UNIVERSITY OF EDUCATION, WINNEBA

A STUDY OF SELF-EFFICACY BELIEFS IN COMPUTER USE OF UNDERGRADUATE MATHS STUDENTS' AND ITS RELATIONSHIP TO THEIR COMPUTER EXPERIENCES IN SHS

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DECLARATION

STUDENT'S DECLARATION

I, Alexander Kofi Amoateng, declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

Signature: ……

Date: ……

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

Name of Supervisor: Mr Jones Apawu

Signature: ……

Date: ……

DEDICATION

This study is dedicated to the loving memory of my deceased parents, Mr and Mrs Amoateng. You inspired greatness in me. May your legacy live on.

ACKNOWLEDGEMENT

What shall I say unto the Lord for all His mercies? Great is your faithfulness! Thank you Father. I am very much grateful to my supervisor, Mr Jones Apawu under whose direction and guidance this work has been a reality. I would sincerely like to express my heartfelt gratitude to him, for his patience, many in-depth and constructive criticisms and valuable suggestions, which have immensely contributed to the success of this work. God richly bless you.

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ABSTRACT

This study investigated Self-efficacy Beliefs in Computer use of Undergraduate maths Students' and its Relationship to their Computer Experiences in SHS. The study used quantitative methodology which employed survey design as an approach of inquiry. Bandura self-efficacy beliefs theory was used as a conceptual model to assess the extent of students' computer competence and constructivist teaching and learning principle as a theoretical framework to assess SHS students' computer experience. The population was first year undergraduate maths students from Kwame Nkrumah University of Science and Technology, Kumasi in the Ashanti Region during 2017/2018 academic year. The sample consisted of students from three programmes of study; BSc Statistics, BSc Actuarial Science and BSc Mathematics. A sample of 258 undergraduate students participated in the study (159 males, 97 females and 2 missing gender data). The researcher used questionnaire for data collection. The study revealed that, majority (75%) of the students had High self-efficacy beliefs in computer use and 25% had Low self-efficacy beliefs in computer use. Another notable finding made was that there was no gender difference in undergraduate students' self-efficacy beliefs in computer use. It was also found that majority (55%) of respondents had low computer experience in SHS and 45% respondents had high computer experience in SHS. Finally, it was observed that respondents with higher computer experience in SHS had high self-efficacy beliefs in computer use and respondents with low computer experience in SHS had low self-efficacy beliefs in computer use presently. The Pearson Correlation analysis showed that there was a relationship between undergraduate students' self-efficacy beliefs in computer use and their computer experiences in SHS. A more remarkable finding is the impact of the previous computer experience on current computer competence.

CHAPTER 1

INTRODUCTION

1.0 Overview

This chapter is the introductory section of the research. The chapter starts off with a background to the study, statement of the study problem, purpose of the study, objectives of the study, research questions, significance of the study, assumptions, delimitations of the study, limitation of the study, definition of terms, and organisational of the study.

1.1 Background to the Study

Humanity's behaviors towards controlling and altering the environments to meet their needs started with the existence of human beings and humans have used their mind to design and develop tools for their use (Isik, 2018). Technology is such tool and skill developed for use in these environments for learning and the use of technology improves student learning and motivation (Ciampa, 2014). Bandura (2012) suggested that technology has fundamentally changed the way society acts and interacts with technology by allowing people to exercise greater influence in how they communicate, educate themselves, carry out their work, relate to each other, and conduct their business and daily affairs. It is then critically important to understand the factors that impact the way individuals perceive and utilize technology.

Technology is defined as "the tools that human beings develop to control and change their material environment and the knowledge of all relevant things" (Isik, 2018, p. 704). The use of technology and its application has become a crucial tool in the development of every society and plays a significant role in nation building with a global perspective. In the 21st century, ability to work with Information and

Communication Technology (ICT) is an invaluable asset in education, life and workplace success as basic human needs are (The Ethiopian Herald, 2015).

The Ethiopian Herald (2015) also stated that:

> In the era of globalization where economic and technical development has pushed nations to stiff competition, ICT has been playing a paramount role in running all sorts of business at ease and Not only ICT a tremendous contribution to the effort geared towards enhancing socio-economic development but it also helps facilitate good governance through two way communication between citizenry and elected officials and technocrats (The Ethiopian Herald. (2015, June 01). *allAfrica.* Retrieved September 20, 2018, from https://allafrica.com/stories/201506010625.html)

ICT is now varying how education, business and nations are interacting making dynamic changes in society and influencing all aspects of life. The influences are felt more and more at schools. For the reason that ICT provide both students and teachers with more opportunities in adapting learning and teaching to individual needs. Inasmuch as society is adapting to this new technological advancement, it is also forcing schools appropriate respond to this technical innovation (Ratheeswari, 2018).

The rapid growth in technology has made ICT to be considered one of the basic building blocks of modern society since the dawn of the 21st century. United Nations Educational, Scientific and Cultural Organization, UNESCO, also states that:

> ICT has become, within a very short time, one of the basic building blocks of modern society. One of UNESCO's overriding aims is to ensure that all countries, both developed and developing, have access to the best educational facilities necessary to prepare young people to play full roles in modern society and to contribute to a knowledge nation (UNESCO. (2014, April 24). *Multimedia Archives eServices*. Retrieved August 05, 2019, from United Nations Educational, Scientific and Cultural Organization:

http://www.unesco.org/archives/multimedia/subject/55/access+to+knowledge

ICT is measured to be a set of tools enabling, supporting, and reinforcing educational reform that fits the educational demands of the knowledge society (Dede, 2000; Ward, 2005). UNESCO refer to ICT as a scientific, technological and engineering discipline and management technique used in handling information, its application and association with social, economic and cultural matters (UNESCO, Mobile Learning Week Report , 2011). Ratheeswari (2018) defined ICT as "technologies that offer access to information through telecommunication" (p. 45), and further explained that ICT principally focuses on communication technology which includes the internet, wireless networks, cell phones and other communication mediums similar to Information Technology (IT). According to Rouse (2015) IT refers to the use of computer technology to store information through networking and other physical infrastructure devices to process, create, secure and exchange all forms of electronic data. Computer technology is a key component of ICT and its literacy is very important in this modern era of technological advancement. It is important to distinction between all the different technological literacies for this research purposes. A number of experts consider digital literacy as a new literacy consisting of multiple dimensions and represented in new, multimodal social practices. Digital literacy is considered to be evolving from other literacies including information literacy, media literacy, Internet literacy, and computer or ICT literacy and, as such, is greater than the sum of the other literacies.

Law, Woo, Torre, and Wong (2018) define Digital literacy as the ability to access, manage, understand, integrate, communicate, evaluate, create information safely and appropriately, through digital technologies for employment, decent jobs and

entrepreneurship. Law et al. (2018) also includes competences that are variously referred to as computer literacy, ICT literacy, information literacy and media literacy.

Computer literacy is prevalent at all levels of Ghanaian society currently, due to the information technology policy framework adopted for education reforms in Ghana to be competitive in the rapid changing scope of technology world-wide. The government policy spelt out the need to increase and sustain socio-economic development through the implementation of 'solid' ICT programmes at all levels of educational institutions (Ministry of Education, 2003). As technology has become more prevalent, computer literacy broadly defined as the ability to use computer technology, has become an important form of human capital that affects economic success (Levy & Murnane, 1996; Reilly, 1995). It is anticipated that teaching and learning of ICT will have innovative impact on society with profound potential to transform nations and even overlap some aspects of human life. Computers have emerged as a learning technology which has been identified as an alternative theory of learning that is based on Constructivist Principles (Duffy & Cunningham, 1996). Using computer technology as a learning tool is basically learn and interact with each other, with technology and with life in general. McNeely (2005) simply put it as learning by doing. Constructivism is a paradigm of learning that assumes learning as a process individuals ''construct'' meaning or new knowledge based on their prior knowledge and experience (Jonassen, 1991). Constructivism is not a specific pedagogy. Educators call it the emerging pedagogy in contrast to the long existing behaviourism view of learning (Ratheeswari, 2018). A constructivist view of learning places importance on the learners' cognitive activity and the mental models they form (Leachey & Harris, 1993; Schultz & Schultz, 1992). Piaget's theory of Constructivist learning has had wide ranging impact on learning theories and teaching methods in education and is an underlying theme of

many education reform movements. This learning theory and teaching methods emphasizes on learning which is concrete rather than abstract and focuses on teaching as guiding the learner to build on and modify their existing mental models (Piaget, 1972). In other words, teaching and learning focus on knowledge construction rather than knowledge transmission (McInerney & McInerney, 1994; Slavin, 1994).

There are accepted changes in teaching and learning practices in recent years in Ghana. These changes have been underpinned by shifts in ideological theory; the most recent being the change in favour of constructivism. Stakeholders in Ghana's education sector have greeted the changes and implementation of the policy across schools as remarkable and contributed a lot to education in the area of computer competence, knowledge acquisition, communication and information sharing, and new innovations. The justification for ICT investments in education was to provide learners the opportunity to create their own knowledge and for students to possess a wide variety of computer knowledge and skills for both academic and career success (Furst-Bowe, Boger, Franklin, McIntyre, Polansky, & Schlough, 1995; Oliver, 2000). However, the question is: what computer competence, knowledge and skills should university students possess when they enter and leave university?

The Senior High School (SHS) curriculum demands that all students be taught certain basic ICT competence, knowledge and skills before completing programmes of study (Ministry of Education , 2010). Hence, it is assumed that all freshmen at the tertiary level of education who have passed through the Ghanaian SHS system must have acquired certain basic ICT competence, knowledge and skills. Ministry of Education (2010) curriculum for SHS students describes the rationale for the teaching and learning of core ICT as imperative for every student to be competent in the use of ICT for many tasks and the themes in the syllabus include; Introduction to ICT, Word

Processing, Internet, Typing, Spreadsheets and Presentation. One of the major goals of ICT education in Ghana is to improve higher order thinking skills; hence emphasis on how ICT is taught and assessed in Ghanaian schools is very relevant. Granted undergraduate students have already completed some basic computer course at SHS level, yet lecturers at the various universities are met with a wide range of computer knowledge or competence and occasionally compelled to commence teaching of information literacy to first year students (Yeboah, Dadzie, & Owusu-Ansah, 2017). This creates misunderstanding on the exact level of computer competence and knowledge taught in SHS and the level of computer competence freshmen should have.

Generally, computer competence is said to have two ideologies; Computer self-efficacy (CSE) and Task-specific self-efficacy (TSE) (Marakas, Yi, & Johnson, 1998). Marakas et al. (1998) drew a distinction between CSE and TSE. They explained that, CSE is an individual's judgment of efficacy across multiple computer application domains and defined TSE as perceptions of ability to perform specific computer related tasks in the domain of general computing. In the era of technological advancement, studies of the effects of computer competence point to how important the role of self-efficacy helps in determining individual's behaviour and performance using computer technologies (Compeau & Higgins, 1995; Gist, Schwoerer & Rosen, 1989; Simsek, 2011). Campbell and Williams (1990) also reported influence of cognitive, social, and motivational factors affecting computer competence and the influence includes computer ownership, age, computer experience, gender, computer confidence and attitudes. It has been determined that self-efficacy also affects other predictors such as gender, perceived computer background and mathematics achievements (Schunk, 1991). There are other similar research which confirms computer ownership, confidence, attitude, age, gender and experience influencing computer competence

(Corston & Colman, 1996; Rozell & Gardner, 2000). This indicates that self-efficacy plays a big role in determining an individual's competence, knowledge and skills in computer use.

Self-efficacy is a component of social cognitive theory with a multidimensional fundamental structure that addresses both the development of competencies and the regulation of action (Bandura, 1986). According to Bandura's social cognitive theory, self-efficacy plays a central role in guiding human motivation and action. Bandura (1995) defined self-efficacy as; the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations. Bandura went further to describe self-efficacy as people's judgment of their capabilities to complete a designated task successfully (Bandura, 1997). It suggests that not only do individuals need to have the skills and knowledge to execute a task successfully but they also need to have a certain level of expectation for success before they perform the task. Thus, individual's self-efficacy is an awareness of their ability to accomplish a goal.

Bandura (1986) identified four major informational sources of self-efficacy and they are:

- Mastery experiences (e.g., past successes and failures),
- Vicarious experiences (e.g., observation of other student's performances),
- Social persuasion (e.g., encouragement and support) and,
- Physiological states (e.g., anxiety and fatigue).

According to Bandura (1997) the combined effect of these four major informational sources determines an individual's self-efficacy belief toward a given task. So individuals' or students' self-efficacy are based on these four major informational sources. Students' self-efficacy is an important basis for their academic motivation, performance, choice and capabilities to take on a task. Students' self-efficacy influences

their motivation to engage in any academic task with belief in their capabilities to accomplish that specific task. Students' self-capability also facilitates other elements that determines academic outcomes (Bandura, 1986; Schunk, 1991). Therefore, the confidence students' have in their own capabilities helps determine what they do with the knowledge they have acquired and skills they possess. By and large, academic performance of students is determined in large measure by the confidence with which they approach academic tasks. Pintrich and Schunk (2002) found a link between academic performance and self-efficacy in a study they conducted. Pintrich and Schunk suggested academic self-efficacy is a strong predictor of academic performance. Schunk (1991) referred academic self-efficacy to a person's perceived capability to perform given academic tasks at a desired level. There are studies which suggest three different levels at which academic (students') self-efficacy can be measured and these are:

1. Task specific level .e.g. self-efficacy measure for division or multiplication (Schunk, 1981).
2. Domain-specific level e.g., computer (ICT), science or mathematics (Hackett & Betz, 1989).
3. General academic level .e.g., expectancies for academic success (Malpass, O'Neil, Jr, & Hocevar, 1999; Meece, Wigfxeld, & Eccles, 1990).

In this study, students' (person's) perceived capability (i.e. self-efficacy) to perform a given academic tasks by the use of computer at a desired level was measured using domain-specific level.

There is a problem with teaching, learning and assessment of ICT currently in Ghana. At the SHS level, core ICT is mandatory but it is currently not an examinable subject (Mensah, 2017). This makes it difficult to measure students' academic

performance in relation to international standards so there is the need for an alternative assessment that will inform all stakeholders about students' computer experience, competence, and skills level. Over the years, ICT has been emphasised in the curriculum by decision makers and the government. However, assessment turns to focus on infrastructure, providing of computers to schools and office-oriented skills while not much attention are given to assessment of competence and experience. As a result, there are reports showing that about 14.1% of Ghanaians surveyed in the top earning working class use computers, as against 2.9% of those in the bottom (Frempong, 2012). Also, a survey conducted by Research ICT Africa found that, 10% of Ghanaian respondents indicated that they have used a computer before far behind South Africa (26.7% computer use) and Cameroon (15.1%), but better than 1.9% of Tanzania. This 10% computer use suggests that Ghana's government policies aimed at increasing ICT use have not been effective. There are many research works which focus on ICT penetration, teaching and learning of ICT, assessment of ICT, to name a few in Ghana; however the problem of assessing the level of computer competence and experience of Ghanaian students remains unattended to. The question that remains unanswered is what computer competence and experience does SHS graduates possess prior tertiary with regards to computer use. In this study, the researcher adopted self-efficacy belief introduced by Bandura (1977) to assess first year university students' self-efficacy to measure the level of computer competence and experience.

1.2 Statement of the Study Problem

The curriculum of ICT for SHS students, states the following as a rationale for teaching and learning core ICT: "ICT is so important in the world today that it makes it imperative for every person to be competent in the use of ICT for the many tasks that he/she will have to accomplish" (Ministry of Education , 2010, p.ii).

The syllabus is designed to provide basic skills in ICT for SHS students and it is expected that the knowledge and skills gained in this course will help students to use ICT in almost all their courses at school (Ministry of Education , 2010). The syllabus further states that: "The syllabus covers selected basic topics in ICT which offer hands-on activities to help students acquire the required ICT skills for the job market and social interaction in the global village" (Ministry of Education, 2010, p.ii).

Undergraduate first year students have already completed a basic computer course at SHS, yet, it appears most students still do not have a strong background in ICT (deGraft-Yankson & Avoke, 2007). Additionally, interactions the researcher had with some lecturers at the KNUST indicated that most first year students of their respective departments lack the requisite computer competence and experience which is needed at the university level. Consequently, adding up to the previously acquired experience and competence by students' becomes a challenge.

