faculty members agreed that some measures have to be implemented to ensure that educational technology is fully integrated into teaching. Five (5) sub-themes emerged. These are:

- Training for faculty members
- Active management involvement
- Institutional policy on technology integration
- Improvement in infrastructure and
- Provision of adequate educational technology tools/devices.

4.8.1 Training for faculty members.

Faculty members expressed that to ensure effective educational technology use in teaching, there is the need for continuous training. They expressed that:

> "*The training programmes have played a part in our use of educational technology for teaching. I learned something just recently when I was using the zoom, which I did not know. Through the training, I now know it; I am doing it even better than when I used to try it on my own. Some staff members are surprised at the rate at which I apply technology into teaching, but yeah, that's training" [FFM1].*

Another teaching staff emphasised that:

> "*You know technology keeps evolving right, so to keep abreast, I will need training" [MFM6].*

Besides, some faculty members expressed their experiences in educational technology use and the need for training. They indicated that:

> "I *think COVID has exposed some of us. We have to use the zoom and all those technologies available, but it seems we have limited training, even though we have had some. I think we need training in the use of some of the new software applications. I am not fully into technology, so I do not know much, but I think we need some training in educational technology to enhance our knowledge and skills" [MFM10].*

Another faculty member indicated:

> "*At the moment, there is this zoom application. I do not know how to integrate it. On the zoom app, I need training on how to switch from sharing your screen to getting to a different platform. For instance, if you share your screen with your students, you quickly want to refer to something. Sometimes it is not easy to do that. I need training on how to use the zoom very well and not only that but also training in the use of the VLE. I see they are good tools for teaching, but I do not know how to use them effectively for teaching" [FFM11].*

4.8.2 Active management involvement

Faculty members pointed out that the university's management needed to take full responsibility to ensure that educational technologies are integrated into teaching. They narrated that:

> "*I think if technology can be used in the lecture halls for teaching, the university must ensure that the lecture halls are furnished with the state-of-the-art technology like laptops, projectors, speakers, microphones and all the necessary gadgets we may need to use for teaching" [MFM3].*

In addition to that, one participant noted that:

"We should have more computer laboratories" [MFM6].

In a similar narrative, a participant stated:

"Management should not just pay lip service to technology integration and keep saying it is in the pipeline, they must initiate moves and install the computer labs and classrooms with the needed educational technologies for use by lecturers and students" [FFM10].

4.8.3 Institutional policy

The faculty members emphasised the need for a comprehensive policy on the use of educational technologies for teaching. A faculty member indicated that:

"*We have an ICT policy in the university. In the policy, we are entreated to use technology to teach. However, the policy did not give any guidelines for ICT usage. Besides, there is no basis for assessing the use of technology in teaching. My friends and I use them when we feel like doing so. I think the ICT policy should be revised and make the use of technology for teaching compulsory" [MFM2].*

Besides, a faculty member stated:

"*Nobody assesses how I integrate technology into teaching. There is no assessment. If we have a policy on how to assess how faculty use technology for teaching, it will also help. This will encourage most of us to start to learn and use technology for teaching" [FFM7].*

Lastly, a respondent mentioned:

"I believe the university should make the use of teaching with technology a must for all. The COVID 19 outbreak has shown that

without technology, we cannot as an institution strive. I believe a new policy be made to ensure technology use in teaching" [FFM10].

4.8.4 Improvement in infrastructure

Faculty members pointed out that enhancing the consistency of internet connectivity will support technology integration into teaching. Continuous internet connectivity was regarded as key for successful integration of educational technology into teaching as faculty members expressed:

"*Well, you know, the effectiveness in the use of technology for teaching in our universities today largely depend on the internet. For the internet, it is crucial. I think if the internet is consistent and the speed is good, more lecturers and students would love to use it for teaching" [FFM5].*

In addition, a teaching staff responded:

"*The leaders must invest more in internet infrastructure. Because if you have a good policy on technology use in teaching, adequate devices, training and there is good internet, it will make technology integration very challenging" [MFM1].*

4.8.5 Summary

To ensures effective and smooth used of educational technology devices in teaching, measures that can be adopted to ensure smooth and easy integration include improving educational technology infrastructure and setting of policy to enforce the integration. It would also require training of faculty members and active participation of management.

4.9 Gender Differences in Educational Technology Usage

Six (6) sub-themes emerged from the interaction with male and female participants on why they use educational technologies for teaching. The sub-themes are curiosity and love for technology; work overload; inadequate knowledge and skills; familiarity with technology; perception, and attitude towards technology.

4.9.1 Curiosity and love for technology

Six males and one female faculty member agreed that they use educational technology for teaching because of curiosity. Some of the views expressed by participants include:

> *"For me, it started as a curiosity even right down in the university, my time in the university, there were limited computers for learning so when I started work in a private firm, I had the opportunity to have a desktop to myself and I was able to do a whole lot of things. For some of the things I am teaching the students, I learnt them on my own, and that motivated me also to do more because one thing about technology is that the more you use it, the better person you become so it's my motivation to use technology that is helping me use it for teaching" [MFM1]*

Moreover, another male respondent stated that:

> *"I love technologies, and I also love to find different ways to teach my students to understand better. It has nothing to do with the regulations of the university. Personally, the motivation is the joy I derive from it, I feel happy using the technology" [MFM2].*

4.9.2 Work overload

All five female respondents and four males indicated work overload as the main issue that affects their ability to use educational technology in teaching. The other eleven male faculty members indicated that work overload does not stop them from using educational technology in teaching. One respondent said:

> *"I teach four courses in a week. Each course has three credit hours. Besides, I have to assess student's project works and attend to other extracurricular activities. Some of our lecturers have travelled overseas to study and their courses shared amongst existing lectures teach" [FFM8].*

4.9.3 Inadequate knowledge and skills

Ten out of the fifteen males and one female faculty member expressed the view that they lack the skills and knowledge to use educational technology in teaching. Four out of the six female faculty members indicated that their inability to use educational technology results from a lack of knowledge and skill. For instance, some female respondents expressed that:

> "*I don't think I have the expertise to use educational technology to teach. This makes me nervous to use it." [FFM12].*

Another female respondent stated:

> "*I do not have enough skills to incorporate educational technology devices in my lesson, and I am anxious to use educational technologies for teaching" [FFM7].*

4.9.4 Familiarity with technology

Three female faculty members indicated they are not familiar with the use of most of the educational technology devices; therefore, using it for teaching becomes a difficulty. One female faculty member expressed that:

> "Apart *from my mobile phone and the laptop that I use too frequently, I don't use the other technologies. The issue is that I am not conversant with their use" [FFM9].*

4.9.5 Perception

All the twenty faculty members had a good perception of the educational technology used for teaching. Some of the things some male faculty members spoke about include:

> "*Educational technology use in teaching is good and has to be encouraged" [MFM6].*

Besides, a faculty member indicated that:

> "*Although I don't use educational technology to teach because I don't have the knowledge and skill. I sincerely think it is suitable for teaching" [FFM8].*

Also, a faculty member stated that:

> "*Educational technologies are important tools in teaching; for effective teaching, we can't do without them, where we have come in terms of modernisation, educational technology should be incorporated into our teaching activities, and students should also make maximum use of them"[MFM4].*

Furthermore, a faculty member stated that:

> "*We cannot do away with technology. It is good though it comes with its challenges. Nevertheless, I think the good we get from using educational technology for teaching are many" [MFM5].*

Besides the male responses, some female faculty members expressed that:

> "*You know, the world has changed, and we need also to change. The old methods of teaching are giving way to new ways of teaching. We are in a technological age, and for our students to be able to link-up well in the industry, we have to use technology for teaching so that they do not become aliens in the industry" [MFM4].*

Similarly, another female respondent stated that:

> "*I believe that educational technologies are important tools in teaching; for effective teaching, we can't do without them. Educational technology should be incorporated into our teaching activities, and students should also make maximum use of them" [FFM3].*

Lastly, a female faculty member from the Secretaryship and Management Studies Department said:

> *"Educational technology use for teaching is good and must be encouraged. If we as teachers do not change, it will be difficult to meet the learning needs of our students who are becoming more technologically inclined" [FFM12]*

4.9.5 Attitude towards technology

Sixteen faculty members, including two females, showed a positive attitude towards educational technology. However, three females and one male faculty

member had a negative attitude towards the use of educational technology in teaching. Some of the participants who expressed a positive attitude to the use of educational technology stated:

> *"To me, working with technology is a daily activity. I use technology for all my research and programmes. It is something that I love to use, and I am never nervous about using technologies to perform my task" [MFM4].*

Also, participants expressed that:

> *"I have used educational technologies to teach for many years, and I feel okay to continue to use it. I am neither worried nor afraid to use educational technology to teach. I am familiar with their usage, especially for teaching in class" [MFM3].*

On the contrary, two female participants who expressed negative feelings towards educational technology use. For example, a female faculty member FFM9 said;

> "I *lack skills and knowledge to use educational technology to teach. This makes me nervous about using it." [FFM9].*

The second female participant indicated that:

> *"I do not have enough skills to incorporate educational technology devices in my lesson, and I feel uneasy using educational technologies for teaching" [FFM7].*

Besides, a male faculty member who had a negative attitude toward the use of technology use for teaching stated that:

"I know using computers and other technologies to teach these days is good but, it is not easy. Some of us were not exposed to it in our school days, but we have to force to learn and use it. You see, I am getting to 60 years" [MFM4]

4.9.6 Summary

The decision to use educational technology in teaching is influenced by several factors. Gender use of educational technology devices are influenced by workload, perception towards the integration of educational technology, attitude towards the use of a given educational technology, lack of knowledge in the use of educational technology and curiousity.

