UNIVERSITY OF EDUCATION, WINNEBA

USING COMPUTER ASSISTED PROGRAMME TO IMPROVE PERFORMANCE OF SENIOR HIGH SCHOOL FORM ONE STUDENTS IN INTEGRATED SCIENCE

ASI PETER

MARCH, 2017

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A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF SCIENCE, FACULTY OF EDUCATION, UNIVERSITY OF EDUCATION, WINNEBA IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF EDUCATION (SCIENCE EDUCATION) DEGREE.

MARCH, 2017

DECLARATION

STUDENT'S DECLARATION

I hereby declare that, except for reference to other peoples work which has been duly acknowledged, this project work consists of my own work produced from research undertaken under supervision and that no part has been presented for any degree in the university or a university elsewhere.

Asi Peter …… ……

Name Signature Date

SUPERVISOR'S DECLARATION

I hereby certify that, the preparation and presentation of this project work was supervised in accordance with the guidelines on supervision of long essay laid down by the University of Education Winneba,

NAME: Dr. Ernest Ngman-Wara

Signature ……. Date; …….

ACKNOWLEDGEMENT

To all those who made the finalization of this project work, and thus the culmination of this work,

I humbly acknowledge my supervisor Dr. Ernest Ngman-Wara for his dedication and guidance and most of all his support in ensuring that this work was completed and at the acceptable standard.

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Finally, my profound appreciation goes to all lecturers in the Science department of University of Education, Winneba.

DEDICATION

This project is foremost dedicated to my wife and children, for their wonderful support and all my students in SAHESS, who in diverse ways provided me with their unflinching support throughout my academic pursuit in the University of Education, Winneba.

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LIST OF ABBREVIATIONS/ ACRONYMS

CAI- Computerized Assisted Instructions

CBI- Computer Base Instructions

LEAs - Local Education Authorities

GES- Ghana Education Service

WASCE- West African Schools Certificate Examinations

BECE- Basic Education Certificate Examinations

WAEC- West African Examination Council

MDGs - Millennium Development Goals

UNICEF - United Nations Children's Emergency Fund

UN - United Nation

UNDP - United Nation Development Project

fCUBE – free Compulsory Universal Basic Education

ICT- Information and Communication Technology

ABSTRACT

The study investigated the use of computer assisted programme to improve the performance of first year General Arts students on digestion of humans.

The study employed action research design. The sample used for the study was 60 first year General Arts students. The instruments used for data collection were pretest and posttest and structured interview. Data collected were analyzed using SPSS. Descriptive statistics were used to organize students' test scores into means and standard deviation. Inferential statistics involving t-test was used to establish any significant difference between the pretest and posttest. The results of the study revealed that there was a statistically significant increase in the performance of students that received computer based lessons. In addition, the research indicated that using computer assisted programme as a teaching tool increased the academic success of the students and also facilitated their understanding of abstract concepts. It can be concluded that the use of computer assisted programme in teaching integrated science has the potency to improve academic performance of students.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter contains information on the background to the study, statement of the problem, purpose of the study, research questions, and significance of the study, delimitations and limitation of the study.

1.1 Background to the Study

Ever since ancient times people have devised various techniques for communicating their thoughts, needs and desires to others. In early civilized times, people tended to cooperate in geographically localized clusters in which communication was adequately achieved through speech and written messages. As civilization spread over larger geographical areas, a variety of long – distance communication methods were tried such as smoke signals and carrier pigeons. One of the earliest known optical link, was the use of fire signal by Greeks in the eighth century B.C. for sending alarms, calls for help, or announcement of certain events (UNESCO, 2013). Developed countries such as South Korea, China, and Japan are modes of developing countries. This is because of their rise in their science base and application of science in the field of technology. The development of science and technology is observed in all aspects of life such as education, agriculture, industries, businesses and others events (UNESCO, 2013).

For the past 17 years Ghana has gone through rapid changes in technological advancement. Several governments, both past and present, have made it an agenda to develop the country through science and technology. Ghana with low technological development, the youths in the country are growing up in a complicated and fast developing society and are in the position of change as they are confronted with new information and product of technology (Abbey, 1995).

For Ghana to develop more rapidly, then some of the paramount areas of education to consider are science, mathematics and technology starting from early childhood. In support of this, the Anamuah–Mensah Committee (2012), recommended that greater emphasis should be put on Information and Communication Technology (ICT) and Science and Technology in schools. To make this happen, it is essential that science and science education be given the number one priority.

However, students perceive science to be too difficult. This perception cuts across all levels of education where science is taught. Owing to this perception about science, learners in various institutions try to avoid it when given the opportunity as cited by Brown (2005). This is testified by the number of students that offer elective mathematics, chemistry, physics and biology at the Senior High School level. They are few as compared to those that offer general arts (Chief Examiners Report WAEC, 20013).

The attitude of most students towards integrated science, can be ascribed to several limiting factors, such as lack of competent teachers, appropriate teaching and learning materials and most importantly the approach to the teaching of science, which include requisite skills, methods and preparation on the part of the teacher to achieve effective teaching (Johnstone, 1997).

Some of the few students who make an effort to study sciences, psychologically fall out when they meet challenges which they perceive to be difficult to solve (Wilson, 1999). Some may wish to do away with the subject, especially when it is time for science lesson by staying away from the class; others deliberately fall sick whiles those who sit in class for the lesson, do so passively just waiting for the lesson to be over, (Edwards, 2006).

Science as a subject can be understood by students only when the methodologies, adequate and appropriate teaching and learning materials, effective facilitating and techniques are employed in the teaching and learning process at any academic level. This will facilitate the acquisition of

skills and understanding of science. Students have difficulty in understanding abstract concepts when the processes involved are not physically observable. Some of these biological processes include, functions of the circulatory system of human, fertilization, excretory system and digestive system of humans. The study of these processes pose a lot of challenges to learners, especially beginners, who need to get fundamentals about these topics. Some teachers who taught these topics in abstract terms leave the academically weak students to over-stretch their imagination and may not grasp anything at all. The teaching of integrated science in abstract forces some students to resort to rote-learning because of lack of understanding.