Again, according to Ministry of Education (2010) students should have acquired good reading, writing, numeracy and keyboarding skills from previous establishments to qualify for ICT course in SHS. It is obvious that, computer literacy keeps on changing rapidly and SHS level builds on the knowledge and competence developed at Junior High School (JHS) level. But in reality JHS students, SHS students and first year university students find computer use difficult and cannot use what they have learnt in ICT to solve non-routine problems. The difficult use of computers by

students is opined by Karsten and Schmidt (2008), VanLengen (2007), Wallace and Clariana (2005) and McDonald (2004). They found out in various studies that, first year undergraduate students seem not to have a strong self-efficacy concerning their ability to use computer technology to complete a given task. First year university students in Ghana also seem not to have a strong self-efficacy in their ability to use computer technology. This raises the question as to what type of computer experience and knowledge students' acquire at various levels of JHS and SHS. This makes it difficult for educators to improve on teaching and learning ICT in SHS.

Ministry of Education (2003) justified the investment in ICT education was to provide learners the opportunity to gain knowledge for the job market and social interaction in the global village. It is also acknowledged globally that students must possess a wide variety of computer knowledge and skills for both academic and career success (Furst-Bowe et al., 1995 & Oliver, 2000). Making student's computer knowledge and competence critical skills needed if they, as members of the society, are to contribute meaningfully to the future development of the nation. Danner and Pessu (2013) establish in a study that, within higher education, one of the major teaching challenges has always been helping students to bridge the gap between acquired computer knowledge and real life practice but Thacker (2006) questions whether students have acquire the required competence and experience needed to use computer technology to learn something worth knowing while Warner (2000) asserted that having knowledge about computers does not necessarily make you competent with computer use. This situation is similar to the researcher's observation of SHS students' use of computers and colleague teachers' assessment of computer experience of SHS students is nothing to write home about.

Again, a study between the 1970's and 1980's on gender inequality in education revealed that, there were gender inequality in education and did contribute to gender inequalities in the labour market (England & Browne, 1992; Marini & Fan, 1997). Furtherance to the findings of gender inequality in education is the increase of computer technology becoming more powerful tool in all over the world for changing the strategies of teaching and learning in classrooms. Several past researches have confirmed the existence of gender difference in the use of technology, showing that male students generally have higher self-efficacy towards the use of technology in learning than female students (Grandon, Alshare, & OKwan, 2005; Shen, Laffey, Lin, & Huang, 2006; Park, 2009). Research on the gender gap concerning computer use has mainly focused on gender differences in computer attitude, computer anxiety, computer usage, computer interest, self-confidence, computer experience and not really on computer self-efficacy beliefs.

Recently, gender and computer self-efficacy construct has been of great interest in the educational technology community (Sarfo, 2017). Studies conducted indicates a statistically substantial difference between gender and computer self-efficacy with other findings on the contrary. In general, there were different results for studies in gender and computer self-efficacy, broadly due to self-efficacy construct even where cultural differences play a role in an individual's self-efficacy beliefs. These findings seem not too different with SHS students self-efficacy beliefs in computer use.

Therefore, there is the need to assess students' computer experience and competence level since ICT is not an examinable subject at the SHS level at the moment and also check if gender have effect on students' self-efficacy beliefs in computer use.

1.3 Purpose of the Study

The purpose of the study was to find out the self-efficacy beliefs of undergraduate maths students' and its relationship to their computer experience in SHS.

1.4 Objectives of the Study

The objectives formulated for the study were to:

1. Identify how experienced SHS graduates are in computer use;
2. Identify students' competence level and if it is gender bias;
3. Investigate the extent SHS ICT experience and competence have on students' self-efficacy beliefs in computer use;
4. Find the extent of first year university students' self-efficacy beliefs in computer use.

1.5 Research Questions

The study was guided by the following research questions:

1. To what extent do undergraduate students' have computer self-efficacy beliefs?
2. Are there gender differences in undergraduate students' self-efficacy beliefs in computer use?
3. What are undergraduate students' computer experiences in SHS?
4. Is there a relationship between undergraduate students' computer self-efficacy beliefs and their computer experiences in SHS?

1.6 Hypotheses

To answer research question 2 and 4, the researcher formulated the following null and alternative hypothesis:

Hypothesis for research question 2

H_0: There is no gender difference in undergraduate students' self-efficacy beliefs in computer use.

H_1: There is gender difference in undergraduate students' self-efficacy beliefs in computer use.

Hypothesis for research question 4

H_0: there is no relationship between undergraduate students' computer self-efficacy beliefs and their computer experiences in SHS.

H_1: there is relationship between undergraduate students' computer self-efficacy beliefs and their computer experiences in SHS.

1.7 Significance of the Study

The ability to solve problems using computer technology requires experience and competence which is a lifetime skill that every future potential worker needs since it is a skill to solve non routine problems. Hence, a person who is deficient in either the basics or the competence and experience will be disadvantaged in the ability to cope with the new era of technological advancement. Thus, the findings will:

- Provide realistic evidence on students' weak computer experience and access to computers. This could provide guidance for policy makers and curriculum developers when reviewing the SHS ICT syllabus.
- Reveal strengths and weaknesses of students in use of computers. To help curriculum developers to put in place measures and strategies to help improve all deficiencies;
- Provide basis for cataloguing Ghanaian students' competence level on computer use. This will enable curriculum developers determine best teaching and assessment strategies to enhance students' computer competence levels;

- Provide self-efficacy beliefs as an alternative assessment tool to augment other procedures of assessment in the education sector.

1.8 Assumptions

It was assumed all respondents have already completed some basic computer course at SHS before research questionnaire were administered. This assumption was based on the curriculum of core ICT for SHS students. The curriculum makes it clear that ICT is so important in the world today and makes it imperative for every person to be competent in the use of ICT for the many tasks that he/she will have to accomplish (Ministry of Education, 2010). The syllabus is designed to provide basic skills in ICT for all SHS students and it is expected the knowledge and skills gained in core ICT will help students to use ICT in almost all their courses at school (Ministry of Education, 2010).

1.9 Delimitation of the Study

The study was delimited to first year university students' computer self-efficacy beliefs and computer experiences in SHS. The study is delimited to only Kwame Nkrumah University of Science and Technology (KNUST) Kumasi due to time and financial constraints. Therefore the findings of this study should not be generalized to all undergraduate students since respondents involved were first year students in BSc Mathematics, BSc Statistics and BSc Actuarial Science from the Department of Mathematics, KNUST.

1.10 Limitations of the Study

According to Best and Kham (2007) limitations are conditions beyond the control of the researcher that places restrictions on the conclusion of the study and its application. The finding of this study is limited to only KNUST in Kumasi, even though students in

other universities might have similar issues due to inadequate resources. The researcher decided to test students' practical use of computers but due to inadequate computers available, the practical test was neglected. Therefore, the findings of this study are limited in terms of generalization.

1.11 Definition of Terms

- **Technology**: the tools that human beings develop to control and change their material environment and the knowledge of all relevant things (TDK, 2018)
- **Computer:** is an electronic device, operating under the control of instructions stored in its own memory that can accept data (input), process the data according to specified rules, produce information (output), and store the information for future use (Vermaat, 2014).
- **Computer Technology (CT)**: is the design and construction of computers to better help people at work, school, home, etc. It is also software or computer program that enables learning, problem solving and higher order collaborative thinking processes which also makes/allows activities such as gathering, processing, storing and presenting of data possible. An example of computer technology is the development of a software program that allows people to accomplish task which has been automatically assigned from computers at their job location (Corp, 2018).
- **Computer Experience**: the ability to remember or recall material already learned and constitutes the lowest level of learning (Ministry of Education , 2010). In other words, experience is the frequency of computer usage for different activities and purposes. Bandura (1994) asserted that experience is particularly influential and recognized as one of the strongest factors that contributes to individual's self-efficacy because of its direct and personal nature.

- **Self-efficacy**: is concerned with people's beliefs in their capabilities to produce given attainments (Bandura, 2006).
- **Computer self-efficacy**: a judgment of one's capability to use a computer. It is not concerned with what one has done in the past, but rather with judgments of what could be done in the future (Compeau & Higgins, 1995). Karsten, Mitra, and Schmidt (2012) also defined computer self-efficacy as an individual's perception of efficacy in performing specific computer related tasks within the domain of general computing.
- **Self-efficacy Beliefs**: is a self-system that enables individual to exercise a measure of control over their thoughts, feelings, and actions (Zimmerman, 2000). Zimmerman explains that, efficacy beliefs help determine how much effort people will expend on an activity, how long they will persevere with confronting obstacles, and how resilient they will prove in the face of adverse situations.
- **Mathematical Problem**: mathematical problem is a problem that is amenable to being represented, analysed, and possibly solved, with the methods of mathematics.
- **Level of Experience**: Individuals' level of practical knowledge, skill, or practice derived from direct observation of or participation in events or in a particular activity (Merriam-Webster, 2018).
- **Computer Competence**: Computer competency is defined as the knowledge and ability to use computers and related technology efficiently, with a range of skills covering levels from elementary use to programming and advanced problem solving (Saad, Saifudin, & Yaacob, 2015).

- **Task**: According to Merriam-Webster (2018) task is usually assigned piece of work often to be finished within a certain time or something hard or unpleasant that has to be done. Leont'ev (1975) in activity theory also defined task as procedures embarked on within certain constraints and conditions. In a nutshell, task is what students are asked to do (Christiansen & Walter, 1986; Mason & Johnston-Wilder, 2006).

1.12 Organization of the Study

Chapter 1 is the introductory section of the research. The chapter starts off with a background to the study, statement of the study problem, purpose of the study, objectives of the study, research questions, significance of the study, assumptions, delimitations of the study, limitation of the study, definition of terms, and organisational of the study. Chapter 2 reviews some relevant literature for the study and discusses the theoretical framework. Chapter 3 describes the research methodology which includes the research design, the population and sampling techniques, research instrument, pilot study, validity and reliability of instrument, procedures used for data collection, data analysis and ethical issues.

Chapter 4 presents results and discussion of the research findings. Summary, conclusion, and recommendation of the study are looked at in Chapter 5.

CHAPTER 2

LITERATURE REVIEW

2.0 Overview

This research used self-efficacy theory as conceptual model to assess the extent of students' computer competence. It also used constructivist teaching and learning principle as a theoretical framework to assess students' SHS computer experience. This chapter reviewed works done by other researchers in support of the study. The chapter is organised under the following themes:

- Theoretical Framework
- Self-efficacy Theory
- The Nature of Computer Technology (ICT) Education at the SHS
- Computer Self-efficacy
- Gender Difference in Computer Self-efficacy
- Measuring Computer Self-efficacy

2.1 Theoretical Framework

The process of constructing items to measure teaching and learning of ICT in schools are usually a difficult procedure for educators and finding new ways to measure what students know and can do is sometimes challenging (Reilly, 2018). For that reason it is important to work from a theoretical framework with the need to evaluate students' experience adequately (Kulm, 1990). In this study, Perkins (1991) constructivism principle is used as a theoretical framework to assess first year undergraduate students' computer experience at SHS level. Constructivism is a method for teaching and learning based on the principle that, cognition is the result of "mental construction" and a learning theory found in computer literacy which explains how

people might acquire knowledge and learn (Bada, 2015). The theory suggests that humans construct knowledge and meaning from their experiences. In other words, students learn by fitting new information together with what they already know. Bada explained that, constructivists believe that learning is affected by the context in which an idea is taught as well as by students' beliefs and attitudes. It therefore has direct application to education.

Perkins (1991) suggested that learners should be engaged in thought oriented activities to allow them apply and generalise the information and concepts provided them so as to model or construct their own knowledge. Perkins (1991) and other constructivist believe teaching and learning should be done in such a way that allows students to manipulate with their own environment and also their existing knowledge to make meaning of what they are learning. Teaching principle of constructivists is by guiding the learner to build on and modify existing mental models which focus on knowledge construction as opposed to passively receiving information (McInerney & McInerney, 1994; Slavan, 1994). This teaching and learning involves building on previous experiences in order to allow each learner to choose what they want to learn and how. The emphasis is on learner activity rather than teacher instruction, making the learning process an active one. Hence the primary goal of constructivism principle for teaching is by giving learners the training to take initiative for their own learning experiences. There are acceptable changes in teaching and learning practices in Ghana education sector. These changes have been underpinned by shifts in ideological theory and most recently being the change in favour of constructivism. Constructivist view of learning can be defined under the following three principles;

1. The fundamental principle: which is when learner forms his/her own representation of knowledge, building on experiences and the idea of no single representation of knowledge is correct (Von Glasserfeld, 1984).
2. Attributed to Piaget, is when individuals learn through active exploration, and learn as well when they uncover an inconsistency between their current knowledge and previous experience (McInerney & McInerney, 1994; Slavan, 1994).
3. The third principle is when learning occurs through interaction between learners and their peers' i.e. social setting (Vygotsky, 1978).

In support of constructivist view of learning, Hartmann, Angersbach, and Rummel, (2015) explained constructivism in three different labels; endogenous, exogenous and dialectical. Moshman (1982) described each label as follows:

- Endogenous constructivism stresses on learner's knowledge construction process where the teacher acts as a facilitator and provides experiences to challenge the learners' existing models.
  - In the case of endogenous constructivism, the learner is a discoverer of knowledge. Computer assisted learning material that hinges on endogenous constructivism is hypertext i.e. Hypertext Markup Language (HTML). The second is hypermedia which is accessing large information database. Example is information on CD-ROM/Disc/USB). This computer assisted learning concepts allow learner to browse content and actively search on computer-generated environment.
- Exogenous constructivism is when learners are required to be cognitively active with exercises and instructions which help learners to apply knowledge acquired to realistic tasks later.

- The thought of exogenous constructivism recognises exercise and instruction as key for the learner. According to exogenous view, learners have control over their own knowledge construct and have the opportunity to apply their knowledge later. Computer assisted material that draw on the exogenous view include concept mapping tools, editing tools and practical modules, e.g. problem solving assignments.

- Dialectical constructivism occurs when teachers or experts provide some form of platform for learners to acquire realistic experience as well as joint effort with peers.
  - Dialectical constructivism emphasis is on the provision of support for learners. Computer support collaborative learning (CSCL) is usually used for such support and normally provided by teachers or peers, although software tools can also be used instead. O'Malley (1995) described the term CSCL as group learning and supporting tool. It also improves the quality of instructions, motivates the learning process, encourages students' active learning in the form of participations and feedback at their own pace, and provides students with the psychological incentives they need to work hard (Glasersfeld, 1995).

From Moshman (1982) observation, it can be concluded that teaching and learning of computer technology is founded on constructivist principles. Likewise, according to Duffy and Cunningham (1996), computer technology has emerged as a learning technology which has been identified as an alternative theory of learning that is based on constructivist principles. In support of Duffy and Cunningham, Gunes (2014) indicates that the first step in constructivist educational environments is activating prior learning. The use of computer technology can be activated in the begging of the lesson

by watching a video or an image to provide the students' prior learning. Again, there are also individual differences among students in a constructivist educational environment. Some students need to make more exercise and repetition to learn compared to others. Since technology supports constructivist principles it makes it easier to get to know the individual differences among students (Ciglik & Bayrak, 2015). Computer technology also enable students make as many repetitions and exercises as they want. In constructivist approach, student's self-assessment, learning process and learning output are evaluated using the traditional method. The same evaluation is covered using technological means in recording student's information, constructing process and storing the information (Tezci & Gurol, 2001). Another main element of computer technology that supports constructivist approach to learning is social learning. The constructivist principle of learning by interacting with their environment is also made possible with the use of technology to provide ease communication, enabling student to communicate with their classmates or teachers outside the classroom as well as with anyone from anywhere around the world (Isik, 2018). Technology-supported teaching and learning environments provides learners and tutors the opportunity to interact with each other and able to share their ideas, discuss and change in the case of wrong concepts. In this respect, learners are allowed or given the opportunity to guide their own learning as considered by constructivist (Coppola, 2004). The constructivist approach to teaching and learning requires teachers not to be instructors but act as guides for learners and monitor students during activities. The use of technology helps to provide same guidance by Interactive software which provides opportunity for teachers to examine the process of activity in class, record these activities, assess students' individual progress and give learners new responsibilities depending on their performance (Gilakjani, Leong, & Ismail, 2013). Therefore

educators with the most constructivist teaching philosophies regarded the role of computer technology in their instruction as very important (Becker, 2001; Ravitz, Becker, & Wong, 2000).

Emphasis was given to computer technology in the research as theories of learning that is concrete rather than abstract. In other words, students learn better by "doing" rather than just computing and reciting equations. This process of learning places importance on learner's cognitive activity and this type of learning is associated with constructivist type of learning. A cognitive view of learning places importance on the learners' mental models as they form the ideas (Leachey & Harris, 1993; Schultz & Schultz, 1992) and is in relation with ICT education. Moersch (1999) indicates that higher-order cognitive activity or skills and complex thinking skills are supported by technology. Individuals access information, process this information and construct new information. In other words, individuals use their high-order cognitive skills actively in order to be successful in today's society. In constructivist approach, on the other hand, students are expected to construct information by processing it cognitively. Renshaw and Taylor (2006) found in a research that, properly designed computer-supported teaching could affect some students' high-order cognitive skills positively.