4.10 Relationship between educational technology and teaching

To understand the benefits derived from educational technology for teaching by faculty, participants expressed their views accordingly. Seven (7) sub-themes emerged, and they include enhancing teaching, makes teaching flexible, makes teaching interactive serves as a teaching aid and task enabler, reducing stress, promoting distance teaching and promote collaboration between teachers and learners.

4.10.1 Enhances Teaching

The respondents affirmed that educational technology enhances teaching. For instance, a male faculty member said:

"Unlike before, where I struggled to explain some abstract ideas to my students, now I can download videos from YouTube on my laptop for teaching. Using educational technology makes teaching easy" [MFM3].

Besides, a faculty member narrated that:

> "*Since I began to use educational technology like the computer and the internet for my teaching, I can transmit my notes and presentations either on my mobile phone or laptop at any time without difficulties" [FFM10].*

Another faculty member indicated that:

> *"If I even should situate educational technology into the current problem (COVID 19) we find ourselves in, it is educational technology that enables us to send assignments and notes to our students. Educational technologies help us to carry out teaching and to make teaching easy and accessible to our learners" [MFM2].*

A female faculty member expressed that:

> "*Since I began to use educational technology for my teaching, I have realised that my students become active participants and contribute to class discussions. Students talk about issues on slides by themselves, discuss them, and argue about them. I only come in to summarise points. I talk less in class. I have noticed that my teaching has improved. I do not stress myself talking for a very long time, trying to explain ideas to them. The students can search for information using educational technologies by themselves and can contribute meaningfully to class discussion. I strongly think educational technology enhances teaching" [MFM4].*

A male participant indicated that:

> *"I thought using technology was difficult initially until I tried using one with some students who are inclined to use technology. Though it was initially not easy after I had used it more than two times, I observed that it allows the students to talk about issues themselves. Students can interact and collaborate. The use of educational technology makes teaching very interesting" [FFM10].*

4.10.2 Makes teaching flexible

To understand how teaching has become flexible to faculty members in their use of educational technologies, some of the narratives they expressed include:

> *"Well, today, I can interact and teach my students in many ways without necessarily having to be in the lecture hall. Educational technologies offer me the chance to teach my students while at home" [MFM2].*

Similarly, a study participant indicated that:

> "*Now, I can use a variety of teaching strategies to impart knowledge to my students. I have taught for about twenty years. In recent times when I began using educational technology, I can reschedule some of my lectures with the students at a later time, sometimes on weekends on the zoom platform" [FFM9].*

4.10.3 Makes Teaching Interactive

The study respondents expressed that the use of educational technology in teaching makes teaching interactive. Some of the views expressed were:

> "*The use of educational technologies makes me frequently interact and discuss teaching issues with my students. After the formal class meeting, I can make conference/video calls to students and help them with their problems. My students feel encouraged to hear me discuss their academic issues on their platforms. They can ask me several questions they cannot ask during formal class hours [MFM4].*

Besides, a study participant narrated that:

> *"The use of educational technologies is even evident in this COVID era. You see, by using educational technology, we can communicate with our students online. You know, the COVID 19 has made it impossible to meet face-to-face with our students. We need to use our computers, laptops, and mobile phones to communicate and disseminate information to our students. Imagine COVID 19 without educational technologies. I strongly think the integration of educational technology into teaching is important these days if our universities will grow and compete" [MFM4].*

4.10.4 Serves as a teaching aid and task enabler

The participants identified that educational technology enables them to perform their tasks. For example, two male faculty members in the engineering faculty said:

> "*I use educational technology often in my teaching. One key benefit I derive is that it enables me to design building plans and layouts. It takes off the task of designing building plans on the board. I can use my computer to design sketches and post them to my students via email or WhatsApp to study before formal class meetings" [MFM6].*

Besides, a female faculty member from the Business School narrated that:

> "*The use of educational technology, e.g., the desktop computer and the laptop, enable me to sketch office layouts, type letterheads, and set margins and spacing of text for students. It makes the demonstration and illustration of concepts very easy and interesting. For my course, teaching without the computer is boring and makes it difficult for students to understand" [FFM11].*

4.10.5 Reduces stress

Also, faculty members stressed that the use of educational technology reduces stress on them. Some male faculty members in the Faculty of Applied Arts narrated:

> "*Integrating educational technology is good in the sense that it takes off some stress. Educational technology makes it possible to view pictures and videos. You do not have to stress yourself so much trying to explain a particular point several times. The students can be able to see the videos and make meaning out of it, so for me, it's good, and I like using them" [MFM2].*

A female faculty member narrated that:

> "*I have observed from some of my colleagues who are good in using technology for teaching that they look more cheerful and can interact with the students freely. I think in some way, it reduces stress and workload on lecturers" [FFM7].*

4.10.6 Extension of instructional time

The participants noted that educational technology in teaching enables them to extend teaching hours beyond the lecture halls. They indicated that unlike before, where they had to be in the classroom to deliver instruction and content, educational technology has made it possible to teach beyond the classroom. They expressed that:

> "*Before now, I needed to come to the lecture hall every time I have lectures. Since I started to use mobile phones, laptops, and the internet, I can reach out to my students anytime. When I am occupied and unable to meet them in the regular periods, I can schedule lectures via zoom in the evenings and sometimes on weekends" [MFM1].*

A faculty member who teaches in the Fashion Department emphasised that:

> "*I have 13 students I teach in the evening school. I usually meet them using google classroom to teach. The evening school students come for classes from 5 pm to 10 pm. so usually, they get tired and unable to finish our lectures. I arrange a time convenient for them on the weekends and continue the teaching online. These days they prefer online teaching. We hardly meet in the lecture hall for face-to-face teaching. All our classes are now held online. The students send their assignments online via email, and feedback is given to them" [FFM7].*

4.10.7 Collaboration

The study participants also asserted that educational technology encourages them to collaborate and consult their colleagues at any time for clarification on issues and share ideas regardless of distance or geographic area. According to

participants, teaching should be a collective activity. It should not be teacher-centred but a cooperative activity between teacher-teacher and teacher-students. A participant indicated:

> "*I think one key advantage of the use of educational technology is its ability to assist lecturers and students to share and discuss issues. It enables me to collaborate with colleagues to discuss educational issues. It also helps my students and me to collaborate online using social media platforms to share and disseminate information. I can work with my students after usual class hours to discuss unfinished matters" [FFM9].*

4.10.8 Summary

Educational technology tools used related to improvement in teaching. For example, the integration of educational technology devices foster participation in class, makes teaching interactive, makes teaching flexible and served as a teaching aid and task enabler

4.11 Perception about the use of educational technology in teaching

The sub-themes that emerged from the above theme included very good, good and somehow good.