In order to achieve desirable outcomes, learners should be engaged in the teaching process so that the lesson becomes student-centered and appropriate evaluation strategies and questioning techniques like 'how' and 'why' are used for learners to think about wide range of ideas. A teacher who regularly interacts with students has to device means of averting the challenges of student misconception. This challenge or desire to avert the formation of misconception among learners moved the researcher to assess the potential of using computer aided programmes to make learning of science easier and less abstract. This alternative of computer aided programme was to improve the performance of first year students of Sacred Heart Senior High School in the Brong Ahafo.

1.2 Statement of the Problem

Numerous teaching strategies have been developed which correspond to the accommodation of students' need and diverse learning methods. One such strategy involves the use of information and communication technologies.

The country is confronted yearly with situations of poor performance in integrated science by senior high school candidates who write the West African School Certificate Examination. The results for 2013-2015 is summarized in Table 1.1

Year	No. of Candidates Registered	Percentage Passed	No. Of Candidates Registered (Nov.Dec)	Percentage Passed
2013	409,832	73.6%	140,420	20.8%
2014	242,157	48.7%	142,849	32.4%
2015	254,658	52.8%	176,618	28.9%

Source: www.ghanawaecdirect.org, 2015

Table 1.1 reveals that, the mean percentage performance within the three years' record is 58.36%. This is below the cut off percentage pass by the Chief Examiner's Report of WAEC in May 2016 which was targeted to be 75% average.

Over the past decade, Ghana has recorded falling standard in education according to UNESCO (2009). This has been a matter of great concern for all stakeholders in education. Some people are of the view that teachers are not putting in the required effort; others think that absenteeism and lazy attitude on the part of students are some causes of the falling standards of education in the country. Another school of thought believes that both parents and students do not pay particular attention to education and for that matter school performance is not taken into consideration (Ghana Education Service Stats, 2015).

According to Oshodi (1999), awareness towards the use of communication technology is increasing in the classroom in the developing world such that mere verbalization or over verbalization of words alone in the classroom to communicate ideas, skills and attitude to educate learners is futile. Busari (2006), is of the view that bad reading skills of science and technology students, the state of laboratory facilities, inadequate of science text books, affect effective teaching and learning of science subjects.However, the nature of Ghana's economy requires that every citizen of the country needs some level of training in science to enhance their effective adaptations and use of the natural gifts by nature.

In addition, Integrated science is one of the core subjects pursued in all Senior High Schools in country. Over the years, the performance of students in Integrated Science has however, been very poor. A research into this revealed quite a number of reasons: Some concepts are very difficult for teachers to teach as well as for students to learn of which biological process is one. (Bangkok, 2004).

The biological process of circulation of blood in mammals, human digestion, fertilization in flowering plants, protein synthesis, RNA, DNA, cell division are few topics teachers normally neglect teaching due to their abstract nature (Ertmer, 2003). The most common method of teaching science has been the traditional methods of teaching which include classroom discussion and abstract explanations. These methods are unable to explain concepts properly.

The traditional method has been a major setback to effective teaching and facilitating of the learning process of most students in the areas of science. It is in line with this problem that this study was carried out to find out how the use of computer assisted programme could be used to improve performance of senior high school students in integrated science.

1.3 Purpose of the Study

The purpose of the study was to use computer assisted programme to improve the performance of senior high school form one students in integrated science.

1.4 Objectives of the Study

The following objectives were formulated to guide the study:

1. To identify problems facing form one students of Sacred Heart SHS in understanding "digestion in human".

2. To find out the impact of the use of computer assisted programmes for teaching integrated science on the academic performance of students in Sacred Heart Senior High School.

1.5 Research Questions

The research questions of the study were:

1. What problems do form one students of Sacred Heart SHS have in understanding of digestion in humans?
2. To what extent will the use of computer assisted programmes for teaching integrated science improve the performance of form one students of Sacred Heart SHS on digestion in humans?

1.4 Hypothesis

The research will answer the following hypotheses:

1. H_0: There will be no significant difference in the academic performance of student using computer assisted programmes
2. H_1: There will be significant difference in the academic performance of student using computer assisted programmes in teaching

1.6 Significance of the Study

The potential benefits of Computer Assisted programmes cannot be underestimated in this contemporary world. There is a plethora of established findings on the instructional value of computer, particularly in advanced countries. There are now several programme packages on

different subjects. It is obvious that the current trend in research all over the world is the use of computer facilities and resources to enhance students' learning and teachers teaching of basic concepts in all subject areas.

Hence the outcome of this study would provide guidance for policy makers and stakeholders in education when structuring and introducing integration policies in Senior High Schools. This would also serve as the basis for future studies on how to address some of the challenges of the use of computer assisted programmes in education.

1.6 Delimitations

The study focused on how the use of computer assisted programmes can improve the academic performance of students in integrated science. The research was conducted in three purposively selected general arts classes in Sacred Heart Senior High School in the Sunyani West District of the Brong Ahafo Region of Ghana.

1.7 Limitations

There is the anticipation that some of the respondents especially teachers and students may not avail themselves to respond to the questionnaires and the semi-structured interview guide. Others may also give wrong information with the view of protecting themselves and their wards or the other way round, with the fear of being victimized and seen narrow minded in the subject area. These are some major limitations that may affect the outcome of the quality of the results. However, this will be minimized by assuring both respondents of confidentiality of their responses.

1.8 Organization of the Chapters

The research work is divided into five chapters. Chapter one comprised the background to the research, problem statement, general and specific objectives, research questions, significance of the study, delimitations, limitations, definition of terms and organization of the study.

Chapter two also covers the critical literature review; comprising the theoretical review, empirical review, and the conceptual framework.

Chapter three deals with the methodology; which covers the study area, research type and design, population, sample and sample techniques research instruments, validity and reliability evidence, data collection procedure, and data analysis plan. The chapter four is also made up of the results and discussion; which include bio-data of respondents as well as the appropriate sub-headings.