The researcher categorization of students' computer experience depended on learner's knowledge construction process, the opportunity to apply their knowledge later and building on the previous experience. Thus, making the learner a discoverer of knowledge and can apply the knowledge acquired to realistic task while having control over his/her own knowledge construct. But all this knowledge acquisition can happen when the teachers or experts provide some form of platform for learners to acquire realistic experience.

2.2 Self-efficacy Theory

In recent years, there has been a renaissance of interest in self-efficacy beliefs since Bandura (1977) wrote his original article; percieved self-efficacy, with a considerable expansion on the theory. Bandura (1995) defined self-efficacy as the belief in one's capabilities to organize and execute courses of action required to manage prospective situations. Bandura (1995) further explained that, self-efficacy affects individuals choice of activity, effort applied, and persistence (Bandura, 1977; Bandura, 1982). A further study on self-efficacy by Akhtar (2008) defined self-efficacy as the belief an individual have in his or her abilities, specifically the ability to meet the challenges ahead and the overall belief ability to succeed. There are many specific forms of self-efficacy (e.g., academic self-efficacy, sports self-efficacy, parenting self-efficacy, leadership self-efficacy, etc.), although they are related, they are uniquely distinct constructs. For instance, Self-efficacy does contribute to one's sense-esteem, but the two are separate constructs. Self-esteem is focused more on "being" while self-efficacy is focused more on "doing" (Neill, 2005). Self-regulation/control is also related to self-efficacy but they are two distinct constructs (Zimmerman, 1989). Self-regulation refers to an individual's strategy for achieving one's goals, especially in relation to learning while self-efficacy relates to an individual's perceived abilities. Likewise**,** self-efficacy is positively related to self-confidence but they are not the same. A person develops his self-efficacy depending on how confident the person is in his abilities to complete a task. Finally, although self-efficacy and self-motivation are deeply entwined, they are also two separate constructs. Self-efficacy is based on individual's belief in their capacity to achieve, while self-motivation is centred on individual's desire to achieve (Ackerman, 2018).

In essence, there exists relationship between knowledge and action, which affect both motivation and behavior. Bandura's (1986) social cognitive theory postulated that self-efficacy plays a central role in guiding human motivation and action. The construct/theory of self-efficacy was developed as a component of social cognitive theory. Social cognitive theory suggests that behaviour, cognition and the environment exist in a reciprocal relationship and influence each other (Bandura, 1986). There are several forms of social cognitive theory and all centres on purposive human behaviour being controlled by practical cognised goals. Some of the forms are as follows;

- Personal goal setting which is influenced by self-appraisal capabilities .i.e. individuals set higher goals for themselves when they have higher percieved self-efficacy and are commited to it (Bandura & Wood, 1989; Locke, Frederick, Lee, & Bobko, 1984; Locke & Latham, 2013; Nicklin & Williams, 2011; Taylor, Locke, Lee, & Gist, 1984).
- Challenging goal setting which raises the level of motivation and performance achievements (Locke, Shaw, Saari, & Latham, 1981; Mentó, Steel, & Karren, 1987).

Personal and challenging goal setting which is part of human behaviour forms the foundation of individuals' self-efficacy beliefs. So to attain some level of motivation and capability to achieve higher performance, one must either have high or low self-efficacy beliefs. Hence, percieved self-efficacy and cognitive model affects each other. People's perception of their self-efficacy are determined by the type of scenarios they anticipate and those with high sense of self-efficacy imagine success scenarios which gives positive guides for performance, and those with scenario of failure i.e. low self-efficacy gives negative guides for performance (Bandura, 1986; Corbin, 1972). Within any action, self-efficacy belief strongly influence efforts, thought patterns, emotional

response and stress reactions. Bandura (1986) identified four major informational sources of self-efficacy. The four major informational sources are:

1. Mastery experiences: the belief students have in their ability to succeed in future given task if they succeeded in that same task previously. Most students' beliefs are based on this mastery experiences. (e.g., past successes and failures)
2. Vicarious experiences: when students observe their peers social models similar to themselves succeed in particular tasks. Students will feel more confident in computer use (ICT) or mathematics if they see peers they perceive as similar to them succeeding in ICT. (e.g., observation of other student's performances)
3. Social persuasion: refers to both positive and negative encouragement from friends, teachers and parents. (e.g., encouragement and support)
4. Physiological states: also refer to student's physical state such as fatigue, pain, or nausea. (e.g., anxiety and fatigue).

According to Bandura (1997) the four combined effects of these major informational sources determine an individual's perceived self-efficacy toward a given task. The extent of students' self-efficacy beliefs in computer use and competence hinges on these four combined major informational sources.

Rotter (1966) developed life expectancy belief with locus of control theory. The considerable development and expansion of Rotter's theory led to the development of self-efficacy theory by Bandura (1977). There is a relationship between self-efficacy beliefs and expectancy beliefs so it is very important to distinguish between the two for easy assessment. Self-efficacy beliefs is about ability to perform actions and locus of control theory is concerned with beliefs about outcomes of actions. Bong (1996) held the diferrences is due to self-efficacy constructs and expectancy belief constructs. Where self-efficacy constructs includes task-specific self-efficacy, computer self-

efficacy, and percieved self-efficacy, expectancy belief constructs includes performance expectancy, self-concept of ability, expectancies, percieved control, percieved ability, subjective competence and confidence. But all the progress in constructs currently in use would not have happened if they differed considerably from each other. They rather have a lot of similarities in definitions. For instance; subjective competence was defined by Boekaerts (1991) as a person's knowledge, beliefs, and feelings about his capabilities and skills. Byrne (2001) also defined self-concept of abilities as individuals feelings and knowledge about their abilities and skills. In perspective, self-efficacy belief, expectancy belief and locus of control theory share similarities.

However, to assess all these theories depends on the type of questions used to initiate measurement. To measure perceived ability, the construct item, "I can do well in computer technology" (Greene & Miller, 1996; Woon, Wang, & Ryan, 2016), is used while construct item for ability perceptions is "How have you been doing in computer technology this semester?" (Meece, Wigfield, & Eccles, 1990) and self-appraisal of ability construct item "How do you rate yourself in assignment compared to your peers?" (Brown, 2015; Felson, 1984). These assertions has left researchers with the task of determining what construct best fits their decisive charateristics (Bong, 1996). Since self-efficacy beliefs concerns individuals rather than groups, it is measured with direct construct, rather than indirect construct. Every individual is different in the way they foster their self-efficacy and implying self-efficacy is not a general but individualistic trait linked to distinct self-beliefs. Hence the construct item for self-efficacy is meant to measure individuals' judgment capability. The construct item is couched in terms of *can do* rather than *will do*. Example: I can use computers to solve mathematics problems. Where *can* is a judgment of capability while *will* is a statement of intention.

Conception of capability is ones important belief system (Bandura & Dweck, 1985; Nicholls, 1984). Capability is sometimes regarded as an acquired skill by some individuals that can be improved on by gaining knowlegde and perfecting competences. Since self-efficacy belief is one's capabilities to organize and execute courses of action required to manage prospective situations (Bandura, 1995), it is safe to cnclude that self-efficacy is a measure of one's capabilities. Self-efficacy is now applied in different levels of educational settings like; content domains (e.g. computing, mathematics, science) and student ability levels (e.g. extraordinary, skilled). Additionally, students who hold strong self-efficacy beliefs in learning a given task and performing it successfully are more likely to engage in similar task in future, while less self-efficacious students are likely to avoid it (Pintrich & Schunk, 2002). In this study first year undergraduate students were expected to exhibit some level of self-efficacy beliefs in computer use with the knowledge and competence acquired from the learning of ICT in SHS.

2.3 The Nature of Computer Technology Education in the SHS

Increasingly, computer technology has become most powerful or sort after tool in all over the world for strategies of teaching and learning in classrooms. This has been necessitated by the conceptions of techno-reformers (e.g. Papert, 1980) that computer technology can revolutionaries the educational landscape. Similarly, many governments in both developed and developing countries have invested in computer technology to improve teaching and learning (Buabeng-Andoh, 2012). ICT integration into school curriculum has become necessary as witnessed in other countries due to its relevance for country development (Majid, Chang, & Foo, 2016). It is on this premise that Ghana rolled out an ICT for Accelerated Development (ICT4AD) policy in March 2003 (Ministry of Education, 2003). The policy stated that: "it is imperative for every person

to be competent in the use of ICT for the many tasks that he/she will have to accomplish" (Ministry of Education, 2010, p.ii). The policy was implemented using the curriculum to cover selected basic topics in ICT with hands-on activities to help students acquire the required ICT skills for the job market and social interaction in the global village (Ministry of Education, 2010). As a result of the policy, ICT courses were introduced in all Junior and Senior High School in Ghana. Among other things the policy required was the use of ICT or computer technology for teaching and learning at all levels of education. Themes covered in the curriculum include; Introduction to ICT, Word processing, Internet, Typing, Spreadsheets and Presentation. The curriculum is designed to provide basic skills in ICT for SHS students and according to Ministry of Education (2010), the pre-requisite skills for students are that, students should have acquired good reading, writing, numeracy and keyboarding skills. Students should also have a sense of responsibility and the ability to follow rules and regulations to qualify for core ICT in SHS. Again, students should be able to perform tasks according to procedure. Consequently it is expected upon completion of JHS and SHS, every person/student will be experienced or competent in the use of ICT for the many tasks that he/she will have to accomplish (Ministry of Education, 2010). According to Majid, Chang, and Foo (2016) it is expected of students to be independent users of ICT but this is probably not the case in Ghana. Evidence shown by Sarfo and Ansong-Gyimah (2011) in a study on integration of computer technology into education in spite of the huge investments has not been effective or successful as expected. Currently, core ICT at the SHS level is mandatory, but not an examinable subject. Making instructional procedures, teaching and learning of ICT distinct and the use of ICT to complete non-routine task in other subject area very difficult for students'. The Ghanaian society is also challenged with different kinds of information technology sources making it

difficult to authenticate the relevant ones for good teaching and learning purposes. Computer literacy keeps changing rapidly with students risking exposure to too much information which can be counter-productive or irrelevant for learning. Mereku et al. (2009) affirmed these challenges in a study on pedagogical integration of ICT in various basic and secondary schools in Ghana and indicated the gap between the policy directives and actual practice.

It is obvious that, successful integration of computer technology into education both in developed and developing countries have challenges. Hence, having access to the right information for teaching and learning of ICT in primary and secondary schools is very important for acquiring good knowledge, skills and competence in the use of computer technology.

2.4 Experience and Computer Self-efficacy

There is a dramatic change in learning and teaching in education because of the use of computers and other common tools used in most institutions. While some students are showing intense and fervent interest in computer use others are nervous, anxious and not too keen on using computers. Computers are now used almost in every aspect of daily routine task and supports learning. It has become important for students/individuals to get abreast with computer use. Students do contribute meaningfully to computer-dominated society if they are computer oriented or have computer experiences (Ertmer, Evenbeck, Cenramo, & Lehman, 1994). It is imperative for every student to be computer literate with a very good foundation and experiences to build on. Research has shown that students with prior experience of computer technology learn quickly, adopt and develop confidence of learning new skills when they go into a course (Yates & Chandler, 1991). For that reason previous experience is key element for success and achievement. Hence experience or prior knowledge in

computer use offers students more positive attitudes toward the learning of computer technology.

According to Delcourt and Kinzie (1993), attitude towards computer technology is closely connected with computer self-efficacy concept. They also said attitude is linked to level of determining one's computer self-efficacy. The concept of computer self-efficacy was improved by Compeau and Higgins (1995) and was used in the context of Information Systems which is normally called computer self-efficacy. Computer self-efficacy is a theory based on Bandura's (1977) theory of self-efficacy and its role in social cognitive theory (Bandura, 1986). Compeau and Higgins (1995) defined computer self-efficacy as an individual's ability to apply his or her computer skills to a wider range of computer related task. Marakas, Yi, and Johnson (1998) also defined computer self-efficacy as an individual's perception of efficacy in performing specific computer related tasks within the domain of general computing. In essence, people's perception of their ability to perform task using computers is termed as computer self-efficacy. Therefore, individual's judgement about what they could do in future with previous experience and not what they have done with computers before is computer self-efficacy. In context of computer self-efficacy, there are three levels of computer self-efficacy and these are; 1.Magnitude 2.Strength and 3.Generalizability. They are defined as follows:

1. Magnitude is the level of computer capabilities expected from individuals to complete a task. Individuals with high magnitude of computer self-efficacy have the potential to complete a difficult task compared to one with lower magnitude of computer self-efficacy.

2. Strength refers to the level of confidence an individual exhibits with regards to their ability to perform different forms of task related to computers. It is the level of belief or judgment held by an individual.
3. Generalizability is when the judgement of computer related tasks are limited to some specific task. Therefore, people with high computer self-efficacy generalizability execute different types of software application and hardware system more than those with lower generalizability of computer self-efficacy.

Hence, computer self-efficacy beliefs depends on experience of computer capabilities, level of confidence and the specific task carried out. Hill, Smith, and Mann (1987) affirmed the relation between experience and computer self-efficacy in a research of 133 female undergraduates students. They found strong positive correlation between previous computer experience and computer self-efficacy beliefs. The study also revealed that, computer use is influenced by experience in the form of behavioural intents through self-efficacy beliefs. Therefore the kind of computer experience acquired by students' are the most important and not just any computer experience. Positive previous computer experience increases self-efficacy beliefs of individuals while negative experience decreases self-efficacy beliefs. A study by Ertmer et. al (1994) reinforced this position where computer experience increases computer self-efficacy and quality of experience correlates with higher self-efficacy beliefs. In a nutshell, previous computer experience, attitude and knowledge has a huge influence on individual's computer self-efficacy and prior computer experience helps increase one's computer self-efficacy.

2.5 Gender difference in Computer Self-efficacy

A study between the 1970's and 1980's on gender inequality in education revealed that, there were gender inequality in education and did contribute to gender inequalities in the labour market (England & Browne, 1992; Marini & Fan, 1997). Furtherance to the findings of gender inequality in education is the increase of computer technology becoming more powerful tool in all over the world for changing the strategies of teaching and learning in classrooms. One of the factors also affecting student's use of technology is gender difference (Kekkonen-Moneta & Moneta, 2002; Abbasi, Shan, Doudpota, Channa, & Kandhro, 2013; Rivis & Sheeran, 2003). There are continuous debates on gender difference in the education sector in relation to computer technology. Several past researches have confirmed the existence of gender difference, showing that male students generally have higher self-efficacy towards the use of technology in learning than female students (Grandon, Alshare, & OKwan, 2005; Shen, Laffey, Lin, & Huang, 2006; Park, 2009). The gender gap issue in computer technology is still subject of many studies both locally and internationally. Schumacher and Moharan-Martin (2001) in a study established that females are less inclined to the use of computers than males. Another research by Volman & van Eck (2001) also indicated significant gender differences among students' computer use at home and at school.

These debates has led to policy formulation to be adopted and help address these challenges. It led to tremendous increase of female numbers or participation in tertiary education (Bradley & Ramirez, 1996; Charles & Bradley, 2002). Gender difference in computer self-efficacy has also been a subject of study in recent years and the findings have been varying due to different constructs researchers apply. There are various constructs that contribute to students' attitude toward computers. Attitudes towards computer use may be defined as specific feelings that indicate whether a person likes or

dislikes using computers (Simpson, Koballa, Oliver, J.S., & Crawley, 1994). According to Talja (2005) individual attitudes are constructs context-dependent. Some of the constructs include; computer anxiety, computer self-efficacy, self-confidence, interest, pleasure and experience in using computers in daily activities (Talja, 2005), and also the extent students find computers useful (Koohang, 1989; Temple & Lips, 1989; Violato, 1989). Sutton (1991) conducted a survey using attitude as construct to find gender diferrence in computer use and discovered that girls were less represented and performed poorly in computer lessons. The poor performance and under-representation of girls contributed to negative attitude toward computers, hence creating gender difference in computer use. Kadijevich (2000) in a study with interest as a construct showed boys having more interest in computer use than girls finding computer useful. Creating gender difference in favor of boys. In another study with self-confidence as a construct, girls were less self-confident in computer skills than boys (Huber & Schofield, 1998; Volman ,1997). Using computer experience as construct in a study by Hsi-Chi, Yuh-Rong, and Ya-Ling (2010) found gender differences in computer experience. So far, research on the gender gap concerning computer use has mainly focused on gender differences in computer attitude, computer anxiety, computer usage, computer interest, self-confidence, computer experience and so on. Recently, gender and computer self-efficacy construct has been of great interest in the educational technology community (Sarfo, 2017). Some studies conducted indicates a statistically substantial difference between gender and computer self-efficacy with other findings on the contrary.