Responding to the interview, a female faculty member said:

> *"I feel like I am too old to learn to use educational technology and not to mention integrating educational technology, our generation is over. The world is changing fast, and I believe educational technology enhance teaching. "I am too old to adapt to the new teaching styles, and I am happy with my old teaching period" "I believe in traditional*

> *methods which let the students touch, feel and learn. I could make interactive lessons without using educational technology devices" [FFM 1].*

Faculty members had varied views on the use of educational technology for teaching. Their conceptions and misconceptions varied depending on their exposure to educational technologies. Some faculty members' views on the concept of educational technology included PowerPoint presentations and the use of the internet to search for information. Others also expressed that educational technology cut across all the available technologies that enhance teaching within and outside the lecture hall. A female respondent said that:

> *"The use of educational technology in teaching is essential to both the lecturer and the learner. I use YouTube and Google to search for relevant materials for lessons and use educational technology devices to teach the students" [FFM 3].*

Faculty members also believed that educational technology integration into teaching is critical in determining instructional delivery's success and effectiveness. From one of the interviews, a faculty member narrated:

> *"My view about educational technology is how best to incorporate technology into whatever we do in our various institutions. For instance, using computer laboratories, photocopier machines, and other electronic devices to support teaching. I believe it is good to use. I feel good to use them" [FFM12].*

Faculty members perceived that the advantages derived from the integration of educational technology for teaching surpassed the disadvantages; therefore,

educational technology is a helpful tool for facilitating teaching in the lecture halls. Based on these, they expressed that:

> *"Integrating educational technology is good in the sense that it takes off the stress. Educational technology makes it possible to view pictures and videos. You do not have to stress so much trying to explain a particular point several times. The students can see it and make meaning out of it, so for me, it is good, and I like using them [MFM 8].*

Faculty members also expressed that integrating educational technology into teaching is good in this modern age of technological advancement. They emphasised that it is needful to integrate them into teaching to derive the maximum benefit from it. Some of their expressions included:

> *"Educational technologies are important tools for teaching; For effective teaching, we cannot do without them, where we have come in terms of modernisation, educational technologies should be incorporated into our teaching activities, and students should also make maximum use of them" [MFM7].*

Similarly, faculty members admitted that the benefits derived from integrating educational technology into teaching exceed the drawbacks. Faculty members expressed that the traditional teaching technique must be replaced with technology since the world has entirely changed how teaching is done. A participant narrated that:

> *"We cannot do away with technology. It is good though it comes with its challenges. The advantages derived from using educational technology outweigh the disadvantages. The world has changed, and*

> *we also must change. The old methods of teaching are giving way to new ways of teaching. We are in a technological age, and for our students to be able to link up well in the industry, we have to start using technology for teaching so that they do not become aliens in the industry" [MFM 4].*

Another faculty member stated that integrating educational technologies like mobile phones and laptops is vital for teaching. A participant narrated:

> *"Using mobile phones and laptops to teach is bad. These devices enable us to post notes/presentations to students. Technologies are good for teaching. I buy books online using the visa card" [MFM 6].*

4.11.1 Summary

As regards the perception of the integration of educational technology in teaching, most teaching staff believe that it is good and must be encouraged. Though, there are some hindrances to integration of EdTech in teaching, they believe the benefits derived from the use of educational technology devices in teaching is good and must be encouraged.

4.12 Motivation for Educational Technology Use

The responses from the interviews at the two Ghanaian technical universities indicated that faculty members motivation to integrate educational technology into their teaching had been influenced by the following sub-themes: (1) Necessity, (2) Curiosity, and (3) Obligatory.

4.12.1 Technology as a Necessity

Faculty members believed that technology is evolving and therefore recognized that its integration into teaching is necessary to enhance their

teaching effectiveness. The mere fact that technology is an integral part of teaching in our contemporary education, they have to use it. Participants who held later opinions recognised the vital role of educational technology in their students' ability to stay alive and focus throughout their teaching period.

> "*Technology keeps changing therefore, there is the need to always learn and get used to new technology for teaching" [MFM 4].*

One participant also noted:

> *"The world is changing with the advent of information and communications technology and technology has become important tool for transmitting information and for imparting knowledge. For example, without technology it will be difficult to reach out to our students in this COVID era" [MFM1].*

4.12.2 Curiosity

Others indicated that their curiosity to know inspired them to learn the use of educational technologies for personal and professional work. They believed that educational technology has come to stay, and it is part of their everyday reality in the instructional process. Therefore, whether there is a reward to incorporate or not incorporate educational technology into their teaching, they do not border. To reinforce the assertion on staff curiosity to learn educational technology independently, one faculty member had this to say:

> *"For me, it started as a curiosity even right in my school days in the university. In my university days, there were limited computers for learning, so when I had the opportunity to start work in a private firm; I was given a desktop where I learnt a whole lot of things. Some of the things I'm teaching the students, I didn't learn them from anywhere, I*

learnt them on my own, and that motivated me to also do more because one thing about technology is that, the more you use it, the better person you become so it's my initiative that is still keeping me going." [MFM 7].

4.12.3 Obligatory

There was another category of respondents who inwardly had no inspiration to personally integrate technology but because the institution had a policy and the policy mandates all teaching staff to integrate educational technologies into teaching, they had no other option than to try and do their best to integrate educational technology into teaching. A female faculty member had this to say:

> **"***The university has made it compulsory for lecturers to use the learning management system to teach our students especially in this COVID era. If not for the university rule on the use of technology, it would have been difficult for me to learn and use it. I am trying to use it, but it is still difficult for me." [FFM 9].*

4.13 Summary

The chapter discussed how data collected from teaching staff on the integration of educational technology in teaching in two Ghanaian technical universities were analysed. The results showed that the frequently integrated educational technology tools were laptops, mobile phones, and projectors.

With reference to the uses of educational technology, results showed that educational technology is mostly used for lesson presentation, to transmit information, for students' assessment and for researching information on the

internet. Faculty members perceive that the continuous use of educational technology is very good as it enhances their teaching. Educational technology is beneficial as it serves as teaching aid and task enabler, makes teaching flexible, interactive and promote collaboration between teachers and learners.

The factors that affect the faculty members' ability to integrate educational technology in teaching included inadequate educational technology tools, inconsistent internet connectivity, and lack of technical support staff.

The results showed that male faculty members integrated technology into their teaching more than their female counterparts. For example, the independent sample t-test result indicated a statistically significant difference in educational technology integration between males and females. The correlation results showed a statistically positive significant relationship between the variables concerning the relationship between educational technology integration and enhanced teaching, indicating that teaching is enhanced in Ghanaian technical universities with the deployment of educational technology.

The results of the study showed faculty members' experiences with integration of educational technology are influenced by their feelings; perceptions, conceptions and misconceptions; and challenges in usage. However, based on their experiences, they also offered suggestions on measures to ensure integration including training, management involvement, institutional policy, improvement in infrastructure and provision of adequate educational technology tools/devices. The next chapter introduces the discussion of the results based on the study objectives.

CHAPTER FIVE

DISCUSSION OF RESULTS

5.0 Introduction

This chapter discusses the results of the study in light of the context of the literature and theoretical Model underpinning the research. The discussion of the results is presented per the order of the themes in the research objectives in the first chapter.

5.1 Educational Technology Devices Frequently Integrated into Teaching

In terms of educational technology devices frequently integrated into teaching in Ghanaian technical universities, both quantitative and qualitative results of this study found high usage for laptops, mobile phones and projectors. This finding collaborates earlier studies (see, Can et al., 2012; Jordan & Papp, 2014; Rogers, 2003) that noted that laptops, mobile phones and projectors are frequently integrated into instructional delivery of most higher education institutions in the world.

The advantages of using these devices include familiarity, easiness of use, and accessibility. These advantages could perhaps account for why most faculty members of Ghanaian technical universities use them to teach. In addition, it is believed that these devices make teaching lively, less stressful, flexible, enhance the delivery of instruction, and foster collaboration between students and faculty members (Alkash & Al-Dersi, 2017; Chevers & Whyte, 2015; Tondeur et al., 2016). Another possible explanation could be that most faculty members own laptops and mobile phones and used them for various social activities. It is also reported that most students have laptops and mobile

phones; therefore, faculty members may find it ideal for sharing information and educational resources with them (Cao et al., 2013; Starcic, 2010).

Similarly, educational technologies have also been found to increase faculty members' ability to speedily search for information (Nkansah et al 2020; Tu & Blocher 2010; and library databases (Keser et al., 2012). By implication, the findings mean that if faculty members are assisted with technological devices, it will boost their morale and encourage them to integrate educational technology into teaching (Allahawiah & Tarawneh 2015; Kirkwood & Price 2013). This will enhance the quality of teaching and consequently impact students learning. Therefore, it is suggested that the management of Ghanaian technical universities must provide their faculty members with good laptops to enable them to use educational technology for teaching since faculty members prefer using them to teach.