Chapter five also contains the summary, conclusion, recommendations and suggestions for further research. Nonetheless, references and the appendices have also been taken care of after the chapter five.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter reviewed related literature to the study. The purpose of this literature review was to look at an overview of the introduction of CAI into education and the impact that CAI has on learning and more specifically, on students learning in integrated science achievement.

2.1 Theoretical Frame Work

This research was based on constructivism. Constructivism is a term used to represent a collection of theories, such as generative learning (Wittrock, 1990), discovery learning (Bruner, 1961), and situated learning (Brown, Collins, & Duguid, 1989). Constructivism is defined as a set of beliefs about knowledge that begins with the assumption that reality exists but cannot be known as a set of truth (Tobin & Tippins, 1994). Kruckeberg (2006) indicates that if new content is not connected to students' prior experiences, it is difficult for the student to find it meaningful, which impacts their ability to assimilate the new information.

The fundamental insight of the constructivist theory is that knowledge is actively constructed and not simply acquired by the learner. According to Roblyer & Edwards (2006), learners construct knowledge themselves rather than simply receiving it from knowledgeable teachers. Constructivism sees learning as a dynamic and social process in which learners actively construct meaning from their experiences in connection with their prior understandings and the social setting (Driver, Asoko, Leach, Mortimer & Scott, 1994). Constructivist views also emphasize generative learning, questioning or inquiry strategies (Slavin, 1994). An emphasis on constructivism and hands-on inquiry-oriented instruction to promote children's conceptual knowledge by building on prior understanding, active engagement with the subject content, and

applications to real world situations have been advocated in science lessons (Stofflett & Stoddart, 1994). Constructivist views emphasizing discovery, experimentation, and open-ended problems have been successfully applied in science (Neale & Smith, 1990). Wildy and Wallace (1995) believed that good science teachers are those who teach for deep understanding: "They use students' ideas about science to guide lessons, providing experiences to test and challenge those ideas to help students arrive at more sophisticated understanding. The classrooms of such teachers are learner-centered places where group discussion, exploration and problem solving are common place." (p.143)

Teaching methods based on constructivist views are very useful to help students' learning. They are used to make lessons relevant, activate students' prior knowledge, help elaborate and organize information, and encourage questioning. Important concepts from this perspective are :

a. Advanced organizers: general statements given before instruction that relate new information to existing knowledge to help students process new information by activating background knowledge, suggesting relevance, and encouraging accommodation;

b. Analogies: pointing out the similarities between things that are otherwise unlike, to help students learn new information by relating it to concepts they already have; and

c. Elaboration: the process of thinking about new material in a way that helps to connect it with existing knowledge. (Slavin, 1994, p.237-239):

To explicitly build on students' existing knowledge is one of the ways to encourage deep approaches to learning (Biggs, 1995). To achieve this, teachers should have a clear idea of what students have already known and understood so that they can engage students in activities that help them construct new meanings (von Glaserfeld, 1993).

Computer assisted instruction programmes have been related to constructivism in that students are at the centre of the learning process, rather than being passive recipients of instruction. They are actively involved in constructing knowledge (Hogan, 2005). Constructivism theory argues that human beings generate knowledge and meaning from an interaction between their experiences and their ideas. Learners learn by experimentation, and not by being told what will happen. Learners are left to make their own inferences, discoveries and conclusions. It also emphasizes that learning is not a haphazard process but that students learn the new information that is presented to them by building upon knowledge that they already possess. This theory suggests that the teacher's role is not only to observe and assess but to also engage with the students while they complete activities, suggest solutions and pose questions to the students to promote reasoning (DeVries, 2002). Computer assisted instruction programmes are interactive and enable students to control the pace and sequence of their learning (Driscoll, 2000, Silverman & Casazza, 2000). During the learning process, a student is presented with specific tasks and must master them before going to the next level. In the drill and practice of computer assisted instruction, the pace and number of trials to reach mastery varies from student to student.

2.2 History of Computer Assisted Instruction in Education

The idea of using technology to enhance education has been around for a long time. Back in 1928, courses werw offered through radio. These classes were for enrichment or credit and were centered in Ohio and Wisconsin, (Clark, 2003). With the introduction of television, in 1932 the University of Iowa began experimenting with offering classes using this technology. Several years later in 1944 computers made their first appearance with the invention of the MARK I; a large mainframe used primarily in perform math and science calculations. Using television as an educational tool slowly began to grow and in the 1950s, seventeen educational programs started using television as a way to reach their students and twenty-two years later there were at

least 233 educational stations. Throughout this time period, computers began to filter more into the education world and in 1959 at the University of Illinois the first large scale use of a computer assisted instruction (CAI) system, PLATO, was introduced (Molnar, 1997).

Technology transitioned in the early seventies and universities began installing microwave networks to create close-captioned classes for students at remote locations. CAI systems continued to be developed throughout this time period, but lessons were dull and uninspired (Minoli, 1996) and 50% to 60% of the material in the lessons was extraneous (Saettler, 2004). For this reason, even though the eighties, about 95% of public television stations and one third of universities continued to offer distance learning courses through the Adult Learning Service (ALS) using television. Still, the use of computers continued to grow and by 1975, 23% of schools were using them for educational purposes and 55% of schools at least had access to them (Molnar, 1997).

It was not until the nineties, when computers took on a newer, more efficient structure, became faster and more multifunctional (Harting & Erthal, 2005), did society really began to consider their potential in education. During this period, schools purchased around two million computers, resulting in almost 100% of educational institutions using this technology in their buildings (Cotton, 2001). Out of need, the Virtual High School Global Consortium was created in 1996, and by 2009 over 1,000,000 students were enrolled in at least one online class. (Picciano, Seaman, Shea, & Swan, 2012). By the beginning of the twenty-first century, computers were fully implemented into schools and being utilized in a variety of ways.

2.3 Traditional Method of Teaching Science

Traditional instruction is teacher-centered and characterized by direct instruction (Brown, 2003). According to Kinney and Robertson (2003), direct instruction usually includes the presentation

of material, thinking aloud by the teacher, guided practice, correction and feedback and modelling by the teacher. The teacher plays the role of the expert imparting knowledge and decides what, when and how students should learn with all students studying the same topic at the same time (Brown, 2003). A teaching style inventory administered to 381 faculty members at 200 United States of America public and private colleges and universities revealed that 60% of them taught using the teacher-centered mode of instruction assuming the role of expert, authority and model (Grasha, 1994).