For instance, in order to find gender difference in computer self-efficacy with all construct in mind, Whitley (1997) conducted a study to check gender difference in computer self-efficacy and found gender difference in favour of men. Kong, Chai, Tan,

Hasbee and Ting (2014) also conducted a study of 102 Malaysian English as Second Language (ESL) teachers and discovered that male teachers have a significantly higher computer self-efficacy than their female counterparts. In a related gender and computer self-efficacy study for 94 males and 113 females by Cassidy and Eachus (2002), Cassidy and Eachus found higher computer self-efficacy for males than females. Another study by Miura (1987) with computer self-efficacy as construct, discovered males having significantly higher self-efficacy beliefs than females. Hattie and Fitzgerald (1987) also found gender difference in computer self-efficacy but found no difference in computer knowledge and related the gender differences in computer self-efficacy to perceived masculinity of computer tasks but the differences in performance were related to differences in computer experence. In a separate study, Volman (1997) found gender differences in computer self-efficacy in a separate research he conducted and Busch (1995) also indicated high self-efficacy in men with regards to complex task when using different computer applications where the applications were independent of training received.

Doorekamp (1993) held a contrary view earlier. Doorekamp found no gender difference in achievements in computer assignments and computer self-efficacy during secondary education in a study conducted. In support of Doorekamp findings, Peng, Tsai, and Wu (2006) also conducted a survey with a total of 1,417 college students from Taiwan and discovered there was no gender difference in student's ability to use the internet; but there was gender difference in favour of males in their ability in internet communication. Durndell and Thomson (1997) also observed that, at the end of secondary education there was not much difference between boys and girls in their knowledge of informaation technology. Jegede (2007) found no gender influence on

teachers' computer self-efficacy in a study conducted to explore factors that are associated with computer self-efficacy among teachers.

In general, there were different results for studies in gender and computer self-efficacy, broadly due to self-efficacy construct even where cultural differences play a role in an individual's self-efficacy beliefs. It can be agreed that, gender difference in computer self-efficacy does not have a decisive conclusion due to different constructs researchers apply in their work. All constructs plays a role in determing individuals computer self-efficacy. Conversely, how complex the task determines the level of gender difference in computer self-efficacy.

2.6 Measuring Computer Self-efficacy

The use of technology for learning and teaching in schools is now unambiguous, but instrument to measure it effectiveness is now a bit challenge for educators. Computer self-efficacy is an often studied construct that has been shown to be related to an array of important individual outcomes. Unfortunately, all other constructs plays a role in measuring computer self-efficacy but the need to find the distinct difference within the construct for measuring becomes important. Self-efficacy concerns personalities rather than populace therefore it is measured with direct construct, rather than indirect construct. Every individual is different in the way they foster their efficacy. Self-efficacy is not a general trait but individualistic trait linked to distinct self-beliefs. Bandura (1997) defined self-efficacy as beliefs in one's capabilities to organize and execute the courses of action required to produce given achievement. In effect, self-efficacy is more of expectation oriented belief that is displayed by an individual's ability to show a level of competence in a given task.

Computer self-efficacy is an often studied construct that has been shown to be related to a selection of important individual outcomes. Computer self-efficacy is considered as an individual's feelings toward their capabilities in working with computers (Cassidy & Eachus, 2002). In research, computer self-efficacy has been shown to predict or moderate several noteworthy relationships, which include computer anxiety, computer attitudes etc. To measure individual's computer self-efficacy, there is the need to differentiate between the two kinds of self-efficacy beliefs. Bandura's (1997) social cognitive theory recognized the different sides or situations under which self-efficacy beliefs are distinct functioning domains across each other. The two different self-efficacy expectations that an individual exhibits on level of competence are self-efficacy expectation and outcome expectation. Bandura (1986) described self-efficacy expectation as an individuals' arranged/combined state of belief and actions that are needed to carry out a given task. Bandura also defined outcome expectation as one's estimate of likely consequences for performing a task at a level of competence. The distinction between self-efficacy and outcome expectations forms the bases in constructing instrument to measure computer self-efficacy.

To create construct instrument to measure outcome expectancy, questions like "if I complete a given task at a certain level, what are the likely consequences" is used. But self-efficacy expectancy asks questions like "do I have the ability to complete a given task at a desired level". Since self-efficacy is associated with perceived capabilities, constructed to best fit domain of interest should be a scale to measure perceived capability (perceived self-efficacy). Perceived self-efficacy is an important determinant of intentions but the two constructs, perceived and intentions are not the same. There are other constructs like self-esteem, locus of control and outcome expectation, which

are also different from perceived self-efficacy. The differences according to Bandura (1986) are;

- Perceived self-efficacy is a judgment of capability
- Self-esteem is a judgment of self-worth
- Locus of control is belief about outcome contingencies
- Outcome expectations are the judgment outcome that flow from performance, either negative or positive.

Distinguishing perceived self-efficacy from the other constructs helps in constructing the response scale for measuring the self-efficacy beliefs. There is no specific one fit all instruments to measure perceived self-efficacy but self-efficacy scale must be constructed to function within a particular task area. Self-efficacy is measured using self-report scales. There are different types of scales developed to measure self-efficacy in the domain of computer use. Example of the scale is a 9-item measure of computer self-efficacy developed by Vasil, Hesketh, and Podd (1987) for children to rate their level of confidence in specific computer related task. Another was Miura (1987) sample of university students computer self-efficacy belief measured in 15 computer related tasks in classification of computer programming, computer course work and personal computer use. The perceived level of confidence of respondents was rated in completing each of the tasks. There are other scales that only incorporate measures of computer self-efficacy as components and computer attitude scale is an example and includes 10-items computer confidence sub-scale (Lloyd & Gressard, 1984) where the sub-scale measured self-efficacy in relation to specific computer technologies such as word processing, spreadsheets, e-mail, and internet. A 10-item scale was also developed by Compeau and Higgins (1995) to measure general computer use in the context of completing a job. It is used to judge how confident one is in completing a particular job

with the help of a new software package and with different levels of supports. Likely the most popular measure of computer self-efficacy was this one created by Compeau and Higgins. This measure asks participants about their capability beliefs to use a novel work related program but this measure used regularly, has its own concerns.

There is standard response scale for measuring self-efficacy beliefs of individuals to show their strength of belief in completing a task at different levels but construct to measure self-efficacy belief should measure judgment capability so the item should be couched in terms of *can do* rather than *will do*. Where *can* is a judgment of capability but *will* is a statement of intention. The scale measures the confidence or strength of efficacy beliefs on 10-point or 100-point scale, ranging from 0 to 10 or 0 to 100 in 1-unit or 10-units intervals respectively. Ranging from 0 = Cannot do; through 5 or 50 = Moderately certain can do; to 10 or 100 = Highly certain can do. Scale with only few units should be avoided because few steps are less highly responsive and less reliable. The self-efficacy scale with response format 0 – 100 is a stronger predictor of performance than one with a 5-interval scale (Pajares, Hartley & Valiante, 2001).

In administering the response items, there must be a standard system in place to safeguard the process to minimize response biases. To get accurate and frank response and minimize biases, self-efficacy judgement must be recorded secretly and if posible label changed from self-efficacy to evaluation inventory. The item should also be pretested and removed or discard the same items with most response units.

2.7 Summary

Teaching and learning should involve the building on of previous experiences in order to allow each learner to choose what they want to learn and how. According to Perkins (1991) teaching and learning should be done in such a way that, it allows students to manipulate their own environment and existing knowledge to make meaning

of what they are learning. Computer technology emerged as a learning technology as identified as an alternative theory of learning based on constructivist principle (Duffy & Cunningham 1996). Moshman (1982) agrees with them and according to him, teaching and learning of computer technology is founded on constructivist principles. The primary goal of constructivism principle for teaching and learning is by giving learners the training to take initiative for their own learning experiences.

Emphasis was given to computer technology in this research as theories of learning that is concrete rather than abstract i.e. students learn better by "doing" rather than just computing and reciting equations. This process of learning places importance on learner's cognitive activity and this type of learning is associated with constructivist type of learning. The research categorization of students' computer experience depended on the learner's knowledge construction process, the opportunity to apply their knowledge later and building on the previous experience. It is obvious computer literacy keeps changing rapidly thus having access to the right information for teaching and learning of ICT is very important for acquiring good knowledge, skills and competence in the use of computer technology. Consequently, it is expected upon completion of JHS and SHS, at least SHS students must have acquired some form of competence in the use of ICT for the many tasks that he/she will have to accomplish (Ministry of Education, 2010) and according to Majid, Chang, and Foo (2016) it is expected of students to be independent users of ICT.

While some students show intense and fervent interest in computer use others are nervous, anxious and not too keen on using computers. It is imperative for every student to be computer literate with a good foundation and experiences to build on. Research has shown that students with prior experience of computer technology learn quickly, adopt and develop confidence of learning new skills when they go into a course (Yates

& Chandler, 1991). So it is believed that, attitude towards computer technology is closely connected with computer self-efficacy concept. Computer self-efficacy is a theory based on Bandura's (1977) theory of self-efficacy and plays role in social cognitive theory.

There exists a relationship between knowledge, experience and action, which affect motivation and behavior and according to Bandura's (1986) self-efficacy plays a central role in guiding human motivation and action. Bandura (1995) defined self-efficacy as the belief in one's capabilities to organize and execute courses of action required to manage prospective situations which also affects individuals choice of activity, effort applied, and persistence. So personal and challenging goal setting which is part of human behaviour forms the foundation of individuals' self-efficacy beliefs. Therefore, to attain some level of motivation and capability to achieve higher performance, one must either have high self-efficacy beliefs or low self-efficacy beliefs. Within any action, self-efficacy belief strongly influence efforts, thought patterns, emotional response and stress reactions. It is safe to conclude that self-efficacy is a measure of one's capabilities. Self-efficacy is now applied in different levels of educational settings like; content domains (computing) and student ability levels (skilled).

Compeau and Higgins (1995) defined computer self-efficacy as an individual's ability to apply his or her computer skills to a wider range of computer related tasks. In essence, people's perception of their ability to perform task using computers is termed as computer self-efficacy. Computer self-efficacy can be measured with direct construct, rather than indirect construct. Every individual is different in the way they foster their efficacy. Hence, computer self-efficacy is not a general trait but an individualistic trait linked to distinct self-beliefs. In effect, self-efficacy is more of

expectation oriented belief that is displayed by an individual's ability to show a level of competence in a given task.

In a nutshell, computer self-efficacy beliefs depend on experience of computer capabilities, level of confidence and the specific task carried out. Positive previous computer experience increases self-efficacy beliefs of individuals while negative experience decreases self-efficacy beliefs. Previous computer experience, attitude and knowledge also has a huge influence on individual's computer self-efficacy and prior computer experience helps increase one's computer self-efficacy.

CHAPTER 3

METHODOLOGY

3.0 Overview

This chapter discusses the research design, population for the research, sample and sampling procedures, the research instrument, data collection procedure, and data analysis.

3.1 Research Design

A significant part of any good research is the method used to collect the needed data. Any assessment in a research needs to have its own unique plan and strengths. The main aim of this research was to use self-efficacy theory to assess undergraduate computer competence and its relationship to their SHS computer experience. To achieve this aim, a survey design in the form of questionnaire was used. The survey design was appropriate for the research because respondents were asked to provide information about their own knowledge, beliefs, and attitudes towards computer technology use. It also matched the researcher's available resources, time, and money as well as making it easy for university staff to help conduct the study. Survey design provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population (Creswell, 2009). Polland (1998) also defined survey design as a systematic way of asking people to volunteer information about their own knowledge, attitudes, beliefs, or behaviours. Surveys are the most widely used methods of collecting data, especially when the information is from a large sample where standardization is important and for the information gathered to be expressed numerically. Each question in any survey or all questions asked in a

survey has its own corresponding response or choices which can be assigned a numerical value.

3.2 Population

Pilot and Hungler (1999) defined population as an aggregate or totality of all the objects, subjects or members that conform to a set of specifications. In essence, population is all the members of any well-defined class of people, events or objects. The population for this research consisted of first year undergraduate students in 2017/2018 academic year at Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana. The researcher selected this population because the study focused on assessing the level of first year undergraduate students' computer competence and how it is related to their SHS computer experience. This criterion specified the characteristics that people must possess in order to be included in the study (Pilot & Hungler, 1999).

3.3 Sample and Sampling Procedures

A sample is a subset of a population selected to participate in a study, or a fraction of the whole selected population in a research project (Brink, 1996; Pilot & Hungler, 1999). The process of selecting a portion of the population to represent the entire population is known as sampling (LoBiondo-Wood & Haber, 1998; Pilot & Hungler, 1999). The sample deemed to be a representative of the population of undergraduate students from KNUST was selected from the Department of Mathematics. The sample consisted of students from BSc Statistics, BSc Actuarial Science and BSc Mathematics. This sample was selected by purposive sampling technique, also called judgment sampling, because of its deliberate choice of a respondent due to the qualities the respondent possesses. Purposive sampling is a

nonrandom technique that does not need underlying theories or a set number of respondents. Simply put, the researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience (Bernard, 2002). This involves identification and selection of individuals or groups of individuals that are proficient and well-informed with a phenomenon of interest (Creswell & Plano Clark, 2011). In addition to knowledge and experience, Bernard (2002) and Spradley (1979) note the importance of availability and willingness to respondents, and the ability to communicate experiences and opinions in an articulate, expressive, and reflective manner.

In this light, the total number of students sampled from the three programmes BSc Statistics, BSc Actuarial Science and BSc Mathematics had respondents (*n*) of 258, 62% (*n* = 159) represents males, and 38% (*n* = 97) represents females with 2, 0.8% missing gender data. The sample also had 21% (*n* = 53) from BSc Actuarial Science, 43% (*n* = 111) from BSc Mathematics, and 36% (*n* = 93) from BSc Statistics with 1 missing data representing 0.4%. This sample was typical of the population because first year students from Department of Mathematics at the KNUST have studied core ICT at SHS.

3.4 Research Instrument

The study involves the assessment of computer experience of SHS graduates, gender difference in computer experience and students' perceived self-efficacy belief in computer use at first year of university. The research instrument used for collection of data was a structured questionnaire. Structured questionnaires consist of closed or prompted questions with predefined answers (Marsden & Wright, 2010). In other words, question in which respondent selects one or more options from pre-determined

set of responses. Further, multiple choice closed ended question with more than two response alternatives were used.

The structured questionnaire consisted of items which demanded students' to provide bio-data in Section A, undergraduate students' self-efficacy beliefs in computer use in Section B and computer experience in SHS in Section C. This helped the researcher to have an in depth knowledge of students' computer experience at SHS and the level of competence in computer use at first year university education.

A questionnaire is a list of questions used to gather information in a survey on printed paper. According to Burns and Grove (2001), a questionnaire is a form of instrumentation in a printed self-report form designed to elicit information that can be obtained through the written responses of the respondents. The information obtained through a questionnaire is similar to that obtained by an interview, but the questions tend to have less depth. A questionnaire was chosen because:

- This method is familiar to respondents;
- It allows respondents to complete the questionnaire at their own convenience and;
- It allows respondents some time to think about their answers (Muijs, 2004).

The questionnaire enabled the researcher to collect bio-data of students including sex, programme offered, how often they used computer and the type of computer software programmes they have used before as seen in Appendix A. Students' self-efficacy belief in computer use was collected using Bandura (2006) confidence scale. Respondents indicated based on the scale their strength of ability to complete a given task. The self-efficacy belief was on 100-point scale, ranging in 10-units from 0 to 100, with 0 = Cannot do at all, through midway degrees of confidence, 50 = Moderately certain can do, to 100 = Highly certain can do (Bandura, 2006). In all, there were eight

(8) questions. Students' with a Total_Score ≥ 400 on the scale were labelled High Self-efficacy beliefs and Students' with a Total_Score < 400 were labelled Low Self-efficacy beliefs.

Section C of the questionnaire recorded respondents year of study they used computer in SHS, i.e. either SHS 1, SHS 2, SHS 3, SHS 1 – 2, SHS 2 – 3 or SHS 1 – 3. Level of experience of undergraduate students' computer use in SHS was on 5-point Likert-scale, ranging in 1-unit from 1 to 5, with 1 = Not at all (NA), 2 = Rarely (R), 3 = Occasionally (O), 4 = Frequently (F) and 5 = Always (A) (Cassidy & Eachus, 2002). The students' raw data from the Likert-scale was converted to a Total Experience score by summing the scores from the Likert-scale for what each respondent's recorded in Level of Experience in Section C of Appendix A. Total Experience of each respondent was split into groups of High Experience and Low Experience with the mean serving as the mid-point. A score above the mean value indicated High Experience and score below the mean value indicated Low Experience. The Total score indicated the relative position of respondents or individuals.