Comparing the results of this research to previous studies with a similar focus reveals some consistencies. For example, Bozalek et al. (2013) revealed that educational technology devices are used in teaching in higher institutions in South Africa. Furthermore, Sife et al. (2007) found that higher institutions' faculty members use educational technology for many educational purposes in Tanzania. The results also corroborate with Akgün et al. (2016) who reported that most lecturers were proficient in using educational technology devices for teaching.

Arguing from the perspective of Rogers' (2003) Diffusion of Innovation Theory, which anchors this research, one would reason that if educational technology devices are not easy to use, not accessible, and do not offer relative

advantages to faculty members, they might decline their usage in teaching. It becomes clear that faculty members in technical universities, like any other higher institutions, have perceived assumptions about educational technology use in teaching. The implication here is that faculty members in technical universities such as Takoradi, and Koforidua Technical Universities would use educational technology devices to teach if the devices are easy to use, easily accessible, and offer relative advantages. Therefore, the management of technical universities must make educational technologies accessible and provide training in educational technology use for faculty members to ensure that faculty members fully incorporate educational technology into teaching. Applying what Rogers (2003) termed "innovative adoption decisions" to the results, a case may be made that providing educational technologies that are easy to use, accessible and offer relative advantages meant that the management of Ghanaian technical universities are interested in ensuring that educational technology was used in teaching.

5.2 Factors that Affect Educational Technology Integration in Teaching

Both the quantitative and qualitative results showed similar findings. Quantitative results (see Table 4.2) showed that faculty members of Takoradi and Koforidua Technical Universities generally agree that some factors are important in determining the degree to which they integrate educational technology into teaching. Of the eight factors, inadequate educational technology resources ranked the highest, followed by inconsistent internet connectivity and lack of technical support systems.

Although other factors ranked lower than these three factors, they should not be neglected as they each recorded a mean score that is at least 2.77. Thus, the

results showed that, the continuation of the use of technology in teaching was not the result of a single factor, but the combination of all factors. If all these factors are addressed sufficiently in technical universities and in order of priority according to the ranking provided by faculty members, it is clear that the faculty members might consider utilising educational technology with greater frequency and for more direct classroom tasks.

The result of the study is not startling as many kinds of research in higher education in developing nations have revealed similar findings (Adedokun-Shittu & Shittu, 2011; Asabere et al., 2017). A possible reason for these results may be attributable to inadequate funds. For example, Alazam et al. (2013) disclosed that the lack of funds makes it difficult for institutions of higher learning to acquire the necessary technological resources for teaching. Providing adequate technology resources (e.g., computer laboratories) for instructional delivery allows educators to use various educational technology tools for teaching. It is suggested that there should be adequate provision of computer laboratories for use. These laboratories should be accessible to faculty members and students at any time, not only during instructional hours. This would ensure that faculty members and students who cannot afford laptops or mobile phones could visit the laboratory for their research, access the various educational technologies, and use them to learn.

Conversely, inadequacies in educational technologies will constrain lecturers to incorporate technology into their teaching. This can adversely affect the quality of teaching in technical universities. As technical universities are mandated to provide technical and hands-on training to students, adequate educational technology tools will enhance and facilitate teaching and provide

students with the requisite technical skills for industry work. This finding implies that inadequacy in the provision of educational technologies for teaching may result in graduates who would not be technically inclined to industry work, which will affect their future employability. Besides, inadequacy in educational technology would make faculty reluctant to integrate technology into teaching.

The results of the study also showed inconsistent internet connectivity as a hindrance to the continuous use of educational technology in teaching in the technical universities. The issue of inconsistent internet connectivity may be due to a poor network and/or a heavy load on the internet servers (Jimoh et al., 2012). The situation could also be associated with the technical university's lack of funds to pay for consistent internet services, hence the providers' frequent disruption in internet service (Adedokun-Shittu & Shittu, 2011). Indeed, this situation has distressing consequences and may deprive faculty members of integrating educational technologies into teaching. Since most faculty members rely on the internet to download teaching materials, assess student's assignments, and teach, it is believed that consistent internet connection increases faculty access and interest to deploy educational technologies in teaching (Asabere et al., 2017).

In a related development, Obiri-Yeboah et al. (2013), Bagheri et al. (2013), and Schrum et al. (2011) found inconsistencies in internet connectivity as the critical factor that confronts higher institutions to use educational technology to teach. A similar finding has been documented in the literature showing that constant internet supply encourages faculty to use educational technology in teaching (Nawaz et al., 2015; Mutekwe, 2015; Asiri et al., 2012). The results

also corroborate Bagheri et al. (2013) who found that some faculty members are deterred from using educational technologies in the instructional process because there is not consistent provision of internet services to motivate them to frequently use educational technologies for teaching.

Another factor that the study revealed to have negative impact on the integration of educational technology into teaching at the two technical universities is the lack of technical support services. A possible reason for such a problem may be the shortage of technical support staff to assist faculty members who experience technical challenges in their quest to integrate technology into teaching (Barefah & McKay, 2018). This challenge will discourage faculty members from developing the interest, willingness, and enthusiasm to deploy educational technologies in teaching.

The results of this study are connected with Yilmaz (2011) study in Turkey, which reported that teachers' lack of technical assistance frustrates them and makes them lose interest in using technology to teach. In a similar investigation on the factors that affect technology integration in the higher institution in Vietnam. Jimoh et al. (2012) found technical support for teachers as necessary to technology incorporation in teaching. Moreover, the findings of this study closely match Goktas et al. (2009) who investigated the main barriers and possible enablers of technology integration into pre-service teacher education programs and revealed that lack of technical staff in higher institutions makes teaching with technology difficult for the instructor.

The results of this study also showed that poor students' lack of appropriate educational technology devices was a militating factor that offset faculty from

integrating technology into teaching. For instance, faculty members indicated that only a few students had computers/laptops. Even though most students had mobile phones, some mobile phones did not have features that support specific learning applications. Faculty members claimed that if they send information, those disadvantaged students were unable to access them. The result also found that some students did not have either a mobile phone or laptop. Therefore, it became difficult for faculty members to collaborate and interact with such students. Again, participants claimed that even those students who possessed the devices did not have adequate knowledge and skills in their usage.

For effective integration of educational technology in teaching, all the students must have access to the devices to be used for instructional activities. The findings imply that when students do not have the appropriate devices, it becomes difficult for the faculty to use technology for teaching. If technical universities want to integrate educational technology into teaching, they must provide educational technology tools for both faculty and students to ensure effective integration in teaching.

Also, the results showed that inadequate training in the use of educational technologies for teaching hampers the integration of educational technology into teaching. As Shohel and Kirkwood (2012) pointed out, the lack of opportunities for instructors to participate in training programmes affects their knowledge and skills to use technology in teaching effectively. It is alleged that technology integration training is indispensable to developing faculty competencies to use educational technologies for teaching. It is assumed that factors that may account for the lack of training in educational technology use

in teaching in higher education may be inadequate funds to organise workshops and other educational programmes (Shohel & Kirkwood, 2012). It may also be explained that faculty members' unwillingness to participate in technology-related training programmes may be a contributory factor (Oliver, 2011).

Additionally, the results showed that educational technology training could significantly impact how faculty members incorporate educational technologies into teaching. However, inadequate educational technology training could limit the faculty's ability to use educational technology in teaching. The findings of this study are consistent with that of Alexander and Vladislav (2016), who found that faculty training in educational technology is critical for future conception, perception, and subsequent integration into their instructional delivery.

Notwithstanding, there is lack of technology training needs assessment to identify specific areas of technology gap of faculty members (Baran & Uygun, 2016). For the integration of educational technology to be successful, technical universities need to organise training sessions regularly for instructors and students on the opportunities and challenges inherent in the use of educational technology generally so that they would appreciate its use.

The results imply that faculty members can effectively integrate educational technology into teaching when proper technology training needs assessment has been done. Faculty members must show preparedness and willingness to partake in technical training programmes and must be provided technology training to bridge technology skill deficiencies. It is important that careful

considerations must be given to these issues if Ghanaian technical universities desire to provide adequate training in educational technologies for faculty members since educational technology-related training will motivate and enhance faculty knowledge and skills to use educational technology in teaching. However, as new technologies emerge in higher education, there will be the need to constantly provide training and enable lecturers to become accustomed to the use of new technologies and develop the confidence to integrate them into teaching.