The results further revealed that the facilitator and delegator teaching styles, which are student-centered, were used less in mathematics and science and computer science classes than in any other discipline. The tendency is for teachers to use the same instructional methods with which they were taught and about which they feel comfortable.

In colleges and universities, the predominant mode of instruction has been the presentation of material through lecture and demonstration using whiteboard, chalkboard, overhead, power point or graphing calculator (Armington, 2003). The teacher talks and students listen and write. The teacher demonstrates step by step procedures which are reinforced with drill and practice and interaction is limited to students responding to the teacher's questions.

Some educators have a very negative view of the traditional lecture. According to Brown (2003), the teacher is responsible for thinking while the students memorize and recite. Hence teachers are focused on content, schedules and standards, but not on the needs of the students. Felder and Brent Felder (1996), describe the traditional lecture as stenography with the teacher reciting the course notes, the students transcribing the notes, and "the information not passing through anyone's brain" (p.3). Teachers that teach by lecturing operate under the assumption that if they do not lecture they will lose control of the class; they view their students as empty pails waiting to be filled and themselves as the "sage on the stage" (Mahmood, 2006). According to Brothen and Wambach Brothen (2000), faculty, students and administrators think

that teaching means “speaking aloud from the front of the room” (p.64). However, based on their research on a developmental psychology course, they concluded that lectures are inefficient means of delivering instruction. Basically, the teacher controls the instructional process; the content is delivered to the entire class and the teacher tends to emphasize factual knowledge. In other words, the teacher delivers the lecture content and the students listen to the lecture. Thus, the learning mode tends to be passive and the learners play little part in their learning process (Tambade, P.S., & Wagh, B.G. 2011). It has been found in most universities by many teachers and students that the conventional lecture approach in classroom is of limited effectiveness in both teaching and learning. In such a lecture students assume a purely passive role and their concentration fades off after 15-20 minutes (Oni, 2012).

The traditional approach to learning assumes that all students have similar levels of knowledge in the subject being taught and they absorb new material in a similar pace (Marbach, G., Seal, O.& Sokolove, P. 2001*).* Students are rarely given much choice about what they are to learn. (Marbach, G., Seal, O.& Sokolove, P. 2001*),* further stated that the teacher is the centre of any information given to learners, and they only receive information that is given by the teacher from his lecture notes, textbook or any other material he/she has in hand. This approach aims to transmit values, attitudes and ideas from teacher to children, and also demand the children to master concepts and ideas in the books and in teachers’ lectures. Learners are not given the opportunity to search elsewhere for information and this is certainly less influential in improving students’ knowledge.

Thus, the ease with which students absorb knowledge is the same ease with which it goes out (Antwi, 2013). The lecture method also allows students to become passive recipients of information that has been "predigested" by the teacher. Thus, students become dependent on the teacher to tell them what they need to know and can avoid taking responsibility for their own learning (Hansen, et. al. 2000). Furthermore, students accustomed to being passive have a "low

tolerance for challenge" and finally learning as a result of lecture method is relatively superficial and transient (Moust, et.al. 2005). More emphasis tends to be placed on theory without any practical and real life applications/situations.

Studies have shown that with the traditional approach to teaching and learning, most students depend on rote learning and rote problem solving without developing the conceptual problem solving skills that all scientists value (Mahmood, 2006). The lack of conceptual understanding usually goes unnoticed because students can solve many standard problems in spite of the difficulties. They are talented and have memorized rules that are often true (Antwi, 2013).

For instance, the issue of rote learning was identified as a problem among learners, especially Ghanaian students during their final examinations in Physics. Reports from the chief examiner of the West African Examination Council (2002; 2004; 2008), confirm that many students have poor knowledge of science; they avoid questions requiring deductive thinking, and are unable to go beyond stating definitions. In his recommendations, he proposed that teachers should actively involve students in the teaching and learning process, and discourage rote learning as much as possible. Thus teachers were encouraged to adopt methods that would enhance learners' participation and understanding during teaching and learning process.

2.4 Use of Computer Assisted Instructions in Science Curriculum

A computer is an electronic device that has the capacity to store, retrieve and process both qualitative for example, dictionary of terms and quantitative information for example, the formulae. It can accommodate instructional programme which include drills, tutorials and simulations. Computer assisted instruction can have great potential as instructional tools in the classroom (Moore, 1997). The challenge is how to optimize usage. Gonzalez and Birch (2000), ascertain that computer assisted learning has the ability to promote active learning in a wide variety of disciplines from literature to the social sciences and beyond.

The use of ICT can be of assistance to science teachers in several aspects. According to Jeddah (2012), CAI allows students to learn interactively at any time and that education programmed through computers spares teachers time and resources. It is suitable for presenting many things that cannot be experienced otherwise.

Also some science topics are suited to CAI, for example observing the processes of volcanoes and hurricanes, as these cannot be experienced from static teaching aids. Through the use of computers, the learner can observe such natural phenomena at will.

An interview of some students stated that they have seen many websites on the internet that present examples of lenses, light rays, electrical circuits, and many more. This means that ICT enables students to see and study such things as if they were in a real lab. This applies to electrical circuits and the relationship between current and voltage levels. Thus, students who learn with ICT can obtain (virtual) hands-on experiences instead of merely hearing explanations of abstract and theoretical phenomena.

Although traditional teaching methods can be used with some success, they do not prepare our students for the challenges of today's society as observed by (Ivers, 2002). Over the years the role of teacher in the classroom has gradually but drastically and steadily evolved. New teaching and learning methods have emerged, many of which favour individual or small group learning. As a result, the teacher's role has evolved from being the source of knowledge to being a director and facilitator of instruction. For this reason, the teacher has resorted to the use of various resources and organizes learning in varying ways. Jonassen, D & Carr, C (2000), describes computer assisted learning as a way that support learning by allowing students to construct knowledge, explore and assess information with other students and represent what they know. Computers were never developed for improving the quality of teaching and learning process, but researchers started using computers for teaching (Sansanwal, 2000).