3.5 Validity and Reliability of Instrument

Validity and Reliability are used for enhancing the accuracy of the assessment and evaluation of a research work (Tavakol & Dennick, 2011). According to Cohen, Manion, and Morrison (2007), threats to validity and reliability can never be erased completely; rather the effects of these threats can be lessened by giving attention to validity and reliability.

3.5.1 Validity

Validity refers to the degree to which evidence and theory support the interpretations of test scores entailed by proposed uses of tests (Thatcher, 2010). The process of validation involves accumulating evidence to provide a sound scientific basis

for proposed score interpretations (Messick, 1989). Validation also involves interpretations of test scores that are evaluated, but not the test itself (Messick, 1989). In general, validity is a form of checking if any measuring instrument does what it is intended to measure (Thatcher, 2010). During validation process, once a thorough attempt has been made to validate the assessment process then there can be some degree of trust that the assessment is indeed valid for the intended purpose unless proved otherwise (Cronback, 1980). The type of validation that is most important depends on the inferences to be drawn from the instrument (Crocker & Algina, 2008). So in validating the measuring instrument for this research, the scale for measuring perceived self-efficacy beliefs reflect the construct item and since self-efficacy beliefs is concerned with perceived capability to complete a task, the construct item or questionnaire was phrased in terms of can do rather than will do where can is a judgement of capability and will is a statement of intention where the two constructs (capability and intention) are separable. Nonetheless perceived self-efficacy is a major determinant of intention.

The construct item or measuring instrument was contently validated after being phrased. Content validation is most often associated with achievement testing. It also refers to the representativeness of the sample of items included in measurement devices (Martella, Nelson & Marchand-Martella, 1999). The key ingredient in securing content-related evidence of validity is human judgment (Popham, 2000) and can is a human judgement of capability. So the instrument to measure self-efficacy should be able to measure perceived capability to produce given achievements. The measuring instrument had construct validation also performed on it. Construct validation states that: “the skills, attitudes, or characteristics of individuals that is not directly observable but are

inferred on the basis of their observable effects on behaviour" (Martella, Nelson & Marchand-Martella, 1999, pp. 74).

Perceived capability or self-efficacy cannot be measured directly but can only be inferred on the basis of observation and recorded information from respondents. Therefore, perceived capability can easily be construct validated. Hill, Smith and Mann (1987) found a significant positive correlation between previous computer experience and computer self-efficacy beliefs in a sample of 133 female undergraduates. They discovered that, experience only influenced behavioural intentions to use computers indirectly through self-efficacy beliefs. Implying previous experience is important for any future achievements. The assertion of previous experience gives credence to computer experience of SHS students to be criterion (concurrent) validated. Criterion validation is defined as behaviour that test scores is used to predict (Allen & Yen, 2002). The validation of the measuring instrument involved specifying the ability domain of the learner and defining the end points so as to provide absolute scale. In order to achieve this goal, the measuring instrument was constructed and compared to other standards in consultation with my supervisor.

3.5.2 Reliability

Research is considered good when the measuring instrument is reliable. Reliability refers to the consistency, stability and repeatability of results (Twycross & Shields, 2004). That is, result of a research is considered reliable if consistent results have been obtained in identical situations but different circumstances (Twycross & Shields, 2004). Thus, the instrument should be measuring what it purports to measure consistently. There are three types of reliability and they are:

1. Stability - this is when a researcher obtains the same result in repeated administrations or when the same test tools are used on the same sample size

more than once. In this instance, there is a reliability co-efficient that provides an indication of how reliable the tool is.

2. Homogeneity - This is a measure of the internal consistency of the scales. As a result, Cronbach's alpha is used to measure the reliability of the tool. Where Cronbach's alpha is finding an objective way of measuring the internal consistency reliability of an instrument used in a research work (Cronbach, 1951). It is mostly used when the research being carried out has multiple-item constructs or questions. It is usually expressed as a number between 0.00 and 1.0 (Tavakol & Dennick, 2011).
3. Equivalence - This is the level of agreement among researchers using the same data collection tool. The ratings of two or more researchers are compared by calculating a correlation co-efficient (Twycross & Shields, 2004).

The reliability of the measuring instrument in this study was carried out using homogeneity test. In testing for reliability of the measuring instrument for the study, a Cronbach's alpha test was conducted using confidence scale of 100-point, ranging from 0 to 100 in 10-units and comprising of 8 items and experience scale of 5-point, ranging from 1 to 5 in 1-units comprising 5 items. By definition, Cronbach's alpha value of 0.00 means no consistency in measurement while a value of 1.0 indicates perfect consistency in measurement (HOW2STATSb, 2015). The acceptable range is between 0.70 and 0.90 or higher depending on the type of research. 0.70 is acceptable for exploratory research while 0.80 and 0.90 are acceptable for basic research and applied scenarios respectively (HOW2STATSc, 2015). Table 3.1 shows the results of Reliability test of the study.

Table 3.1 *Reliability Test of the Research Instrument (Questionnaire)*

Instrument	Cronbach's Alpha	Number of Items	Reliability Level
Self-efficacy beliefs	0.940	8	Acceptable
Level of SHS Experience	0.854	5	Acceptable

In Table 3.1, the Cronbach's Alpha test conducted for reliability of the measuring instrument indicates Cronbach's Alpha value of 0.940 for self-efficacy beliefs which is a reliable and acceptable variance. Cronbach's Alpha value for level of SHS experience is 0.854 indicating reliability and acceptable variance.

3.6 Piloting the Instrument

It is important in every research to test instruments being used to conduct the study and that can be achieved in the form of a pilot study. To determine the reliability of the instrument pilot study was conducted. Piloting determines whether questions and directions are clear to respondents and whether they understand what is required from them. Piloting is done to determine the feasibility of using a particular research instrument in a major study. It provides an opportunity to try out the instructions for completion of the instrument, especially if it is being used for the first time. Piloting entails a trial administration of a newly developed instrument in order to identify flaws and time requirements (Shilubane, 2010). Hence, piloting a study is reassessment without tears. According to Blaxter, Hughes, and Tight (2010), pilot study is trying out all research techniques and methods, which the researcher has in mind to see how well they will work in practice. They said achieving all the objectives of the actual research,

the trial will help improve data collection, check the appropriateness of standard measures, and provide additional knowledge. When the piloting is successful, then the pilot study can be adapted and modified accordingly.

Pilot study was conducted in Central University, Kumasi Campus. The sample was selected from Mathematics and Business Departments and conducted using purposive sampling technique. The piloting was done in this university because it has the same characteristics as one sampled for the study.

The total number of students sampled from the various department had respondents (*n*) of 52, 56% (*n* = 28) represents males, and 44% (*n* = 22) represents females with 3.8% (*n* = 2) represents missing data. The data collected from respondents was analysed using Statistical Package for Social Sciences (SPSS). Some part of the questionnaire was reviewed after the pilot study. It enabled the researcher to prepare and improve on the questionnaire protocol. This was particularly useful because it gave the researcher the opportunity to compare what occurred in the actual research and the pilot study.

3.7 Data Collection Techniques

The researcher sought permission and approval from the Head of Department, a Senior Lecturer and two teaching assistance at the department of mathematics, KNUST to help administer the questionnaire. The data collection activity was carried out within two months after the pilot study was conducted. Data were gathered through informal questionnaire procedure. In addition to introducing the researcher to respondents by the Senior Lecturer, the researcher also had the opportunity to explain to respondents the purpose of the research and how to answer the questionnaire. A total number of 258 students participated in the study. The questionnaire was instrumental in the descriptive data collection.

3.8 Data Analysis

The collection of large sets of data sitting in spreadsheets does not help to understand the dynamics or characteristics of the population the study is working with, unless the data is used to create information for easy understanding (Attride-Stirling, 2001). So in order to make sense of the data collected in this research, the researcher analysed the information collected for easy interpretation and understanding. In this study, questionnaire was administered to collect data from first year undergraduate students' to assess their extent of self-efficacy beliefs in computer use and their computer experience in SHS. There was the need to analyse and summarize the data collected to answer the research questions, so the data collected were analysed by the use of SPSS. In essence, data were analysed descriptively and inferentially.

3.9 Ethical Issues

Before the administration of the questionnaires to collect data from respondents, a letter of introduction was sent to the Department of Mathematics, KNUST - Kumasi, to sort for consent. This enabled the researcher to acquire permission for the needed support and co-operation from the department. The purpose of the research was explained to management, lecturers, students and all concerned. The questionnaire was administered to respondents based on their informed consent and voluntary participation. They were assured of anonymity and confidentiality of their responses. The study also adhered to other codes of ethics regarding data collection and information retrieval.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.0 Overview

This chapter focuses on the results of the analysis of the data and discussion of the findings. The data collected from respondents were analysed by the use of Statistical Package for Social Science (SPSS). The data were organised and presented using tables, figures, correlation analysis, scatter plot and descriptive statistics.

The following research questions were used to guide the study:

1. To what extent do undergraduate students' have computer self-efficacy beliefs?
2. Are there gender differences in undergraduate students' self-efficacy beliefs in computer use?
3. What are undergraduate students' computer experiences in SHS?
4. Is there a relationship between undergraduate students' computer self-efficacy beliefs and their computer experiences in SHS?

To answer research question 2 and 4, the researcher formulated the following null and alternative hypotheses;

Hypotheses for research question 2:

H_0: There is no gender difference in undergraduate students' self-efficacy beliefs in computer use.

H_1: There is gender difference in undergraduate students' self-efficacy beliefs in computer use.

Hypotheses for research question 4:

H_0: there is no relationship between undergraduate students' computer self-efficacy beliefs and their computer experiences in SHS.

H_1: there is relationship between undergraduate students' computer self-efficacy beliefs and their computer experiences in SHS.

The results and discussions of the findings are presented in this chapter under the following sub-headings:

- Descriptive Statistics of the Collected Data
- To what extent do undergraduate students' have computer self-efficacy beliefs?
- Are there gender differences in undergraduate students' self-efficacy beliefs in computer use?
- What are undergraduate students' computer experiences in SHS?
- Is there a relationship between undergraduate students' computer self-efficacy beliefs and their computer experiences in SHS?
- Discussion of the Findings

4.1 Descriptive Statistics of the Collected Data

This section presents the frequency distribution of data collected from the questionnaire. The data obtained were computed and analysed using SPSS software with results presented in Table 2.

Table 4.1 *Number of Respondent's (n) Gender Distribution*

Gender	Count (%)
Male	159 (61.6%)
Female	97 (37.6%)
Total	256 (99.2%)

The results in Table 4.1 show that, the data collected from Respondents (*n*) in three (3) programmes of study had total respondents of 256. Out of the total of 258 respondents,

61.6% (*n* = 159) represents males and 37.6% (*n* = 97) represents females. This indicates total dominance of male respondents.

Respondents were offering different programmes so the distribution was further organised according to programme of study with the results displayed in Table 4.2.

Table 4.2 *Distribution of Programme of Study*

Programme Offered	Count (%)
BSc Actuarial Science	53 (20.6%)
BSc Mathematics	111 (43.0%)
BSc Statistics	93 (36.0%)
Total	257 (99.6%)

The results show that, about 43.0% (*n* = 111) of respondents were offering BSc. Mathematics, 36.0% (*n* = 93) respondents were offering BSc. Statistics and 20.6% (*n* = 53) of respondents were offering BSc. Actuarial Science. The results further show that a total of 257 respondents provided a programme offering information out of a total number of 258 respondents. This indicates that a large number of the respondents offered BSc Mathematics followed by BSc Statistics and BSc Actuarial Science with the least respondents.

In order to categorise or ascertain how often students' used computers at the university, a descriptive statistic of how often first year undergraduate students use computer were performed from the data collected under section A of the questionnaire and the results shown in Table 4.3.

Table 4.3 *Distribution of Frequent use of Computers Presently*

Computer Use	Count (%)
None	21 (8.1%)
Once a Week	51 (19.8%)
Twice a Week	29 (11.2%)
Three times a week	15 (5.8%)
Four times a Week	12 (4.7%)
Very Frequently	128 (49.6%)
Total	256 (99.2%)

It was observed that 49.6% (n = 128) respondents used computers very frequently representing the highest number of respondents in the study. The results show further that 19.8% (n = 51) respondents used computers once a week, 11.2% (n = 29) of respondents used computers twice a week, 8.1% (n = 21) respondents not using computers presently (none), 5.8% (n = 15) used computers three times a week and 4.7% (n = 12) respondents use computers four times a week representing the least frequent use of computers. This indicates that majority of respondents generally use computers frequently at first year of university and the remaining total half of respondents are also not active users of computers.

The results on computer usage were further presented using histogram plots of male and female respondents to give pictorial results of the analysis as shown in Figure 4.1 and Figure 4.2 respectively. The result in Figure 4.1 of the histogram plot shows how often first year undergraduate male respondents use computer.

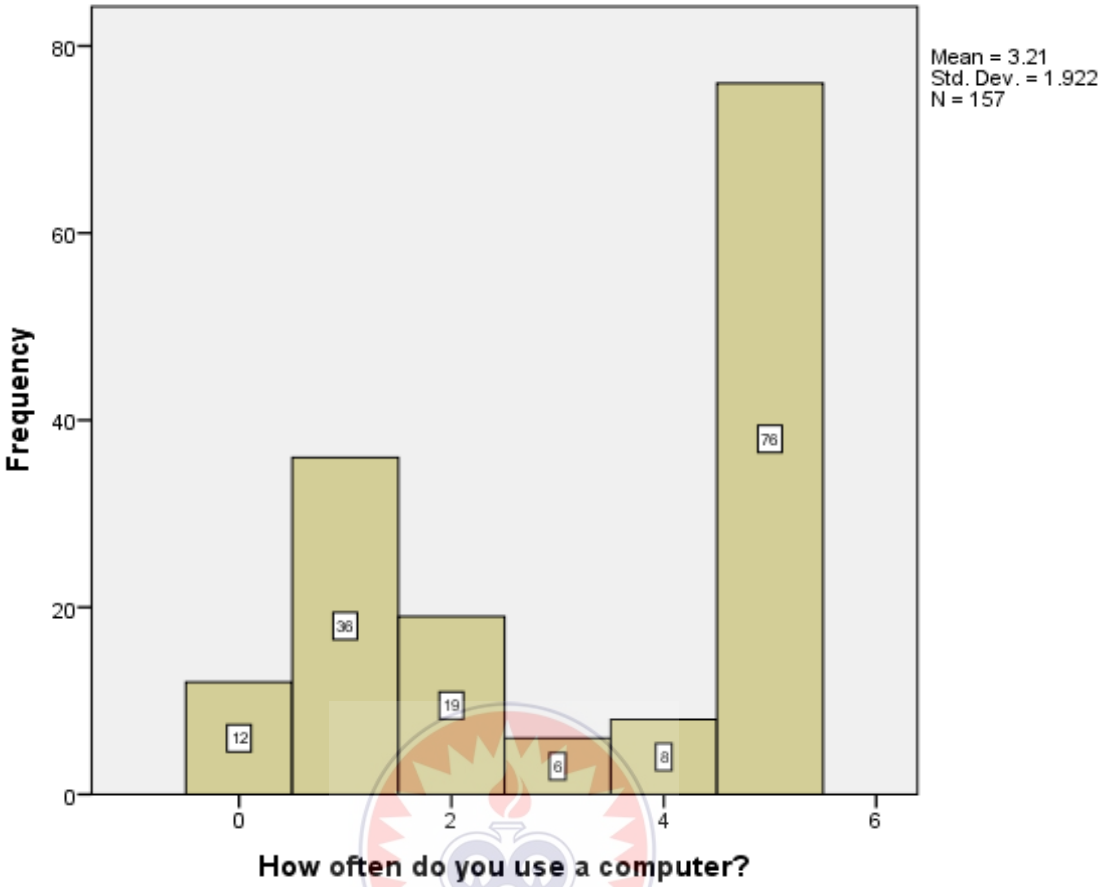

Figure 4.1. Histogram of how often male respondents use computer

Figure 4.1 indicates that, 76 male respondents use computer very frequently while 12 males do not use computers at all.

The result in Figure 4.2 of the histogram plot shows how often first year undergraduate female respondents use computer. Figure 4.2 indicates that, 51 female respondents use computer very frequently while 9 females do not use computers at all.