From Rogers' (2003) Diffusion of Innovation Theory perspective, one would argue that inaccessibility to educational technology and difficulty to observe and try its use limit integration and adversely affect teaching. The implication here is that faculty members and students in the technical universities who do not have access to educational technologies would not integrate technology into teaching. Therefore, the leadership of technical university must provide adequate educational technologies and train instructors and students in their usage to ensure that they use them for teaching. This may also show that technical universities are ready, willing and serious about educational technology use in teaching.

Concerning the factors that influence educational technology use by instructors, this study further drew on Rogers' (2003) five stages of the decision-innovation process that explain how people adopt new ideas. The findings confirmed these attributes: the functionality of a given educational technology, ease of use in terms of its user-friendliness, ease of access by the user, and motivation. It is noteworthy that flexibility and easy access to educational technology helped faculty to perform specific functions. However,

educational technology tools which were difficult to access discouraged faculty members from using them.

In connection with how educational technology is integrated into pedagogy in technical universities, this study also drew on the Technological Pedagogical Content Knowledge (TPACK) Model (Harris et al., 2009). Thus, the study sought to explain how specific content-based materials are taught with Technological Content Knowledge (TCK) for the selection of the appropriate technologies to support specific content-based instructions; the use of specific technologies for teaching; and teaching a particular content-based material with the use of appropriate technologies that are suitable for the content delivery. It is necessary to reiterate that instructors are the drivers and facilitators of teaching; therefore, it is critical to indicate that they play a crucial role in the success or failure of adopting any innovation such as educational technology for instructional purposes. In this regard, the findings of the present study revealed how educational technology was integrated into pedagogical activities like assessment and referring students for further reading, collaborating the TPACK model.

5.3 Differences in the Use of Educational Technology among Gender

The quantitative and qualitative results revealed similar findings that there is a significant difference between male faculty members and their female counterpart in terms of their integration of educational technology in teaching. A perusal of the result from the independent sample t-test (see Table 4.3) showed a significant difference in the use of educational technology for teaching between male and female faculty members. The results depicted that male faculty members use educational technology in teaching more than

female faculty members. The reasons for the difference could be that male faculty members are familiar, more interested, and are inclined to the use of educational technology than their female counterparts (Sahay & Dawson, 2019).

Another possible reason for the finding may be that male teaching staff in Ghanaian technical universities generally have the habit of deploying electronic devices such as the computer/laptop, mobile phones, and other technology tools for learning and have the tendency to have better knowledge and skills in their usage than female faculty members. For instance, males use more computer/laptop and mobiles for internet search, attend more technology-based classes and are self-motivated to learn computer skills (Al-Emran et al., 2016).

Besides, most female faculty members are usually occupied with many activities; therefore, they do not have much time at their disposal to work with educational technologies. For example, it is believed that working with educational technologies is time-consuming and complex, and it requires time and continuous practice (Lewis et al., 2013). Furthermore, it is perceived that female faculty members do not show much interest in exploring technology, unlike their male counterpart; therefore, they may lack the knowledge and the confidence to use technology tools for teaching (Braak, 2001).

Research suggests the reasons for such gender imbalances in the use of educational technologies in higher institutions are socially constructed and are not related to innate ability (Zhou & Xu, (2007). This implies that certain extrinsic variables rather than intrinsic factors make females lag behind male

faculty members in educational technology use in teaching. The results also revealed that previous technology use experience outcomes influence female attitude to technology use in teaching. Previous experience in technology use is essential for a more favourable attitude to educational technology use in teaching (Makewa et al., 2014). One stands to reason that if female faculty members have reduced workload, given support and are trained, they are likely to use educational technologies for teaching. This suggests that the leadership of technical universities in Ghana must provide more training opportunities for female faculty members to explore technology use for teaching.

Relating the findings of the study to existing literature shows similar outcomes in other studies. For example, Chevers and Whyte's (2015) study in New Zealand found that female instructors are less likely to integrate technology into instructional delivery. In a similar development, Markauskaite (2006) found significant inequalities among male and female faculty members in educational technologies use for teaching. Contrary, Jamieson-Proctor et al. (2006), who researched teacher integration of educational technology with 929 faculty members, found female faculty members using educational technology more than male faculty members. In Norris et al.'s (2003) study, it was revealed that gender variables did not predict the use of educational technology among the instructors. In the same way, Makewa et al.'s (2014) test for differences in technology use among gender found no significant differences in the application of educational technology in teaching in South African universities. In Nigeria and Malaysia, Onwuagboke et al. (2015) and

Wong and Hanafi (2007), respectively, found no difference in technology used for instructional delivery among genders in higher institutions.

From the lenses of the Technological Pedagogical Content Knowledge (TPACK) Model (Koehler & Mishra, 2009), one would debate that lack of technological knowledge in the use of educational technology by female faculty members would result in less use of educational technology devices for teaching. However, by applying the TPACK Model, it becomes evident that female faculty members require some knowledge and skills in technology usage, without which educational technology incorporation into teaching becomes difficult. This suggests that female faculty members in Ghanaian technical universities can continuously use educational technology if they develop the requisite technical knowhow and skills.

The TPACK Model emphasises that teaching a particular content requires an understanding of that content, the appropriate technology to make that content available, the pedagogical approach to be used, and an understanding of the needs of learners (Harris et al., 2009). Thus, the results revealed that instructors could integrate educational technologies into various pedagogical activities at specific times, and they were able to facilitate instructional delivery. Developing Technological Knowledge (TK) is an essential factor for teaching. However, lack of Technological Knowledge for the 21st-century faculty member would make knowledge somehow difficult. True classroom technology integration can be attained when faculty understands and negotiate the relationships among the three components of knowledge that is TK, CK, and PK.

5.4 Relationship between Educational Technology and Teaching

Both quantitative and qualitative results showed a relationship between educational technology integration and teaching. The quantitative results on the relationship between educational technology use and enhanced teaching are depicted in Table 4.4. The study results showed a significant positive correlation between educational technology and enhanced teaching in the two Ghanaian technical universities. The enhanced teaching was measured by the number of times educational technology was used to substitute and augment teaching as reflected in Penteudura's (2012) Substitution, Argumentation, Modification, Redefinition model (SAMR) (see Figure 2.6). It also revealed that faculty members believed educational technology integration into teaching makes teaching easy, flexible, and less stressful and improves teacher-student collaboration.

A possible reason that could be attributable to the findings of this study may be because of the growing body of evidence that educational technology integration positively affects instructional delivery, promotes higher-order thinking and enhances effective delivery of course content (Idota & Miyoshi, 2012; Lidolf & Pasco, 2020; Lin et al., 2017).

The results corroborate the outcome of Kumar and Daniel (2016), who reported from Kenya that educational technology integration into teaching enhances faculty ability to deliver content, resulting in effectiveness of instructional delivery. Besides, Adedokun-Shittu and Shittu (2014) in Nigeria also provided evidence that integrating technology into teaching makes it lively, uncomplicated, provides flexibility during teaching sessions and improves teacher performance. In a related development, López-Pérez et al.

(2013) established that educational technology tools for teaching had enabled faculty members to substitute and augment some existing teaching practices for more enhanced teaching strategies to increase their output.

Debating from the angle of Penteudura's (2012) SAMR model point of view, one would reason that the impact of educational technology enhances teaching. However, it must be noted that educational technology use in teaching may be ineffective and inefficient if employed without consideration of its appropriateness and alignment to teacher's philosophy, the nature of course objectives, content and teaching outcomes (Balash et al., 2011). Therefore, faculty members of technical universities necessarily need to develop and carefully plan educational technology integration by identifying and considering their lesson aims, objectives and anticipated teaching and learning outcomes.

5.5 Summary

The chapter discussed the study results based on the themes in the research objectives and linked them to the study's context, theories, and conceptual Model. The key issues discussed in the chapter included educational technology devices frequently integrated into teaching, factors that affect educational technology integration in teaching, differences in educational technology use among male and female faculty members, and the relationship between educational technology and teaching.

The key messages in the chapter are that teaching staff in the technical universities are familiar with the use of laptop, mobile phones and projectors for instructional delivery hence the frequent use of these devices. Educational

technology use increases teacher's ability to speedily search for information. If faculty members are assisted with technological devices, it will boost their morale and encourage them to integrate educational technology in their teaching. Faculty members will decline to use educational technology devices that are not easy to use, not accessible and do not offer relative advantage. Providing adequate technology resources for instructional delivery allow educators to use various educational technology tools for teaching. Male faculty members are familiar, more interested and are inclined to use educational technology in their teaching more than their female counterparts. Lastly, the use of educational technology enhances instructional delivery. The next chapter provides a summary of the whole thesis, conclusions, recommendations based on the findings, implications of the study, contributions to knowledge and suggestions for further study.