Computer Based Instructions (CBI) thus was developed and people gradually started developing computer assisted instruction (CAI) for teaching. The developed CAI was found to be effective in terms of achievement of science process skills. (Antwi 2013). CAI are valuable tools in diverse field of applications and used in diverse fields of education. In the field of teaching in particular, the wide use of CAI is evident in diverse school in elementary, high-schools, colleges and universities. CAI are advantageous in the sense that these machines teach much more effectively in technical sense, they can attain and teach far more students and kept students more focus with the subject.

The World Wide Web access will also enable students to get various educational resources from all above the planet, hence making the globe like a classroom for studying. It enables students to access different ideas. In teaching young learners, the use of CAI in the teaching processes is extremely considerably beneficial. The use of CAI could catch the focus of the kids, generating their attention as well as participation teaching and studying activities. The use of these technologies allow the teachers to increase teaching styles that could probably boost the learning of the students. CAI are advantageous in the sense that these machines educate more effectively. The computer can attain and teach far more students and kept students much closer to the subject. With the access to the internet, it is also feasible to educate these students or learners that are situated in the remote or far places provided these areas have internet signals (Owston, 1997). These technological capabilities make the teacher to reach as well as to educate a lot more learners. The web access will also allow the students to get different educational sources from all more than the globe, thus creating the globe like a classroom of learning, (Bayrak, 2008). It enables the learner to access different concepts as properly as information comes from other areas of the world. CAI can be utilized in education to make it possible for the learners to find out modern day tools and information that will make him or her prepared for the probable technological modifications in the future. This study used computer assisted instruction with the

aim of establishing its impact on academic achievement in teaching and learning of secondary school chemistry.

2.5 Traditional Teaching Methods versus Computer assisted instructions

The use of CAI as a supplement to traditional instructions has the potential to produce higher achievement than the use of traditional instructions alone. Besides this, students can learn instructional contents faster with CAI than with traditional methods and the level of retention may be better with CAI. CAI can improve student motivation (Marr, 2000). Research has found that student using computers have increased self-confidence, self-esteem and are more successful and motivated to learn than some conventional methods (Wishart, 2002). There are many research studies supporting the use of computer instructions in classroom to supplement traditional teaching methods. Miller (1999), indicated that one of the benefits of CAI over traditional teaching methods is the immediate feedback received by the student. Unlike the traditional methods, CAI is effective for teaching and learning with all levels of students including those with special needs.

Researchers have found that one major advantage in using CAI over traditional methods is that they are used across a variety of subject areas, including Mathematics (Christimann, E., & Badgett, J.1999) and also in Science and Social studies, which is not the case with traditional methods (Isernhagen 1999). Students perceive computers assisted instructions as having a positive effect on their learning (Lin, 1998). Learners are likely to be more involved and active participants during instructional process when technology is involved which is also a significant factor over traditional methods (Sivin, 2000). Computer assisted learning can have many positive benefits depending on how they are used as observed by Archar (1998). Many researchers recommend using computer assisted learnings over traditional methods to support

higher order thinking and problem- solving skills. Herrington (1999) describes CAI as intellectual partner that supports learning by allowing students to use them as tools to construct knowledge, explore and assess information with others and articulate and represent what they know. Other researchers noted that using computer instructions can provide students an opportunity to learn and apply real world skills which is not provided or offered by the traditional methods (Ivers, 2002).

The international society for technology in education suggests that teachers who move away from traditional learning environment to new learning environment promote active learning, higher level thinking, collaborative and multisensory stimulation. These environments support multiple intelligence, constructivism and cooperative learning. According to Sansanwal (2000) the teaching learning objectives are multi-dimensional in nature and their achievement to be realized CAIs will for integration of multiple methods. It is a well-known fact that not a single teacher is capable of giving up to date and complete information in his own subject which is a dominant feature with traditional methods. Computer assisted learnings can fill this gap because it can provide access to different sources of information which is not the case with the traditional process and method. It may provide accurate information as comprehensive as possible in different formats with different examples. Computer assisted instruction can provide online interaction facility. It helps learners to broaden the information base. It provides variety in the presentation of context which helps learners to concentrate.

Computer assisted instructions provide flexibility to learners which are sometimes denied by the traditional process and method. Computer assisted learning could be of great help because it includes the drill-and-practice, tutorial, or simulation activities. Cotton found that computer software provides many instructional benefits and CAI can have a much greater impact on student learning when compared to traditional methods. Researchers have also found that CAI enhances learning rate, that is, students learned the same amount of material in less time than the

traditionally instructed students or learned more material given the same amount of time. Moreover, students receiving CAI also retain their learning better (Cotton, 1991). Most researchers concluded that the use of CAI can leads to more positive attitudes of students than the use of traditional methods. This finding has emerged from studies of the effects of CAI on student attitudes as cited by Cotton (2001). The use of a CD-ROM tutorial is ideal to support traditional methods.

One advantage of CAI over traditional methods in teaching is self-paced learning. According to Lawson & Comber (1999), a learner may review specific topics on which he/she needs clarification and if familiar with the topic, may quickly progress at a faster rate to others. This is in contrast to conventional methods, in which learning is based on a predetermined time where learners are individually expected to master the topic during that time. Another advantage of self-paced learning is the flexibility of schedules it provides. Learning is accessible almost anywhere a computer can be located (Congram, 1995). Also, the self-pacing learning concept eliminates the need for group instruction and scheduling (Dhanjal, 1999). Along with flexibility of schedules comes the cost-effectiveness of using CAI over traditional methods. Since learners can study at home avoiding the need to travel to training facilities, this results in saving of time and cost on travel and accommodation (Dhanjal, 1999).