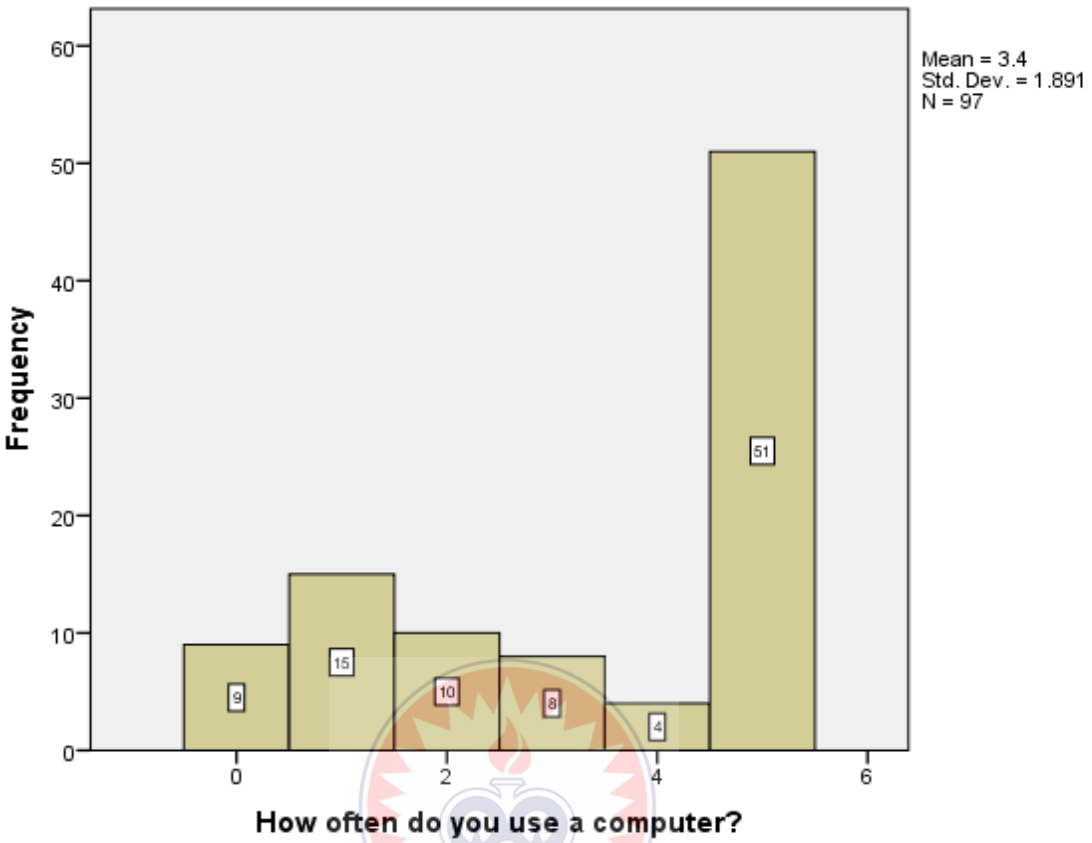

Figure 4.2. Histogram of how often female respondents use computer

This indicates that a large number of male and female respondents were using computers frequently with a few total number of male and female respondents not using computers at all.

The descriptive statistics of how often students' use computer packages (software) to determine student's previous experience from SHS was analysed and the results presented in Table 4.4. The frequency distribution of the analysis represented in Table 4.4 shows respondents from three different programmes of study, indicating the number of computer packages (software) first year undergraduate students' use. It was observed that, 85.3% (n = 220) respondents used spreadsheets while 14.7% (n = 38) did not use spreadsheets.

Table 4.4 *Distribution of How often first year undergraduate use Computer Packages (software)*

Computer Packages	Yes	No
Spreadsheets	220 (85.3%)	38 (14.7%)
Internet Packages	175 (67.8%)	83 (32.2%)
Words-processing Packages	168 (65.1%)	90 (34.9%)
Presentation Packages	87 (33.7%)	171 (66.3%)
Statistics Packages	52 (20.2%)	206 (79.8%)

The results shows further that 67.8% (n = 175) respondents used Internet packages while 32.2% (n = 83) did not use Internet packages. Again 65.1% (n = 168) respondents used Word-processing packages while 34.9% (n = 90) respondents did not use Word-processing packages. It was further observed that 33.7% (n = 87) respondents used Presentation packages whereas 66.3% (n = 171) respondents did not use Presentation packages. The results for Statistics packages showed 20.2% (n = 52) of respondents using the package although about 79.8% (n = 206) respondents were not using statistics package.

Most statistical packages are spreadsheets in nature so on hindsight frequency distribution of statistical and spreadsheets packages should have had closer frequency distribution. However, as shown in Table 4.4, spreadsheets package and statistical package have wide disparities in respondents' response. According to Table 4.4, the distribution of computer package used across programme of study showed the wide use of spreadsheets.

Further analysis using crosstabulation into programme of study as shown in Table 4.5 indicates that, students in general used more spreadsheets in their respective area of study.

Table 4.5 *Crosstab of Programme of study and computer package (software) often used*

			Spreadsheets		Total
Gender of Student			No	Yes	
Male	Programme Offered	BSc Actuarial Science	8	19	27
		BSc Mathematics	10	74	84
		BSc Statistics	5	42	47
	Total		**23**	**135**	**158**
Female	Programme Offered	BSc Actuarial Science	5	21	26
		BSc Mathematics	3	22	25
		BSc Statistics	7	39	46
	Total		**15**	**82**	**97**

4.2 To what Extent do Undergraduate Students' have Computer Self-Efficacy Beliefs?

To answer research question 1, the data collected using Section B of the questionnaire was processed with SPSS to compute total sum (Total_Score) of the respondents score. The total score of each respondent was used against a bench mark of 400 (midpoint) to identify the extent of respondents' computer self-efficacy beliefs. After computation, if Total_Score ≥ 400 then respondents score indicates High Self-efficacy beliefs and if Total_Score < 400, the respondents score indicates Low Self-efficacy beliefs. A Cross Tabulation of programme of study and level of self-efficacy beliefs was performed to check the extent of self-efficacy beliefs per programme of study. There was analysis of self-efficacy beliefs of respondents' use of computer packages (software).

The extent of computer self-efficacy beliefs is concerned with perceived capability to handle a range of various applications as well as individuals general competences with respect to general operating system skills (tasks and activity related) (Compeau & Higgins, 1995; Marakas, Yi, & Johnson, 1998). Self-efficacy belief influences individuals' thought patterns and emotional reactions. As a result, this self-efficacy influence is considered a strong determinant and predictor of the extent of accomplishment that individuals finally attain (Bandura & Wood, 1989). The researcher needed to ascertain the extent of respondent's capabilities to use computer at the university and to establish this, data on students' self-efficacy beliefs in computer use was collected using Bandura (2006) confidence scale in Section B of Appendix A. Respondents recorded their strength of ability to complete a given task using computers. The self-efficacy beliefs were on 100-point scale. Ranging in 10-units from 0 to 100, with 0 = cannot do at all, through midway degrees of confidence, 50 = moderately certain can do, to 100 = highly certain can do (Bandura, 2006). In the analysis a Total Score (Total_Score) of each respondent were computed with eight (8) questions in all. Students' with a Total_Score ≥ 400 on the scale were labelled High Self-efficacy beliefs and Students' with a Total_Score < 400 were labelled Low Self-efficacy beliefs. The results are presented in Table 4.6.

Table 4.6 *Total_Score: Respondents (n) Low and High Self-efficacy Beliefs*

Self-efficacy Beliefs	Count (%)
Low Efficacy	65 (25.2%)
High Efficacy	193 (74.8%)
Total	258 (100%)

Table 4.6 shows that, 74.8% (*n* = 193) respondents have High computer self-efficacy beliefs and 25.2% (*n* = 65) of respondents have Low computer self-efficacy beliefs.

This indicates that, majority of respondents or undergraduate students' have the capabilities or high self-efficacy belief to use computers with just a few of respondents having low self-efficacy belief in their capabilities to use computers.

Further analysis using histogram to show the extent of computer self-efficacy beliefs of undergraduate students' is presented in Figure 4.3. A Total Score (Total_Score) of respondents self-efficacy beliefs against frequency gave Mean value (M) = 486.28 and Standard Deviation (SD) = 161.814.

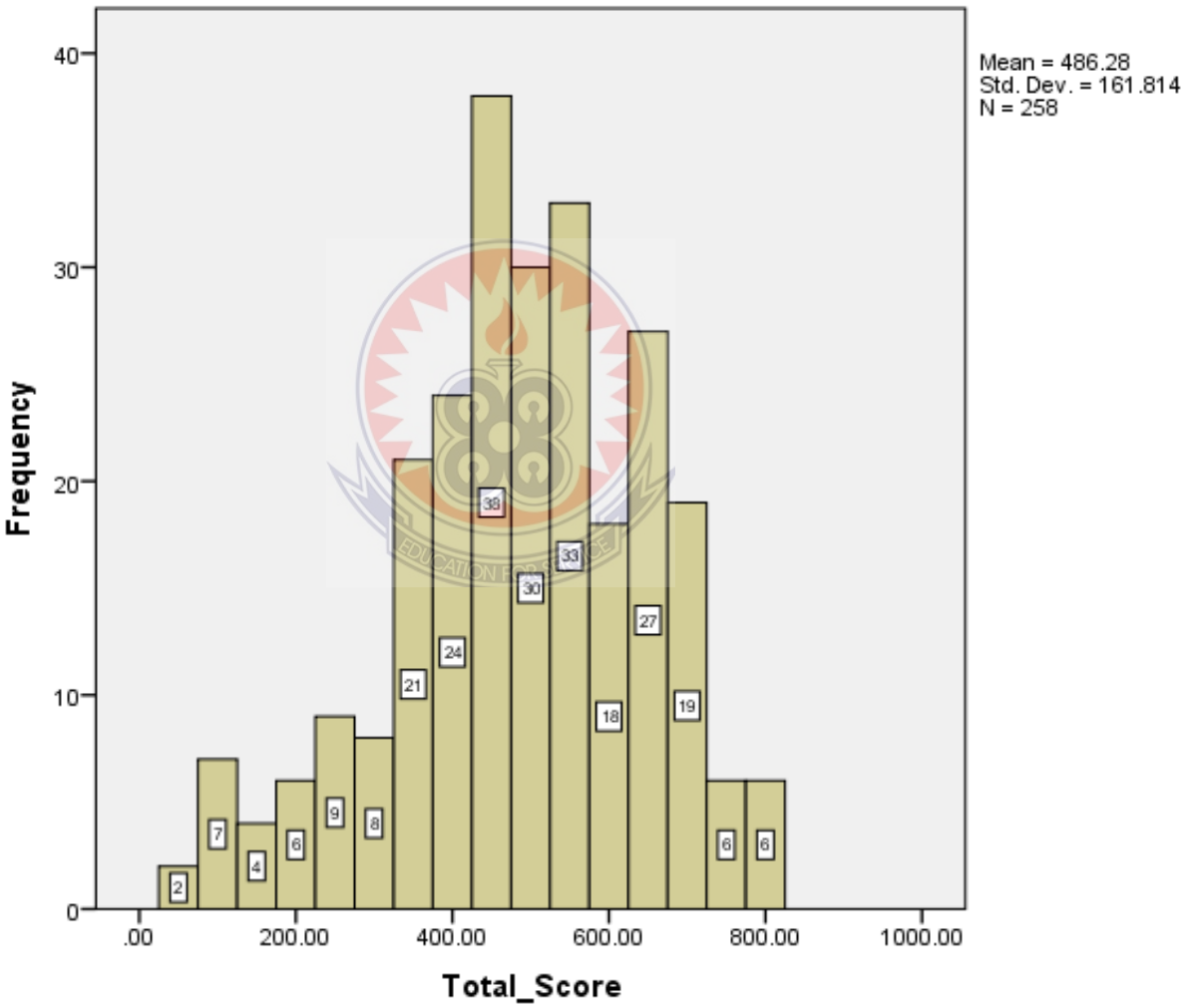

Figure 4.3. Histogram of Students' Self-efficacy Beliefs

The data mean = 486.28 and SD = 161.814 indicates that the data points are sparsely dispersed from the central point (mean) position. This points out that the data points

spread out over a wider range of values. It also shows majority of students' have confidence in their ability to use computers.

Finally, in order to answer research question 1 a crosstabulation analysis was done. Crosstabs are used to examine the relationship between two variables. The variables used for the Crosstabs were; high and low self-efficacy beliefs, and Programme of study. Table 4.7 shows a summary of the crosstabulation analysis matrix between programme of study and the extent of undergraduate students' self-efficacy beliefs.

Table 4.7 *Crosstabulation of Self-efficacy Beliefs and Programme of Study*

Programme Offered	Low	High
BSc Actuarial Science	17 (6.59%)	36 (13.95%)
BSc Mathematics	25 (9.69%)	86 (33.33%)
BSc Statistics	23 (8.91%)	70 (27.13%)

It was observed from Table 4.7 that, 13.95% (n = 36) respondents from BSc Actuarial Science had high computer self-efficacy beliefs whereas 6.59% (n = 17) of respondents had low self-efficacy beliefs. The result also shows that, 27.13% (n = 70) respondents from BSc Statistics had high self-efficacy beliefs whiles 8.91% (n = 23) had low self-efficacy beliefs. BSc Mathematics had 33.33% (n = 86) and 9.69% (n = 25) respondents having high self-efficacy beliefs and low self-efficacy beliefs respectively. In a nutshell, crosstabulation of programme of study and extent of self-efficacy beliefs indicated general high self-efficacy beliefs in computer use among respondents.

The SHS ICT syllabus is designed to provide basic skills in ICT. The syllabus covers selected basic topics in ICT which offer hands-on activities to help students acquire the required ICT skills for the job market and social interaction in the global village (Ministry of Education, 2010). The themes in the syllabus includes introduction

to ICT, word processing, internet, typing, spreadsheets and presentation. In addition to the crosstab analysis on programme of study and the extent of self-efficacy beliefs in computer use, another analysis to determine respondents' self-efficacy beliefs in the use of spreadsheets was performed and results shown in Table 4.8. Spreadsheets were singled out for this analysis because spreadsheets are included in SHS core ICT syllabus and most statistical packages are spreadsheets in nature. Spreadsheets are also very useful software to help solve mathematical task and help prepare students for work in the future (office-oriented software).

Table 4.8 *Respondents Self-efficacy Beliefs in the use of Spreadsheets*

Number of Use	Low	High
No (Not Use)	17 (6.6%)	21 (7.1%)
Yes (Did Use)	59 (22.9%)	161 (62.4%)

The result in Table 4.8 shows that, 62.4% (n = 161) respondents have high self-efficacy beliefs in the use of spreadsheets. This indicates that a high self-efficacy belief in the use spreadsheets is as a result of respondents' previous experience. It is understandable that previous computer experience and knowledge have a huge influence of individual's computer self-efficacy beliefs.

This goes to confirm an earlier research where students with a prior knowledge or experience learn quickly, adopt and develop confidence of learning new skills when they go into a course (Yates & Chandler, 1991).

4.3 Are there Gender Differences in Undergraduate Students' Self-Efficacy Beliefs in Computer use?

In order to answer and analyse research question 2, parts of Section A and Section B on the questionnaire was used in the analysis and in the process formulated the following null (H_0) and alternative (H_1) hypotheses:

H_0**:** There is no gender difference in undergraduate students' self-efficacy beliefs in computer use.

H_1**:** There is gender difference in undergraduate students' self-efficacy beliefs in computer use.

Categorical data groupings (descriptive statistics) which summarise how many times a category occurs were performed to ascertain the number of males and females, programme offered, how often respondents used computer and how many computer package (software) each respondent have used. There was Crosstab analysis to examine the relationship between the two variables: gender of student and undergraduate students' self-efficacy beliefs in computer use. Also, there was Pearson Chi-Square analysis done to compare the significant value of the Crosstab analysis between the two variables and compared to the usual threshold to accept or reject the null hypothesis.

Gender differences in the field of education relative to computer use was reflected in broader self-confidence and self-reported competence in a study by Weis, Heikamp, and Trommsdorff (2013) and found no gender differences in computer competence. In a related study Hattie and Fitzgerald (1987) found differences in computer experience in relation to performance in computer use. Therefore, in order to ascertain the gender difference in undergraduate students' self-efficacy beliefs in computer use, Chi-Square (x^2) test analysis was done. Preceding the Chi-Square (x^2) test

was an analysis to find out the interaction between gender and self-efficacy beliefs. During the analysis a total of 256 respondents' data were used and a summary of the results presented in Table 4.9. The Bio-data in section A of the questionnaire and Section B on Appendix A was used for this analysis.