CHAPTER SIX

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

6.0 Introduction

This chapter presents the summary, key findings, conclusions, and recommendations of the study. Finally, it presents how the study contributes to the existing body of knowledge in technology integration into teaching, implications for Adult Education and Human Resource Studies and practice, as well as suggestions for further studies.

6.1 Summary

The purpose of the study was to assess educational technology integration into teaching in Ghanaian technical universities. The study sought to:

1. determine educational technologies most frequently integrated into teaching in Ghanaian technical universities.
2. assess the factors that affect educational technology integration into teaching in Ghanaian technical universities.
3. measure the extent of educational technology integration between male and female faculty members.
4. analyse the relationship between educational technology integration and enhanced teaching.

The pragmatism philosophy underpinned the study, the approach was Mixed-Method, and the design was Embedded Mixed Method Design. The study was conducted in Takoradi and Koforidua Technical Universities between May 30, 2020 to July 31, 2020. The sample size was 252 lecturers was used with the

help of Yamane's (1967) formula for determining a sample size from a give population. The methods for data collection were questionnaire and interviewing, and the instruments were questionnaire administration and semi-structured interviews. The data obtained from the field were analysed using descriptive and inferential statistics, and thematic analysis. The findings of the study were based on the objectives of the study.

6.2 Key Findings

6.2.1 Educational technologies frequently used for teaching

The study found that educational technologies integrated into teaching are the laptop, mobile phones, and projectors.

6.2.2 Factors affecting educational technology integration in teaching

The study revealed that the main factors affecting the integration of educational technology into teaching are inadequate educational resources, inconsistent internet connectivity, lack of technical support system, lack of motivation, and inadequate training in educational technology for faculty members.

6.2.3 Differences in the use of educational technology between male and female faculty members

The study revealed that there are differences in the educational technology integration among male and female faculty members. Male faculty members tend to integrate educational technology into teaching more than female faculty members.

6.2.4 The Relationship between educational technology and enhanced teaching

The study found that educational technology integration in technical universities enhanced teaching as faculty members can substitute and augment teaching practices with educational technology.

6.2.5 Experiences of faculty members for integrating educational technology

The study revealed that faculty member beliefs, attitudes, perception, previous experience with educational technology and teaching philosophies influence their use of educational technology in teaching. The study found that educational technologies were mostly integrated into lesson presentation, for communication, to assess student's work, to search for information and send course materials to students. However, faculty members lacked training and motivation for integrating educational technology into teaching.

6.3 Conclusions

Based on the findings of the study, the following conclusions were drawn:

1. Laptops, mobile phones and projectors are the most commonly used educational technology in teaching. This means technical universities will have to buy more of these devices for lecturers to use.
2. Many factors affect educational technology use in teaching. This means technical universities should provide adequate resources to support lecturers to use educational technology in teaching.
3. There is gender disparity in educational technology use in teaching. Therefore, technical universities must encourage and motivate female lecturers to use educational technology in teaching.

4. Educational technology improves teaching therefore; technical universities must encourage lecturers to use educational technology in teaching.

6.4 Recommendations

Based on the findings of the study, it is recommended that:

- Faculty members and the university authorities acquire more educational technology devices for teaching to enable faculty members take full advantage of deploying educational technologies.
- Faculty members further explore the various uses of educational technology in order to take full advantage of their uses.
- In order to inspire and motivate faculty members to continuously use educational technology in teaching and research, the various institutions should invest more resources in procuring adequate educational technology tools and ensuring adequate internet bandwidth for internet connectivity.
- Management of technical universities must encourage and motivate female faculty members through continuous training and adequate provision of educational technology devices and technical support services. This will make them confident and boost their morale to integrate educational technology into teaching and research.
- Institutions of higher education must make effort to organize continuous in-service training in the form of workshops and seminars to acquaint faculty members with the needed competencies for

effective and efficient integration of educational technologies into teaching.

6.5 Implications of the Study

6.5.1 Implications for adult education

Technology permeates every aspect of education and adult education is no exception. This implies that facilitators of adult education should be knowledgeable, skillful and acquire the experiences in using educational technology tools to ensure the provision of education either by conventional face-to-face, blended learning, distance education, and online learning.

6.5.2 The implication for educational technology

Technology varies and is also constantly updated. Therefore, they become obsolete with time. This suggests that there should be continuous training and development in the form of workshops and seminars to constantly upgrade teachers' and students' knowledge of prevailing educational technology for effective integration.

6.5.3 Implications for distance education

The spread of COVID 19 has made distance education more necessary than ever; this implies that educational technology is the key and much needed alternative to provide instructions. Therefore, educational technology becomes critical to ensure effective delivery of distance education.

6.5.4 Implications for human resource development

Technological advancement has necessitated virtual training as a tool for the professional development of the human resource. This implies that human resource practitioners, training and development facilitators and educators

must take advantage of technology to enhance the capacities and competencies of the human resource.

6.5.5 Implications for curriculum development

As the world keeps changing due to advancement in technology, it becomes crucial for curriculum developers to continuously update or revise syllabus for teaching to incorporate new technologies since the update in existing educational technology becomes obsolete and would no longer be useful for teaching and learning.

6.6 Contributions to Knowledge

The study contributes to the existing body of knowledge in filling the gap in the literature on educational technology integration into teaching in higher educational institutions, particularly in technical universities. Besides, the study has also contributed to filling the gap in methodology by employing the Embedded Mixed Method Approach to study the phenomenon with more emphasis on quantitative approach since most of the studies reviewed either used the exploratory mixed method approach or qualitative approach in studying the phenomenon.

6.7 Suggestions for Further Studies

The study assessed educational technology integration in teaching in two Ghanaian technical universities, Takoradi and Koforidua Technical Universities. Besides, it employed the Embedded Mixed Method Design. It is suggested that further studies in the broader field of educational technologies for teaching, learning, and research be conducted in other technical universities, traditional public universities as well as private institutions. Also,

further studies may be conducted employing the concurrent mixed method design to give equal emphasis on both the qualitative and quantitative approaches to the study of the phenomenon.

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APPENDICES

Appendix A: Research Questionnaire

UNIVERSITY OF GHANA

DEPARTMENT OF ADULT EDUCATION AND HUMAN RESOURCE STUDIES

The following questions are part of a survey being conducted in partial fulfillment of a Doctor of Philosophy in Adult Education and Human Resource Studies from University of Ghana on the topic, "Assessing Educational Technology Integration in Teaching and Learning in Technical Universities in Ghana." This investigation is purely for academic purpose therefore, confidentiality of information provided is highly guaranteed. You are, therefore, kindly requested to provide accurate answers to the following questions. Thank you.

QUESTIONNAIRE FOR TEACHING STAFF

SECTION A: DEMOGRAPHIC CHARACTERISTICS

a. Name of Institution: ----------

b. Faculty: ----------

c. Department: ----------

d. Gender

1. Male [ ]
2. Female [ ]

e. Age Group

1. 21 – 30 [ ]
2. 31 – 40 [ ]
3. 41 – 50 [ ]
4. 51 – 60 [ ]
5. Above 60 [ ]

f. Level of Education

1. First degree [ ]
2. Master's degree [ ]
3. PhD [ ]
4. Post-doctoral [ ]
5. Others……

g. Years of Teaching

1. 1 – 5 years [ ]
2. 6 – 10 years [ ]
3. 11 – 15 years [ ]
4. Above 15 years [ ]

SECTION B: HOW DO YOU FEEL ABOUT EDUCATIONAL TECHNOLOGY IN GENERAL?

Choose the appropriate response on a scale of 1 – 5, **where:**

Strongly agree = **5** Agree = **4** Neutral = **3**

Disagree = **2** Strongly disagree = **1**

	ATTITUDE TO EDUCATIONAL TECHNOLOGY IN GENERAL	**5**	**4**	**3**	**2**	**1**
	Anxiety					
1.	I am afraid that I might loss all my technological data					
2.	Using educational technology takes too much time					
3. .	I am concerned about my knowledge about using educational technology					
4.	I am afraid of damaging educational technology devices					
5.	Working with educational technology makes me nervous					
	Belief					
6.	Knowing how to use educational technology supports professional development					
7.	Using educational technology is an effective way to grab students' attention					
8.	using educational technology for teaching is important					
9.	Using educational technology is waste of time					

SECTION C: EDUCATIONAL TECHNOLOGIES AND THE NUMBER OF TIMES YOU INTEGRATE THEM INTO TEACHING?