Another advantage of CAI over traditional methods is the increased knowledge retention it affords to students. Content retention is increased by engaging multiple senses i.e. auditory, visual, and kinaesthetic during the learning process (Dhanjal, 1999). Well-designed CAI may incorporate full-colour animation, product simulation and supportive narration to create a professional, yet inviting tone CAI offers realistic, on-the-job scenarios to simulate hazardous situations which test a student's skills and responses. Its detailed, high-resolution graphics and animations enhance learning and promote a better understanding and knowledge of the content (Congram, 1995). Other advantages include consistency of message, which cannot be assumed

with a live instructor (Dhanjal, 1999), measurability, which can be accomplished using self-check questions, pre-tests and post-tests (Lawson & Comber 1999), and customization. Through customization features, curriculum developers can tailor a genetic programme to match with the government policies and procedures (Lawson & Comber 1999). CAI clearly has many advantages over traditional methods.

2.6 Impact of CAI on Learning and Students Achievement

The goal of education is to help students learn and to measure this learning, assessments are commonly used. Several studies have been done to determine if a relationship exists between CAI and learning (test scores) and long term retention. One such study involved 11 and 12-year-old students using an interactive algebra program (Thomas & Tall, 2005). One year after completing the study, both experimental and control groups were retested using the original posttest. Students who used CAI scored significantly higher than students in the control group supporting other research studies (Barrow & Markman, 2009; Burch & Kuo, 2010). Conflicting evidence has been presented in other studies that students who used CAI either had no significant difference in posttest scores or scored lower than students receiving traditional lessons (Linden, 2008; Santally, Boojawon, & Senteni, 2004) and no significant difference in long term retention was determined (Cannon, 2005).

Research conducted with 12 and 13-year-old children by Thomas and Tall (2005) involved fifty-seven matched pairs of students in mixed ability classes were split into two groups. The experimental group completed a dynamic algebra module and the control group learned by teacher directed instruction. Students in the control group scored higher on skill-based questions, while students using CAI scored better on higher level thinking questions. The impact of interactive CAI on higher level thinking has been supported in other research (Wenglinsky, 1998). In one study involving 33 college students, both control and experimental groups had

similar mean test scores, but students working with interactive CAI scored higher on tests involving transfer of concepts (Evans & Gibbons, 2007). A different experiment split 115 third-grade students into two groups to learn about fire safety (Chaung & Chen, 2009). The control group was exposed to text-based instruction on a computer, while the experimental group played a real time computer game with identical information. While no significant difference was observed on matching questions between experimental and control groups on the posttest, the experimental group scored significantly higher on multiple choice and application questions. Raised cognitive levels appeared to be a result of CAI with high interactivity in the form of a computer game (Chaung & Chen, 2009; Squire, DeVane, & Durga, 2008). Regardless of age or education level, high interaction between user and computer seems to increase differentiation and recall, promote problem solving skills, enhance comprehension and encourage higher level cognitive thinking (Chaung & Chen, 2009). evidence has been presented in other studies that students who used CAI either had no significant difference in posttest scores or scored lower than students receiving traditional lessons (Linden, 2008; Santally, Boojawon, & Senteni, 2004) and no significant difference in long term retention was determined (Cannon, 2005).

A meta-analysis on CAI was done by noted researchers, (Kulik &Kulik, 1991). For this meta-analysis, 254 studies were evaluated to insure each fit four criteria:

(1) each study had to have taken place in a real classroom,

(2) both control and experimental groups had to have been evaluated using the same quantitative measure,

(3) no methodological flaws could be apparent, and

(4) the studies had to be obtainable from select sources.

The studies involved a wide range of learners, from kindergarten to adult, and were organized into similar groups; effect sizes for each group were analyzed. Students using CAI had assessments scores increase from the 50th to the 62nd percentile or typically by about 0.30 standard deviations. Another positive aspect found was CAI users used one-third less instruction

time compared to students not exposed to CAI. Duration of use also had an effect on test scores. Students working with CAI four weeks or less had a standard deviation of 0.42, while extended use lowered the standard deviation to 0.26. A meta-analysis by Liao (2004) done 13 years later involving 52 studies of Taiwanese students found comparable results. The average mean of study-weighed effect size was 0.552 for approximately 5000 students with 81% of the studies showing positive effects of CAI use.

In addition to improved test scores and learning, CAI has impacted students in unexpected ways. Users of CAI demonstrated increased computer self-efficacy, an individual's perception of their computer skills and knowledge (Moos & Azevedo, 2009; Chapman, 2000), raised self-regulatory skills (Shen, Lee, & Tsai, 2008) and increased motivation (Macaruso, Hook, & McCabe, 2006; Hannafin & Foshay, 2006; Santally, Boojawon, & Senteni, 2004).

Mathematics and science is considered the most difficult subject to learn out of all core classes. Some think this is because math is not considered natural or intuitive, so any method to make learning mathematics and science less intimidating would result in students' learning more material (Aliasgari, et al 2010).

CAI has helped a number of learners to accomplish by promoting higher level thinking skills (Wenglinsky, 1998), making math less of a memorization task, especially with regard to formulas (Hale, 1985), developing links between abstract and non-abstract concepts (Lei, Joon, & Shaffer, 2003), and even more so for high school students than elementary (Wenglinsky, 1998). Even adding multimedia to CAI has proven to have a positive impact on learning mathematics and science and problem solving skills for high school students (Shyu, 2000; Chuang & Chen, 2009).

Some benefits of CAI show up in students' attitudes towards learning math, even when no differences can be found in academic achievement.

When a teacher in the classroom applies this creative ability to use computers, enormous possibilities do exist for maximum learning. After studying more than 30 researches, Cotton (2001) concluded that compared to students receiving only traditional, teacher-direct instruction, students who had the teacher instruction supplemented by CAI were found to learn faster and had better retention rates. They also improved their attitudes toward school and their potential as learners.