Table 4.9 *Gender of Students and Self-efficacy Beliefs*

		Low Efficacy	High Efficacy	Total
Gender of Student	Male	37 (14.3%)	122 (47.3%)	159
	Female	28 (10.9%)	69 (26.7%)	97
Total		**65 (25.2%)**	**191 (74.0%)**	**256**

The result in Table 4.9 shows that 47.3% (n = 122) male respondents and 26.7% (n = 69) female respondents have high self-efficacy beliefs. Also, 14.3% (n = 37) male respondents have low self-efficacy beliefs and 10.9% (n = 28) female respondents have low self-efficacy beliefs. In both cases Table 4.9 indicates majority of male respondents have high self-efficacy beliefs in computer use and majority of female respondents have high self-efficacy beliefs in computer use. It is also observed from the results that, out of total 100% (n = 159) male respondents, 76.73% (n = 122) have high self-efficacy beliefs and 23.27% (n = 37) have low self-efficacy beliefs. Again out of total 100% (n = 97) female respondents, 71.13% (n = 69) have high self-efficacy beliefs and 28.87% (n = 28) have low self-efficacy beliefs. This indicates that regardless of respondents' gender, both male and female respondents have high self-efficacy beliefs. Hence there is no gender difference in self-efficacy beliefs in computer use or self-efficacy beliefs of respondents are not sex oriented.

To conclude there is no gender difference in self-efficacy beliefs in computer use, a Chi-Square (x^2) tests was performed using the formulated null and alternative

hypotheses as a guide. A Chi-Square (x^2) test is a statistical tool used to examine differences between nominal or categorical variables. The variables for this analysis were gender of respondents and self-efficacy beliefs in computer use. Table 4.10 shows the result of the Chi-Square (x^2) tests that was performed.

Table 4.10 *Chi-Square (x^2) Tests of Gender and Self-efficacy Beliefs*

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	69.062[a]	64	0.310
Likelihood Ratio	82.906	64	0.056
Linear-by-Linear Association	5.842	1	0.016
No. of Valid Cases	256		

Note. a. 123 cells (94.6%) have expected count less than 5. The minimum expected count is .38.

From Table 4.10, the calculated Chi-Square statistic for 64 degrees of freedom (df), Pearson Chi-Square statistic = 69.062. Additionally, the significance value (sig.) = 0.310 which is greater than the usual rejection threshold value $p < 0.05$, that is sig (0.310) > p (0.05). Hence, we fail to reject the null hypothesis: there are no gender differences in undergraduate students' self-efficacy beliefs in computer use. This indicates that, the low and high self-efficacy beliefs between male and female have no interactions with gender.

Further analysis were performed to check if there are any differences in gender and Low/High self-efficacy beliefs across programme of study and results shown in Table 4.11.

Table 4.11 *Gender and Low/High Self-efficacy Beliefs in Programme of study*

	Male		**Female**	
Programme Offered	Low	High	Low	High
BSc Actuarial Science	8	19	10	16
BSc Mathematics	20	64	8	17
BSc Statistics	14	33	15	31

Table 4.11 points to the fact that, both male and female across all the three different programmes of study have high self-efficacy beliefs in computer use. For majority of both male and female respondents to have high self-efficacy beliefs in computer use is an indication that respondents' self-efficacy beliefs are not influenced by gender.

4.4 What are the Undergraduate Students' Computer Experiences in SHS?

Research question 3 seeks to identify the level of computer experience of students' in SHS. Section C of the questionnaire was used to answer research question 3. The first question in section C of the questionnaire was to identify the year in which respondents' used computer in SHS. The second question in section C was to indicate respondents' level of computer experience in SHS. A summary of year level respondent used computer in SHS is shown in Table 4.12.

Table 4.12 *Distribution of Year/Level Respondents used Computers in SHS*

SHS Level	Count (%)
SHS 1	50 (19.39%)
SHS 2	9 (3.49%)
SHS 3	17 (6.59%)
SHS 1-2	32 (12.40%)
SHS 1-3	111 (43.02%)
SHS 2-3	24 (9.30%)
Total	243(94.19%)

The descriptive statistics of the year/level respondents used computer in SHS point to majority of respondents, 43.02% (n = 111) used computers throughout the three years in SHS (SHS 1 – SHS 3). 12.40% (n = 32) used computers in only the first and second years in SHS (SHS 1 – 2). Also, 9.30% (n = 24) respondents used computers in second and third year in SHS (SHS 2 – SHS 3). The analysis also showed 19.39% (n = 50) having used computers in SHS 1. The trend continues with 6.59% (n = 17) using computers in only third year in SHS (SHS 3) and 3.49% (n = 9) having computer experience in only SHS 2. Much emphasis was not placed on the duration a respondent had computer experience because respondents can have quality experience in only a year compared to three years of bad experience. This indicates that at least all respondents have had some form of computer experience in SHS as shown in Figure 4.4.

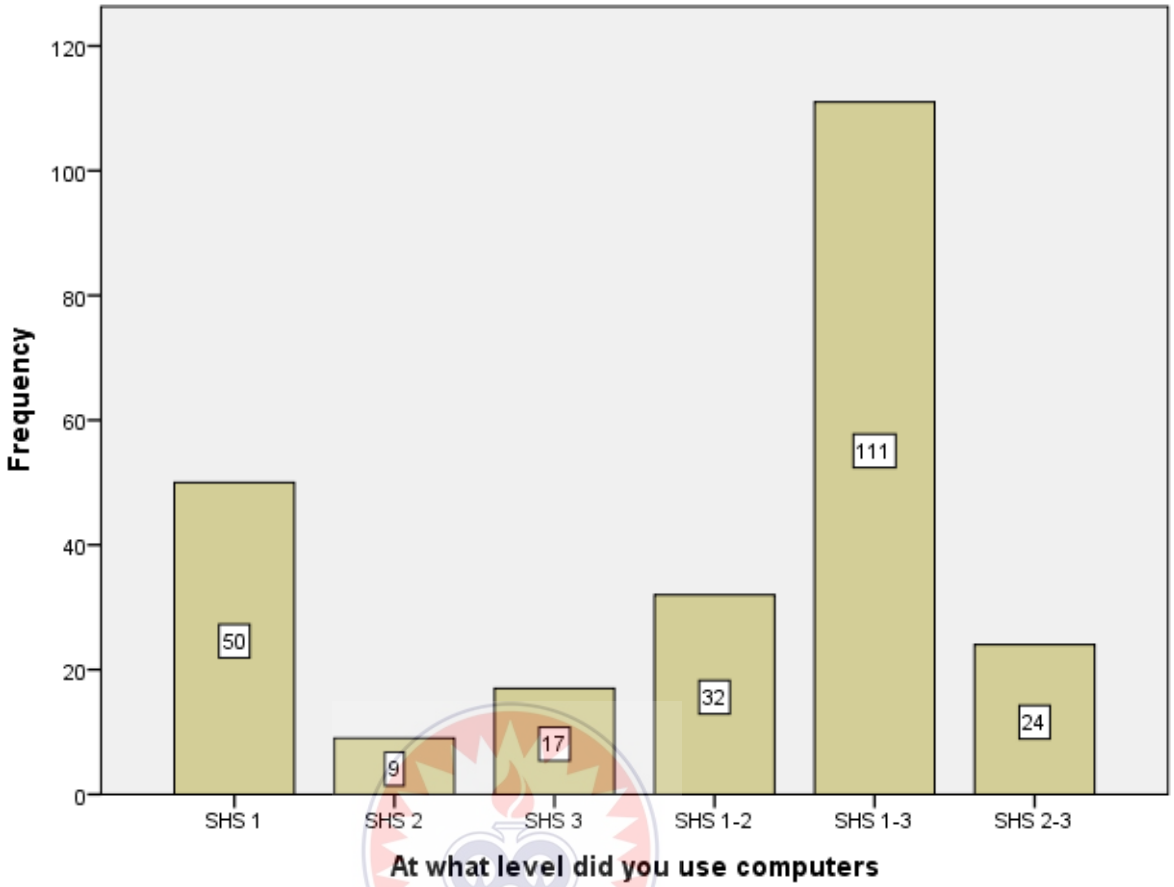

Figure 4.4. Bar chart of level/year respondents' used computer in SHS

Figure 4.4 shows that all respondents used computers at varying stages of SHS education with majority of respondents having used computers in SHS 1 - SHS 3, the second highest is SHS 1, SHS 2, and SHS 3 having a total of 29.47% (n = 76) respondents using computers in first year, second year or third year respectively. The final group consist of respondents using computers in SHS 1 – 2 and SHS 2 – 3 with a total of 21.70% (n = 56).

In order to identify the level of computer experience of respondents, respondents' raw data from the Likert-scale was converted into a tally called Total_Experience by summing the scores from the Likert-scale for each recorded response. In other words, Total_Experience was computed from the value on the Likert

scale. The mean value of Total_Experience was used as the mid-point to make the distinction between high experience and low experience. A higher score above the mean value indicate high undergraduate student computer experience in SHS and lower score value below the mean value indicate low undergraduate student computer experience in SHS. The Total score indicated the relative position of respondents or individuals. A central tendency summary of total experience as presented in Table 4.13 shows 0 as minimum total score of respondent and maximum total score of 22 with a mean value of 11.3295, median = 11.00 and the measure of spread/variation, SD = 4.20718.

Table 4.13 *Summary Statistics of Total_Experience*

	Total_Experience
Mean	11.3295
Median	11.00
Mode	10.00[a]
Std. Deviation	4.20718
Minimum	0.00
Maximum	22.00

Note. a. Multiple modes exist. The smallest value is shown

The descriptive summary statistics of Total_Experience in Table 4.13 shows that, the mean value, M = 11.3295 are used as the mid-point to make the distinction between High Experience and Low Experience.

To conclude on the level of computer experience respondents had in SHS, a frequency distribution table showing low computer experience and high computer experience as seen in Table 4.14 was created.

Table 4.14 *Frequency Table of Low Experience and High Experience*

Computer experiences in SHS	Count (%)
Low Experience	143 (55.4%)
High Experience	115 (44.6%)
Total	258 (100%)

The Table 4.14 shows 55.4% (n = 143) respondents have low computer experience in SHS and 44.6% (n = 115) respondents have high computer experience.

4.5 Is there a Relationship between Undergraduate Students' Computer Self-Efficacy Beliefs and their Computer Experiences in SHS?

Students can contribute meaningfully to computer-dominated society if they are computer oriented or have computer experiences (Ertmer, Evenbeck, Cenramo, & Lehman, 1994). Previous experience plays an enormous role in individual judgement about their future activities i.e. what individual can or cannot do in future is by large self-efficacy of that individual. The last research question was to find out if the low computer experience or the high computer experience of respondents in SHS had any effect on their computer self-efficacy beliefs in the university. Section B and Section C of the questionnaire was used to answer research question 4. During the process, the following null (H_0) and alternative (H_1) hypotheses were formulated:

H_0**:** there is no relationship between undergraduate students' computer self-efficacy beliefs and their computer experiences in SHS.

H_1**:** there is relationship between undergraduate students' computer self-efficacy beliefs and their computer experiences in SHS.

Initially, the researcher did a scatter plot to display the nature of the relationship between undergraduate students' self-efficacy beliefs in computer use and their

computer experience in SHS. The scatter plot was done to check if the two variables, respondent's self-efficacy beliefs and respondent's SHS computer experience were linearly related. The scatter plot indicated an existence of a relationship without any ambiguity and was collaborated by the correlation analysis done. The correlation was to measure the strength or degree of the linear association between undergraduate students' self-efficacy beliefs in computer use and their computer experiences in SHS. It was also to measure how the variables related. The measure used was the Pearson Correlation. Pearson correlation measures linear association or estimates a relationship between two interval variables. The correlation index for relationship is defined to be between 0 – 0.4 indicating weak, positive relationship, between 0.4 – 0.7 indicating moderate, positive relationship or between 0.7 – 1.0 indicating strong, positive relationship. Results of scatter plot from respondents' data for the analysis using section B and section C of the questionnaire is as shown in Figure 4.5. A scatter plot is when data points are plotted on a horizontal and a vertical axis in an attempt to show how much one variable is affected by the other. The variables for the scatter plot were SHS computer experience and students' self-efficacy beliefs in computer use.

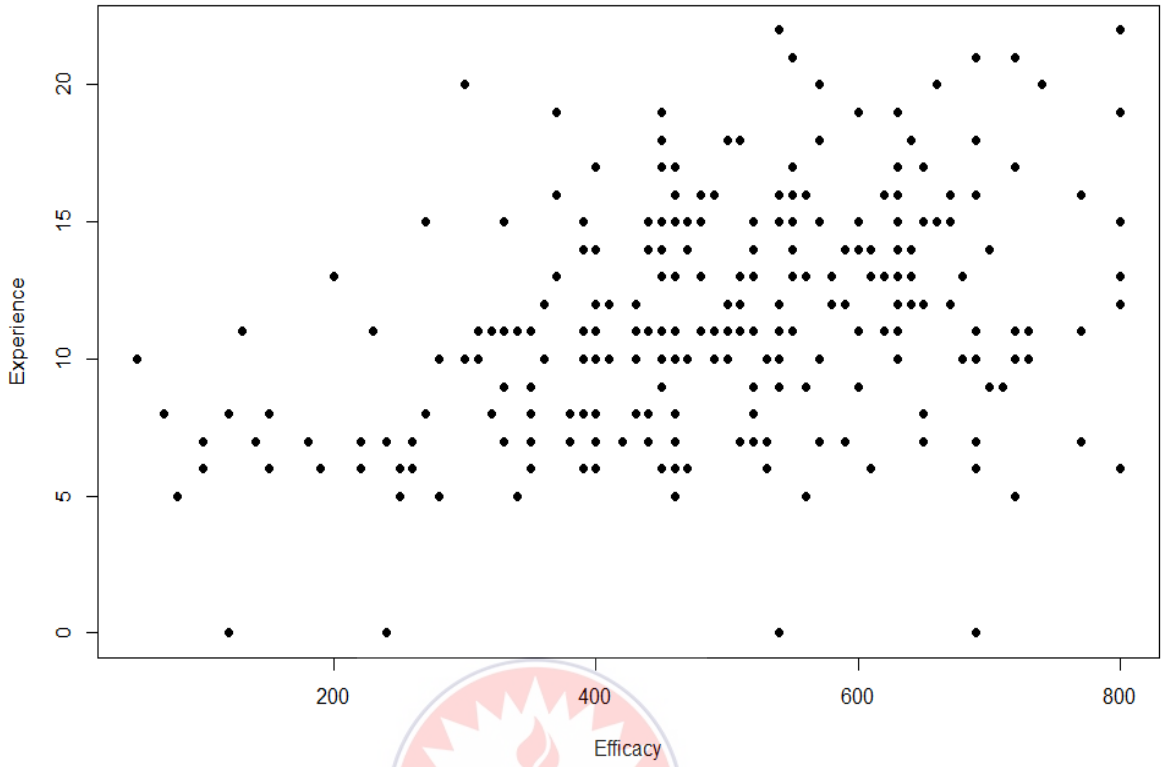

Figure 4.5. Scatter plot of SHS Computer Experience and Self-efficacy Beliefs

In Figure 4.5; it is observed that respondents with high computer experience in SHS have high confidence/efficacy in computer use. It is also observed that respondents with low experience in computer use in SHS have low confidence/efficacy in the use of computers presently at the university. This indicates that SHS computer experience affects individuals' self-efficacy beliefs in computer use in the university. It also indicates a linear relationship between previous experience and self-efficacy beliefs of undergraduate students. In order to measure the strength of the linear relationship, a correlation analysis was performed to measure the degree of relationship using Pearson Correlation.

Before the correlation analysis was performed to measure the degree of relationship, the data were checked to make sure the analysis can actually be analyzed using Pearson's correlation. It was important to check because it is only appropriate to use Pearson's correlation if the data passes four assumptions that are required for Pearson's correlation to give valid results.

The four assumptions that were checked are as follows:

- Assumption 1: The two variables; SHS computer experience and self-efficacy beliefs were checked if the two measured at the interval or ratio level (i.e., they are continuous). SHS computer experience variable was measured from 0 to 5 Likert scale and self-efficacy beliefs variable was measured from 0 to 100.
- Assumption 2: The two variables were checked if they have linear relationship and it was observed from Figure 5, a scatterplot between SHS computer experience and self-efficacy beliefs indicated linearity.
- Assumption 3: The data were checked for no significant outliers. Outliers are simply single data points within data that do not follow the usual pattern. There were few outliers and since Pearson's correlation coefficient, *r*, is sensitive to outliers, and can have a very large effect on the line of best fit, the Pearson correlation coefficient. Hence, the outliers were kept to a minimum.
- Assumption 4: SHS computer experience and self-efficacy beliefs variables should be approximately normally distributed. To achieve normality distribution of the data, each variable was determined for normality separately by the use of Shapiro-Wilk test of normality, and was tested using SPSS Statistics.

Result of the correlation to measure strength/degree of relationship between undergraduate students' self-efficacy beliefs in computer use and their computer

experiences in SHS is shown in Table 4.15. The measure used was the Pearson Correlation which is a measure of linear relationship. The correlation coefficient is defined to be between 0 – 0.4 indicating weak, positive relationship, or between 0.4 – 0.7 indicating moderate, positive relationship or between 0.7 – 1.0 indicating strong, positive relationship.