Choose the appropriate response on a scale of 1 – 5, **where:**

Regularly (Daily) = **5** Frequently (Weekly) = **4** Occasionally (Monthly) = **3** Rarely (1- 2 Times A Year) = **2**

Never Used = **1**

	EDUCATIONAL TECHNOLOGIES	**5**	**4**	**3**	**2**	**1**
	Hardware					
1.	Digital camera					
2.	Laptops					
3.	IPad					
4.	Smartboard					
5.	Desktop Computer					
6.	Video camera					
7.	Headphones					
8.	Television (TV)					
9.	Mobile phones					
10.	Projector					
11.	Speaker					

1. How many times do you use educational technology to substitute and argument teaching?
    1. once [ ]
    2. two times [ ]
    3. three times [ ]
    4. four times [ ]
    5. five times and more [ ]

2. Do you consider taking a course in educational technology?
    1. Yes [ ] 2. No [ ]

3. Have you had any training in educational technology since you began working here
   1. Yes [ ] 2. No [ ]

SECTION D: WHAT IS THE EXTENT TO WHICH YOU INTEGRATE TECHNOLOGY INTO TEACHING?

Choose the appropriate response on a scale of 1 – 5, **where:**

Very great extent = **5** Great extent = **4** Some extent = **3**

Little extent = **2** Very little extent = **1**

	THE EXTENT EDUCATIONAL TECHNOLOGY IS INTEGRATED	**5**	**4**	**3**	**2**	**1**
1.	I incorporate educational technology when presenting lessons					
2.	I use educational technology for online interaction with students					
3.	I use educational technology to assess students' assignment					
4.	I search for information for lesson preparation using educational technology					
5.	I send course outline and reading materials to students using educational technology					
6.	I encourage students use the digital camera for their project work					
7.	I make students use Excel to analyse or graph data					
8.	I urge students take assessment online					
9.	I encourage students use content specific App to learn and reinforce skills					
10.	I urge students use personal devices (smartphones, iPod, iPad, laptops etc) during class					

SECTION E: WHAT ARE THE FACTORS THAT INFLUENCE EDUCATIONAL TECHNOLOGY INTEGRATION IN YOUR TEACHING?

Choose the appropriate response on a scale of 1 – 5, **where:**

Strongly Agree = **5** Agree = **4** Uncertain = **3**

Disagree = **2** Strongly Disagree = **1**

	FACTORS THAT INFLUENCE EDUCATIONAL TECHNOLOGY INTEGRATION	**5**	**4**	**3**	**2**	**1**
1.	I lack leadership support					
2.	Poor students attitude towards the use of educational technology					
3.	Lack of time to plan and integrate educational technology into teaching					
4.	Lack of internet connectivity					
5.	Frequent power outages					
6.	Inadequate technological resources and tools for teaching					
7.	Lack of technical support system					
8.	Lack of institutional support for using educational technology					
9.	Difficulty in learning using educational technology					

SECTION F: WHAT ARE THE OUTCOMES OF EDUCATIONAL TECHNOLOGY INTEGRATION ON YOUR TEACHING

Choose the appropriate response on a scale of 1 – 5, **where:** effect

Strongly Agree = **5** Agree = **4** Not sure = **3**

Disagree = **2** Strongly Disagree = **1**

	OUTCOMES OF EDUCATIONAL TECHNOLOGY INTEGRATION	**5**	**4**	**3**	**2**	**1**
1.	Educational technology serves as a teaching aid and task enabler					
2.	Educational technology makes teaching flexible					
3.	Educational technology makes teaching effective					
4.	Educational technology makes teaching simple					
5.	Educational technology makes instructors prepare lessons with ease					
6.	Educational technology gives me the opportunity to vary teaching methods					

Appendix B: Interview Schedule for Pro Vice-Chancellors

UNIVERSITY OF GHANA

DEPARTMENT OF ADULT EDUCATION AND HUMAN RESOURCE STUDIES

Phase 2: Qualitative

Semi-structured Interview for Pro Vice Chancellors

1. How many years have you worked in the institution?
2. What is your opinion about integrating educational technologies into teaching and learning?
3. What are some of the challenges/factors confronting the institution in their quest to integrate technology into teaching and learning?
4. What motivational do you offer lectures who frequently integrate educational technology into teaching?
5. Do lectures in your institution integrate educational technology into teaching? Is there any policy Model that enforces them to integrate and what punitive measures are put in place to make lectures integrate educational technology into teaching?
6. What measures has the institution put in place to ensure all lecturers teach with educational technologies?
7. What is the state of educational technology infrastructure in your institution?
8. What educational technologies do lecturers and students mostly use for teaching and learning?

9. To what extent do lecturers and students use educational technology of teaching and learning?
10. What are some of the effects of the use of educational technology on lecturer's effectiveness?
11. What are some of the influences of the use of educational technologies on students learning outcome?
12. What measures has your institution put in place to ensure the integration of educational technologies by all lecturers and students?

Appendix C: Interview Schedule for Teaching Staff

UNIVERSITY OF GHANA

DEPARTMENT OF ADULT EDUCATION AND HUMAN RESOURCE STUDIES

Phase 2: Qualitative

Semi-structured Interview for teaching staff

1. Which department do you work with?
2. How many years have you taught in the institution?
3. What is your view on the incorporating educational technology into teaching and learning?
4. Do you incorporate educational technologies into your teaching? If yes! How do you do it?
5. What hardware technologies do you incorporate?
6. How often do you integrate the hardware identified in Q5 in your teaching?
7. Which software or application do you incorporate into your teaching?
8. What is the extent to which you employ these technologies for teaching?
9. What inspires you to integrate educational technologies into teaching?
10. What challenges do you encounter in your quest to integrate the identified educational technologies into your teaching?
11. Since you started working in the institution, have you had any training in educational technology, if yes, how many times and in which specific area

12. Do you think you would need further training in educational technology?
13. How has the integration of educational technologies into teaching helped you and your students?
14. Do you think your institution as the needed or adequate educational technologies for teaching and for learning? if yes, explain and if no, what do you think are the inadequacies and what you think should be done?
15. Do you think your students employ educational technology for learning?
16. In this era of corona virus pandemic, how have you been teaching and how are your students learning?
17. What specific challenges do you as a teacher face in your attempt to teaching and likewise your students in their attempt to learn?
18. Going forward, what do you think you should do to ensure effective integration of educational technologies into teaching and learning?

Appendix D: Permission Letters from Researched Institutions

KOFORIDUA TECHNICAL UNIVERSITY
(OFFICE OF THE REGISTRAR)
P. O. Box KF 981,
Koforidua - E/R
Ghana, West Africa
Tel: (+233) 3420 24466 (+233) 3420 22890 (+233) 3420 24993 Tel/Fax: (+233) 3420 21817
Email: registrar@ktu.edu.gh Website: www.ktu.edu.gh

Our Ref: KTU/HR/Vol.2c/14 Your Ref: Date: 13TH JAN., 2020

Prof. Olivia A. T. F. Kwapong
The Head of Department of Adult Education and Human Resource Studies
School of Continuing and Distance Education
University of Ghana
Legon

Dear Madam,

RE: INTRODUCTORY LETTER – EUGENE OWUSU ACHEAMPONG (SID NO. 10636242)

Your letter dated **2nd December, 2019** with reference **DAEHRS** on the above subject-matter refers please.

We wish to inform you that approval has been granted for **Mr. Eugene Owusu Acheampong** to undertake his academic research at Koforidua Technical University.

He should contact the Head of Human Resource at the University who will assist him in collecting the requisite data for his PhD studies.

Yours faithfully,

N. A. Mensah-Livingstone (Dr.)
Registrar

Cc:
HoD (HR)
Mr. Eugene Owusu Acheampong

TAKORADI TECHNICAL UNIVERSITY

OFFICE OF THE REGISTRAR,
HUMAN RESOURCE DIVISION
P. O. BOX 256, TAKORADI - GHANA
Website: www.ttu.edu.gh Email: hrdivision@ttu.edu.gh
Tel: +233 (0) 312 022 917/ +233 (0) 312 022 918

TTU/Admin/Vol./

30th January, 2020

The Head
Department of Adult Education and Human Resource Studies
School of Continuing and Distance Education
University of Ghana
P. O. Box 31
Legon, Accra

Dear Sir

RE: INTRODUCTORY LETTER – EUGENE OWUSU ACHEAMPONG (SID NO. 10636242)

Your letter on the above subject refers.