Effectiveness of CAI with regard to different subjects' like Science, Mathematics; CAI was found effective in terms of students' achievement at school level. It is worth nothing that CAI was effective not only for effective dimensions such as Attitude, Interest, and behaviour pattern. Although large majority of the studies has reported that higher attitude in different subjects at the secondary level is needed, these were mainly confined to the science subjects. Effective use of computer in education was emphasized since last 30 years but most of studies were carried out mainly in foreign countries and as demand of CAI accelerated in India, studies were carried out during 1990 in India also. (Khirwadkar, 1998) developed software for Chemistry teaching and further studied effectiveness of CAI on student's achievement. Ranade (2001) worked on Science teaching through CAI and concluded that thoughtfully designed CAI is indeed effective in bringing about learning, but when the teacher is really good, a few students prefer traditional face-to face teaching to CAI. The packages when used in the self-learning/group learning mode can be a better alternative to ineffective teaching. Barot (2009) conducted research on effective use of CAI in Sanskrit. Likewise, many studies on Science, Mathematics were carried out in India.

Some of the Benefits of effective use of CAI:

Self-paced learning opportunities: Learner can learn the content as per his capacity and can repeat the task if not understand by the learner (Barot, 2009; Yusuf, 2010 & Cotton, 2001).

Immediate feedback to the student and the instructor: Immediate feedback motivates learner and give direction and if answer of students is wrong then it will help him to correct his mistake (Barot, 2009 & Khirwadkar, 1998).

Automatic adjustment to ability levels of students: CAI programs design in such a way that it helps both brilliant students as well as slow learner. It is flexible as per user 's need (Andrews, 1998; Barot, 2009; Ranade, 2001).

Continuous interaction: Continuous interaction should be possible with CAI. (Khirwadkar, 1998; Barot, 2009).

Flexible time scheduling for the students and the instruction: Programme have flexibility in terms of time, place and pace (Barot, 2009; Yusuf, 2010; Ranade, 2001; Kara, 2007; Cotton, 2001).

2.6.1 Teacher Involvement

Teachers have an impact on the effectiveness of CAI on students' content in the classroom. Solely using technology as a tool to deliver information will "not influence student achievement any more than the truck that delivers our groceries causes change in nutrition" (Clark, 1983). "Yet, our nutrition can be damaged by a bad choice in delivery methods (Li & Ma, 2010)." To be effective teachers, educators must use research to understand the link between technology and how students learn mathematics and science. (Ozel, Yetkiner, & Capraro, 2008). Wenglinksky (1998) found a positive relationship between student achievement in mathematics and science and the amount of professional development teachers received centered on incorporating technology into the mathematics and science classroom to increase higher level thinking skills. Not only does professional development need to be available, but teachers need to be active participants to make CAI effective for their students (Cavalluzzo, Lowther, Mokher, & Fan, 2012)

Connell (1998) conducted a study over a period over one year in two rural elementary classes. The traditional teacher centred class used technology solely as a presentation tool, while the student centered classroom used technology to encourage math exploration. Both classes scored higher than other students in their school and state. However, students using technology as an exploration tool, scored significantly higher than the class using technology as a presentation tool. This idea was supported in a meta-analysis done by Li and Ma (2010) in which 85 independent effect sizes were analyzed from 46 studies. A positive correlation (0.79 standard deviations) was found between using computer technology as a learning tool to teach mathematics and science as opposed to a presentation tool. Haas (2005) conducted a meta-analysis to determine the effect of integrating technology into algebra classrooms and found a strong effect size of 1.42 for advanced algebra students and a smaller one of 0.63 for algebra students. The meta-analysis included 35 studies at the secondary level between 1980 and 2002 with a focus on students taking algebra. In the study, six different teaching methods were scrutinized. Technology as a stand-alone tool was the least effective of all methods, but the effectiveness increased when combined with direct teacher instruction

2.7 Challenges of CAI On Education

Notwithstanding the benefits of CAI in education it has a number of challenges. William Rukeyser, founder of *Learning in the Real World,* an organization that examines "the costs and benefits of education technology" (www.realworld.org), and writers Jane M. Healy and Todd Oppenheimer are critics of CAI. All three believe educators are putting too much emphasis on computers resulting in unbalanced education for children (Chapman, 2000). Critics attribute some success of CAI to the Hawthorne Effect: students do better when using computers because of increased attention. Another shared concern is that computers drain financial resources from other aspects of education, such as highly qualified teachers or availability of elective courses. A fear that students will develop short attention spans, devalue books, and have imposed

boundaries on inquiry has also been voiced (Chapman, 2000). The U.S. Department of Education sponsored the *2008 Final Report of the National Mathematics and science Advisor Panel*. In this report, writers suggested insufficient research has been done to determine if CAI has had a conclusive impact on students' learning.

Wenglinksy (1998) stated three concerns expressed by critics in the report *Does It Compute? The Relationship Between Educational Technology and Student Achievement in Mathematics and science*. First, historically teachers have been resistant to change, especially with regards to technology. Critics acknowledge that CAI could benefit students, just as any other teaching strategy, but if teachers are unwilling to use technology, then it is worthless (Cuban, 2003; Li & Ma, 2004; Brown, 2006). Secondly, the cost of installing computers in a school outweighs the effect CAI might have on a student's learning. Lastly, students do not learn by exposure to content alone, but also by the dynamic socialization between teacher – student and student – student interactions. These same ideas were mirrored fifteen years later in Andrew J. Rotherham's 2012 editorial *Can Computers Replace Teachers?* (http://ideas.time.com/2012). Rotherham summarized his views with, "American education desperately needs an overhaul that goes far beyond upgrading computers in the classroom. It's the last major American field relatively untouched by technology." Samuel G. Sava, past director of the National Association of Elementary Principals (NAESP), presented a speech in 1997 to the NAESP State Leaders Conference. He made a strong argument against CAI by pointing out that of the seven countries scoring higher than U.S.A on the Third International Math and Science Study, five seldom, if ever, used computers, and yet, even with CAI available, American children are still behind in math and science.

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International Math and Science Study, five seldom, if ever, used computers, and yet, even with CAI available, American children are still behind in math and science. Spearman-Brown formula (reliability of 0.74). A pre-test and post-test was also given to evaluate students' attitudes about math with a reliability of 0.82 determined by Cronbach's alpha coefficient. The twenty question test used a Likert scale, with five questions having possible negative response values.