Table 4.15 *Correlation between Experience and Self-efficacy*

		Total_Score	Total_Experience
Total_Score	Pearson Correlation	1	0.398**
	Sig. (2-tailed)		0.000
	Number of Respondents	258	258
Total_Experience	Pearson Correlation	.398**	1
	Sig. (2-tailed)	.000	
	Number of Respondents	258	258

*Note.***. Correlation is significant at the 0.01 level (2-tailed).

The analysis in Table 4.15 shows Pearson Correlation index of 0.398 for the relationship between Experience and Self-efficacy. The correlation is significant at 0.01 level and the correlation index of 0.398 is within 0 – 4 indicating weak but significant positive relationship. Additionally, the significance value (sig.) = 0.000 is less than the usual rejection threshold value of 0.05 (i.e. $p < 0.05$). This suggests that there exists weak but significant positive relationship between undergraduate students' self-efficacy beliefs in computer use and their computer experiences in SHS. This indicates that having sig. value = 0.000, $p<0.05$, we reject the null hypothesis H_0**:** there is no relationship between undergraduate students' computer self-efficacy beliefs and their computer experiences in SHS in favour of H_1: there is relationship between

undergraduate students' computer self-efficacy beliefs and their computer experiences in SHS.

4.6 Discussion of the Findings

The study aimed at finding the extent of students' computer self-efficacy beliefs in university by using self-efficacy theory as the measuring instrument. The study examined whether students self-efficacy beliefs in computer use were influenced by gender. The researcher used students' previous computer experiences in SHS to measure the extent of students' computer self-efficacy beliefs in university. It also examined the relationship that exists between undergraduate students SHS computer experiences and their self-efficacy beliefs to use computers in the university. As a survey, the objective was not to generalize the findings but to provide an expansion on the debate on the learning of ICT in SHS schools in Ghana. Single survey may not be used for generalization, however they may provide insights that may enable people to modify old generalizations (Stake, 1995).

The results on research Question 1, which was about to what extent do undergraduate students' have computer self-efficacy beliefs, show that majority (75%) of the students have High self-efficacy beliefs in computer use and 25% have Low self-efficacy beliefs in computer use. Earlier studies by van Braak (2004) into the extent of computer competences showed similar results which was concerned with perceived capability to handle a range of various applications as well as general competences with respect to general operating system skills (tasks and activity related). It is also consistent with Marakas, Yi, and Johnson (1998) findings, which defined computer self-efficacy as: an individual's judgment of efficacy across multiple computer application domains. The research question identified the magnitude of respondent's

capabilities and as a result, determined and predicted the extent of self-efficacy beliefs of respondents.

The study revealed that 14% of respondents in BSc Actuarial Science had high computer self-efficacy beliefs; with 7% having low computer self-efficacy beliefs. The study further revealed that 25% of respondents in BSc Statistics had high self-efficacy beliefs in computer use; with 11% having low computer self-efficacies beliefs. In BSc Mathematics 32% of respondents had high self-efficacy beliefs in computer use; with 11% having low self-efficacy. In all the three programme categories, more than half of the total respondents (62%) had confidence in using spreadsheets for tasks activities. The self-efficacy beliefs to use spreadsheets reflected respondents previous SHS ICT Syllabus. Spreadsheets were taught in SHS ICT programme. This finding of the study agreed with earlier research of Bandura (1997) which suggested that students with higher levels of self-efficacy tend to be more motivated to learn and more likely to persist when presented with challenging tasks. Bandura (1997) identified that students based most of their beliefs about their abilities to complete a given task on their mastery experiences. For example, students who have repeatedly succeeded in previous science courses will most likely believe that they have the ability to succeed in future science courses.

The quantitative analysis on gender difference in undergraduate students' self-efficacy beliefs in computer use showed that 46% male respondents had high self-efficacy beliefs in computer use; with 16% having low self-efficacy beliefs in computer use. The results also showed that 25% Female had high self-efficacy beliefs in computer use; with 12.89% having low self-efficacy beliefs in computer use. The findings revealed that low and high self-efficacy beliefs did not have any interaction with gender. This finding is consistent with van Braak (2004) finding in a study where

gender differences in computer competence disappeared when students were controlled for computer confidence. On the findings from gender difference and self-efficacy beliefs in computer use, the Chi-Square (x^2) relational analysis showed there were no gender differences in undergraduate students' self-efficacy beliefs in computer use. The finding is in line with earlier findings of Doorekamp (1993) which found no gender difference in achievements in computer assignments in the first phase of secondary education. In addition Nash and Moroz (1997) confirmed that the gender of a person does not have any effect on the persons' attitude towards computers; rather his/her actions do have effect. Hattie and Fitzgerald (1987) also agreed partly in a study into gender difference in computer usage and found no gender difference in computer knowledge but differences in performance appeared which was closely related to differences in computer experience. However these findings are in contrast with the findings of Schumacher and Moharan-Martin (2001) in a study. They underscored that women generally have less computer experience than men which results in women having negative attitudes toward computers; resulting in gender difference in computer experience. When further analysis was carried out into gender and programme of study to check for respondents' self-efficacy beliefs in computer use, results showed that both male and female have high self-efficacy beliefs in computer use across all the programme of study. Hence, undergraduate students' self-efficacy beliefs in computer use are not influenced by gender.

With regards to the third research question, it is believed that prior experience in any study is a key predictor for future success. It is known that a belief that one will perform successfully in a given course can predict actual successful performance in that course (McKenzie & Schweitzer, 2001). The analysis on level of experience in SHS computer use of undergraduate students' showed that 55% respondents have low

computer experience in SHS and 45% have high computer experience in SHS. This finding is in line with a study of 101 undergraduate college students in India; where Eduljee (2000) confirmed that students who had greater prior computer usage (6 months or more) tend to have more positive attitudes towards computers than students with less than six months of computer experience. It's a true reflection of the poor experience students' gets prior and during SHS education. There are several experiential studies on computer experience which suggest a positive relationship between prior computer experiences leading to very good future computer experience (Koohang, 1989).

Finally, the fourth research question sought to find out the relationship between undergraduate students' computer self-efficacy beliefs in computer use and their computer experiences in SHS. The result with a scatter plot indicates the nature of the relationship as weak but significant positive linear relationship. It was observed that respondents with higher computer experience in SHS have high confidence (high computer self-efficacy beliefs) in computer use and is consistent with Teo (2008) study of 139 preserve teachers in Singapore. Teo confirmed that; years of computer usage is positively correlated with level of computer confidence. The respondents with low computer experience in SHS have low confidence (low computer self-efficacy beliefs) in computer use presently; which can be explained with a study by Fan (2005). Fan was examining gender difference among computer science college students in Taiwan and found female students who had enrolled in prior computer courses experienced more confidence when using computers mainly due to the fact that they gained computer experience prior to entering college.

Hence, to answer research question 4, a correlation to measure the strength or degree of the linear relationship between undergraduate students' self-efficacy beliefs in computer use and their computer experiences in SHS was performed. The correlation

analysis measured a Pearson Correlation index of 0.398 indicating a weak but significant positive relationship. Since the significance value (sig.) = 0.000 is less than the usual rejection threshold value of 0.05 it is suggested that there exists a relationship between undergraduate students' self-efficacy beliefs in computer use and their computer experiences in SHS. The findings concur with several experiential studies on computer experience which suggest a positive relationship between prior computer experiences leading to very good future computer experiences (Koohang, 1989). It is assumed that, partly by the length of time during which students had been familiar with computers and the intensity of computer use, there appeared to increase the level of reported computer competence hence the positive correlation. A more remarkable finding is the impact of the previous computer experience on current computer competence.

In conclusion, it can be argued from the results that majority of respondents used computers very frequently, preferred the use of spreadsheets to complete task compared to other computer packages and all respondents had computer experience in SHS. Also, majority of undergraduate students have high self-efficacy beliefs in computer use. Relational analysis also showed that there was no gender difference in undergraduate students' self-efficacy beliefs in computer use and both male and female across the programme of study have high computer self-efficacy beliefs. The level of computer experience for respondents in SHS was identified to be low computer experience for majority of students. However, respondents with high computer experience at SHS have high self-efficacy beliefs in computer use in university. The study concluded that; there exists a relationship between undergraduate students' self-efficacy beliefs in computer use and their computer experiences in SHS.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Overview

This chapter provides a summary of the findings, conclusion of the research study, recommendations and suggestions for further research.

5.1 Summary

This research was aimed at providing realistic evidence on computer experience and access to computers, reveal strengths and weaknesses of students in the use of computers and provide basis for cataloguing Ghanaian students' competence level on computer use. It also aimed at providing self-efficacy beliefs as an alternative assessment tool to augment other procedures of assessment in the education sector. A sample of 258 undergraduate students participated in the study. The researcher used questionnaire for data collection. The questionnaire focused on students' bio-data, programme of study and rate of computer use. It also solicits information on students' self-efficacy beliefs in computer use, the year they used computers and students level of computer experience in SHS.

The study used quantitative methodology which employs survey design as an approach of inquiry. The data was analysed and presented mainly using descriptive statistics (i.e. frequency distribution, histogram, scatter plot, charts, mean, and percentages) and inferential statistics (cross tabulation and correlation analysis). The data collected was analysed by the use of Statistical Package for Social Sciences (SPSS).

Bandura self-efficacy beliefs theory was used as conceptual model to assess the extent of students' computer competence and constructivist teaching and learning principle as a theoretical framework to assess SHS students' computer experience.

5.2 Major Findings

The study revealed that, majority (75%) of the students have High self-efficacy beliefs in computer use and 25% have Low self-efficacy beliefs in computer use. In all the three programme categories, more than half of the total respondents (62%) had confidence in using spreadsheets for tasks activities. Another notable finding made was that there was no gender difference in undergraduate students' self-efficacy beliefs in computer use; with gender having no interaction with low and high self-efficacy beliefs in computer use.

It was found that majority (55%) of respondents has low computer experience in SHS and 45% respondents have high computer experience in SHS. Also, majority (46%) of students used computers in the three years of study in SHS (SHS 1 – 3) while the lowest (4%) used computers in only second year SHS (SHS 2).

Finally, it was observed that respondents with higher computer experience in SHS have high confidence (high computer self-efficacy beliefs) in computer use and respondents with low computer experience in SHS have low confidence (low computer self-efficacy beliefs) in computer use presently. It was also found from Pearson Correlation analysis that there is a relationship between undergraduate students' self-efficacy beliefs in computer use and their computer experiences in SHS. A more remarkable finding is the impact of the previous computer experience on current computer competence.

5.3 Conclusion

The main purpose of the research was to investigate the level of computer experience of SHS students in order to find the extent of the students' self-efficacy beliefs in computer use in the university. It was also to investigate whether students' self-efficacy beliefs is influenced by gender and whether the SHS experience have any effect on students' self-efficacy beliefs in computer use. This research is significant in the sense that very little is known about self-efficacy beliefs as a form of assessment in Ghana.

The results established that all respondents in the Department of Mathematics, KNUST did have access to computers in SHS at various levels/years. Also, many students had low computer experience in SHS; hence making it difficult to use some other computer software packages except spreadsheets which was widely used.

It was also discovered that majority of undergraduate students have high self-efficacy beliefs but the Chi-Square (x^2) relational analysis showed there were no gender differences in undergraduate students' self-efficacy beliefs in computer use. However, it was observed that students with higher computer experience in SHS have high confidence (high computer self-efficacy beliefs) in computer use in university and students with low computer experience in SHS have low confidence (low computer self-efficacy beliefs) in computer use presently.

Finally, Pearson Correlation analysis identified a relationship between undergraduate students' self-efficacy beliefs in computer use and their computer experiences in SHS. This is due to prior computer experiences leading to very good future computer experiences (Koohang, 1989).

5.4 Recommendations

There was a number of important issues raise base on the findings and conclusions from the research which will be of interest to students, parents, educational authorities as well as the general public. It is recommended that:

- Teachers develop their own self-efficacy instrument to assess students beliefs in every topic taught. This will enable them plan an appropriate intervention for each student. It will also enable the teachers make an informed decision on how to help students improve in any subject area.
- Since past experience has influence on future performance, we recommend curriculum developers and ICT teachers to develop ICT syllabus which will be a continuation from JHS, SHS to university.
- Teaching and learning of ICT in JHS and SHS should be revised by curriculum developers to march modern trends of teaching and learning. Where possible advance from the mere traditional method of theory teaching and learning to applications of the theory to help students acquire the required ICT skills for the job market and apply in other programmes of study.
- Ministry of Education make it priority to provide, maintain, replace and expand ICT facilities in all JHS and SHS schools across the country to aid easy access to promote effective teaching and learning of ICT.

5.5 Suggestions for Further Research

Although the study was limited to only one university (KNUST), the findings provide a conceptual framework for further research into using self-efficacy beliefs in evaluating teaching and learning for teachers. The following are suggested for further research:

- It is suggested that the study should be replicated in many more universities to get the general picture of students' self-efficacy beliefs in computer use. This would provide a basis for more generalization of the research conclusions.
- Self-efficacy beliefs in other areas of study such as problem-solving, self-efficacy beliefs, self-efficacy for academic achievement, teaching self-efficacy beliefs, teacher self-efficacy to promote mathematics and other self-efficacy scales could also be considered for further studies.
- Personal efficacy can be studied as Bandura (2016) pointed out that as technologies and informational changes continuously; personal efficacy is an essential topic for study.
- It is suggested that this study could be researched further to ascertain the practical use of computers (i.e. respondents will answer practical questions using computers) to affirm the response provided on the questionnaire.
- Similar study should be conducted at the final year of this first year undergraduate students to assess their level of competence in computer use. This will help identify the type of added knowledge in computer use.

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APPENDIX A

STUDENT'S SELF-EFFICACY BELIEFS AND COMPUTER EXPERIENCE QUESTIONNAIRE

The purpose of this questionnaire is to gather data to help evaluate your experience and confidence in computer use. This questionnaire is solely for academic purpose and all information given will be treated with utmost confidentiality. I therefore desire your objectivity response to enable accurate evaluation process. Thank you for your participation into this research.

Computer as used in this research refers to computer technology (software) that enables learning, problem solving and higher order collaborative thinking processes which also makes/allows activities such as gathering, processing, storing and presenting of data possible.

The questionnaire consists of three sections: Section A, Section B and Section C.

Answer all Sections

Please tick (√) the box which is applicable to you

SECTION A: Bio-Data

1. Sex: Male [ ] Female [ ]

2. Programme offered: …….

3. How often do you use a computer?: Never [ ]
   Once a week [ ]
   Twice a week [ ]
   Three times a week [ ]
   Four times a week [ ]
   Very Frequently [ ]

4. Please you can tick (√) **one or more,** the computer packages (software) you have used:
   Word-processing packages [ ]
   Spreadsheets [ ]
   Presentation packages [ ]
   Statistics packages [ ]
   Internet Packages [ ]

SECTION B: Undergraduate students' self-efficacy beliefs in Computer use

Please in the column **Confidence**, rate how certain you are you can do the following activities under statements column**.** Indicate your degree of confidence by ticking a number from 0 to 100 using the scale given below:

0	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
Cannot do at all					**Moderately certain can do**					**Highly certain can do**

Source: (Schwarzer & Jerusalem, 1995)(Bandura , 2006)

No	**Statement**	**Confidence**										
		0	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
1	Most difficulties I encounter when using computers, I can usually deal without any help.											
2	I can motivate myself to learn to use new computer package when it is difficult to use.											
3	I am very confident in my abilities to make use of computers.											
4	I can use computers to solve problems.											
5	I can consider myself to be a skilled computer user.											
6	I can consider myself to be very competent when it comes to computer use.											
7	I can learn how to use a new computer package easily.											
8	I enjoy working with computers because it makes my tasks easy.											

SECTION C: Undergraduate Students' Computer Experience in SHS

1. At what level did you use computers?

SHS 1 [ ]

SHS 2 [ ]

SHS 3 [ ]

SHS 1-SHS 2 [ ]

SHS 1-SHS 3 [ ]

SHS 2-SHS 3 [ ]

2. Kindly indicate the level of Experience you had in Computer use in SHS with each of the statement using the following scale: where 1=Not at all (NA) 2=Rarely (R) 3=Occasionally (O) 4= Frequently (F) 5= Always (A)

No	Statement	NA	R	O	F	A
1.	How often were you using Computer and its application at the SHS level?					
2	How often were you using Computer for personal studies out of teaching activities?					
3	How often were you using Computer to perform/learn basic functions in math during mathematics class in SHS?					
4	How often did you use the knowledge acquired in Computer to complete/solve mathematical tasks?					
5	How often did you use spreadsheets to solve mathematical tasks?					

Source: (Cassidy & Eachus, 2002) (Incantalupo, Treagust, & Koul, 2014) (Cassidy S. , 2016)