In your letter you introduced **Mr. Eugene Owusu Acheampong** (SID No. 10626242) as a Ph.D. candidate of the Department of Adult Education and Human Resource Studies of School of Continuing and Distance Education under the College of Education, University of Ghana, Legon.

We write to inform you that approval has been given to Mr. Acheampong to conduct data collection on the study he is undertaking for his thesis: *Evaluating Educational Technology Integration in Teaching and Learning in Technical Universities in Ghana.*

We wish him well on his thesis work.

Yours faithfully

JOSEPH ESHUN
DEPUTY REGISTRAR (HR)
for: **REGISTRAR**

cc:
Vice Chancellor
Pro-Vice Chancellor
Registrar
Mr. Eugene Owusu Acheampong

ADWEN, AKOMA NA NSA MA MPUNTU

Appendix E: Ethical Clearance

UNIVERSITY OF GHANA
ETHICS COMMITTEE FOR THE HUMANITIES (ECH)
P. O. Box LG 74, Legon, Accra, Ghana

My Ref. No…ECH 101/19-20 …

May 26th, 2020

Mr. Eugene Owusu-Acheampong
Department of Adult Education and
Human Resource Studies
University of Ghana
Legon

ETHICAL CLEARANCE
(ECH 101/19-20)

The protocol tittle below has been reviewed and approved by the ECH Committee.

TITLE OF PROTOCOL: **EVALUATING EDUCATIONAL TECHNOLOGY INTEGRATION IN TEACHING AND LEARNING IN TECHNICAL UNIVERSITIES IN GHANA**

PRINCIPAL INVESTIGATOR: **MR. EUGENE OWUSU-ACHEAMPONG**

Please note that the final review report must be submitted to the Committee at the completion of the study. Your research records may be audited at any time during or after the implementation. Any modification of this research project must be submitted to ECH for review and approval prior to implementation.

Please report all serious adverse events related to this study to ECH within seven (7) days verbally and in writing within fourteen (14) days.

This certificate is valid till May 25th, 2021. You are to submit annual reports for continuing review.

Please accept my congratulations.

Yours Sincerely,

Professor C. Charles Mate-Kole
ECH Chair

Cc: Professor Yaw Oheneba-Sakyi, Department of Adult Education, UG
Professor Olivia A. T. Kwapong, Department of Adult Education, UG
Dr. Inusah Salifu, Department of Adult Education, UG

Tel: +233-303933866 Email: ech@ug.edu.gh

UNIVERSITY OF GHANA
DEPARTMENT OF ADULT EDUCATION AND HUMAN RESOURCE STUDIES
SCHOOL OF CONTINUING AND DISTANCE EDUCATION

Ref. No.: **DAEHRS/001**

January 16, 2020

The Chairperson
Ethics Committee for Humanities
ISSER, University of Ghana
Legon

Dear Sir/Madam,

APPLICATION FOR ETHICAL CLEARANCE – EUGENE OWUSU-ACHEAMPONG (SID NO. 10636242)

The above named person is a Ph.D. in Adult Education and Human Resource Studies student of the Department of Adult Education and Human Resource Studies, within the School of Continuing and Distance Education.

He has fulfilled all the necessary requirements to make him eligible to proceed to the data collection phase of his Ph.D. work **(Evaluating Educational Technology Integration in Teaching and Learning in Technical Universities in Ghana)**.

I will be grateful if you could consider his application for ethical clearance approvals to enable him carry out this research.

Thank you.

Yours faithfully,

Prof. Olivia A. T. F. Kwapong
Head of Department

JisL

COLLEGE OF EDUCATION
P. O. Box 31, Legon, Accra, Ghana.
• Tel: +233 (0) 303 938 853 • Email: aehrs@ug.edu.gh • Website: www.coe.ug.edu.gh

Appendix F: Informed Consent Form

UNIVERSITY OF GHANA

Official Use only
Protocol number

Ethics Committee for Humanities (ECH)

PROTOCOL CONSENT FORM

Section A- BACKGROUND INFORMATION

Title of Study:	Evaluating Educational Technology Integration in Teaching and Learning in Technical Universities in Ghana.
Principal Investigator:	Eugene Owusu-Acheampong
Certified Protocol Number	ECH 101/19-20

Section B– CONSENT TO PARTICIPATE IN RESEARCH

General Information about Research

The purpose of the study is to gain better understanding on evaluating educational technology integration in teaching and learning to inform policy, practice, education and future research. I will examine factors that influence evaluation of educational technology in teaching and learning in Technical Universities and also explore the experiences of lecturers on the topic. Although the Technical University Act entreat technical universities to incorporate technologies in teaching, there is no mention on how the outcomes of such integration would be measured, the extent to which the technologies are to be integrated and how they are evaluated to ascertain their effectiveness in teaching. Besides, most studies in Ghana have focused on the technology integration at the basic and second cycle institutions and no study to date has evaluated the integration of educational technology in Ghanaian Technical Universities. It is in response to this literature gap that this study seeks to fill by proposing to evaluate the integration of educational technology in teaching and learning in Technical Universities in Ghana to achieve the needed teaching and learning outcomes.

The specific objectives are to determine educational technologies integrated into teaching and learning in technical universities, examine the extent to which educational technologies is integrated into teaching and learning in technical universities, investigate factors that influence educational technologies integration in teaching and learning in technical universities, analyze the effects of

educational technologies integration in teaching and learning on students learning outcomes in technical universities and explore lecturer's challenges in integrating educational technologies in teaching and learning in technical universities.

This study is of relevance as it will aim at contributing to the existing body of knowledge in the integration of educational technology in teaching and learning. It is expected that the findings of the study will serve as a reference point for other researchers who would like to conduct investigations in educational technology integration in teaching and learning. Besides, the results from the study will inform policy decision-makers on the strategies to employ to ensure the effective and efficient integration of educational technology in the teaching and learning process. Additionally, the findings from the study will also inform educational technology curriculum developers on the best way to incorporate educational technology in course contents to ensure its effective integration in teaching and learning. It will also inform policymakers about the factors that account for poor integration of educational technology in lesson delivery and institute measures to address the problems.

The study involves three phases of data collection. The first phase requires administering questionnaires to lecturer, the second phase requires interviewing pro vice chancellors and the third phase requires conducting focus group discussion among students. It is expected that participants would be required to use 20 minutes to complete the questionnaire, 40 minutes for interviewing and 60 minutes for the focus group discussion.

Benefits/Risks of the study

You will not benefit directly from this study, however results from the study will assist lecturers, the university authorities and the government to adopt strategies to evaluate the integration of educational technologies in teaching and learning.

Data collection will be taken from lecturers, pro vice chancellor and students. There will minimal risks associated with this study beyond the inconvenience of time taken for the researcher to collect data. In the unlikely event you are uncomfortable sharing any information with the researcher, you may withdraw at any time up until the data are analysed. Refusal to speak and/or withdraw from the study will not affect your relationship with your institution or the research team.

Confidentiality

Please note that participation in this study is voluntary. All the information you provide will be treated as confidential. Your name will not appear anywhere in the document. The researcher is under a code of ethics that forbids or does not allow that information gathered for this research to be used for any other purpose other than for this research.

Compensation

Participants will not be paid or given incentives to participate in the study.

Withdrawal from Study

Your participation in this research is voluntarily and you can decline to take part in the project at any time. This will not affect you in anyway. You would still have all the benefits that you enjoy in your work.

If you are uncomfortable sharing any information with the researcher about any topic raised during the interview, you may refuse to speak on the subject and/or withdraw at any time up until data are analysed. If you choose not to speak and/or withdraw from the study, your relationship with your institution or the research team will in no way be affected.

Contact for Additional Information

- If you have any questions about your rights as a research participant in this study you may contact the Administrator of the Ethics Committee for Humanities, ISSER, University of Ghana at ech@ug.edu.gh or 00233- 303-933-866.

Section C- PARTICIPANT AGREEMENT

"I have read or have had someone read all of the above, asked questions, received answers regarding participation in this study, and am willing to give consent for me, my child/ward to participate in this study. I will not have waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for my personal records."

_____

Name of Participant

_____ _____

Signature or mark of Participant Date

If participant cannot read and or understand the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

_____

Name of witness

Signature of witness / Mark Date

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

_____

Name of Person who Obtained Consent

_____ _____

Signature of Person Who Obtained Consent Date