On the math content pre-test, both groups demonstrated no knowledge of the material, but on the post-test, a *t*-test was performed on the difference of the mean scores and a *t* value of 3.41 (p = 0.002) showed a significant difference in favor of the test group. The control and test groups did not score significantly different on the pre-test (t = 1.356) concerning attitude towards mathematics and science, however on the post-test, a calculated *t* value of 9.472 showed the test group had a significant positive change about their feelings towards mathematics and science.

The authors of this experiment concluded that CAI could be beneficial in improving students' content knowledge and attitude towards math over teacher directed instruction. Even though the experiment was limited in scope, it did support other research studies identifying CAI as a positive influence of learning science.

These are presented as separate subsections to fully explore the implications of any identified issues or barriers that may arise. The structural and operational issues impacting the use of CAI into education were many and varied. Some common challenges as stated by Rotherham (2012) are:

- **Financial Constraints.** Studies have reported that integration of CAI in schools is slow due to lack of finance, given the high student populations, the large number of schools, and the cost of ICT equipment. Perhaps those responsible for the budget in the Ministry of Education felt that the annual financial allocation was adequate to support the integration of technical programs, but in reality ICT equipment such as computers and

their laboratories are very expensive, especially when your objective is to make them available to all schools.

- **Administration and Approval Processes**. Another factor that delayed the use of CAI was frequent changes in administration and the complexity of routine procedures. This caused wasted time and resources throughout the education system, and impacted on rising costs of ICT. There is a complex and centralised approval process for new training courses. It is noted that the procedure involved distribution of printed forms to regional educational supervisors to identify training needs, and on this basis the Ministry determines and produces all teacher training curricula for all subjects, including the ICT training programs. These courses are then made available, without any modification, to be delivered throughout the country at teacher training centres. This procedural aspect controls the nature and objectives of the courses, the curriculum and course materials and the courses are delivered without further regard to location, population, or any further dimension or variable. There is little opportunity for teachers to contribute to Ministerial policy or procedures.
- **Technical Support:** Lack of substantial technical support and software were required to achieve a successful outcome in CAI. There were insufficient technicians and specialists available in computer laboratories to cover even basic requirements: "we are forced to postpone some of our projects until the required human resources become available".
- **ICT Systems:** Participants nominated inadequate school computer hardware and software as a primary obstacle in implementing ICT programs. It is regarded that this situation is ongoing, due to the large increase schools' establishment.
- **Teachers' Issues:** Teachers' attitudes to ICT were a systemic factor in integrating CAI in education. Whilst there were several substantive constraints to technological integration reported, such as organisational change, inappropriate school buildings and inadequate resources, the effect of unsuccessful project implementation and lack of a

clear directive from the Ministry of Education resulted in scepticism by teachers for the outcome of any particular project. Teachers apparently tended to return to traditional teaching styles to fulfil the curriculum requirements and not waste time on ICT. In addition, some teachers are resistance to changing their reliance on book learning to CAI teaching styles for some teachers who could not countenance any change in delivering the curriculum. This probably arises from a lack of knowledge of the importance of teachers' professional development or from a fear of adopting modern teaching methods, such as cooperative learning.

- **Resistance to Change.** The attitude of some teachers against the use of ICT was reported to be a contributing factor to the Ministry's mixed results in integrating ICT into the curricula, some study that further work was necessary to address barriers that skeptical teachers raised against computerization, that some officials and teachers remain unconvinced of the benefits of ICT in the classroom, and educational officials and teachers in some case were not aware of the Ministry's intentions to use ICT.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter describes the research design, sample and sampling technique as well as research instruments. The chapter continued with validity and reliability of the instruments, survey instrument, data collection procedure, data analysis and intervention activities etc.

3.1 Description of Study Area/ Institution

The study was conducted in Sacred Heart Senior High School. The school which was established by the catholic church located on the outskirts of Nsoatre Township. Nsoatre is a town in the Sunyani West District in the Brong Ahafo Region of Ghana. The Sunyani West District has 5 Senior High Schools.

The school is rated a 'C' school according to the Ghana Education Service classification. It offers the following programs: General Science, Business, Home Economics, Agriculture, and General Arts. There are nine classes at each level and each of the classes offer integrated Science. It has an average student population of 724.

3.2 Research Design

The study was aimed to collect information regarding the use of computer assisted instruction in the teaching of some selected biology topics in integrated science. According to Miller (2007), action research is a natural part of teaching in which teachers are continually observing students, collecting data and changing practices to improve student learning, the classroom and school environment. Action research provides a framework that guides the energy of teachers toward a better understanding of why and how students become better learners (Miller, 2007).

Action research was chosen because it is believed to improve teacher's classroom practice and enhance students' learning, and also promote personal and professional growth of the teacher (Johnson, 1995).

3.3 Population

A population is known as a well-defined collection of individuals or objects known to have similar characteristics (Castillo, 2009). Castillo differentiates between two types of population: the target population and the accessible population. The target population which is also known as the theoretical population refers to the group of individuals to which researchers are interested in generalizing the conclusions whilst the accessible population is also known as the study population.

The target population for this study was all first year students in the General Arts department of Sacred Heart Senior High school in the Sunyani West District of the Brong Ahafo Region of Ghana. The study was directed at randomly selected General Arts Students in the School. There are two first year general arts classes with a class size of forty-six. Thirty students were selected from each class making up a respondent population of sixty. The first year classes of the general department were purposively and conveniently chosen for the research.

3.4 Sample and Sampling Technique

A sample is a finite part of a statistical population whose attributes are studied to gain information about the larger population (Webster, 1985). According to Castillo (2009) sampling techniques are the strategies applied by researchers during the sampling process.

A simple random sampling method was used to select a sample of 60 students from two selected first year General Arts classes. This procedure offers every member of the population an equal

independent chance of being selected for the sample. In addition, simple random sampling is the most popular and rigorous form of probability sampling.

The intent of simple random sampling was to choose individuals that were to be representative of the population. Out of 86 students from both general Arts classes, sixty students were selected to take pre- and post-intervention tests.

3.4 Instrument

Data were collected using two basic instruments namely: Information and Communication Technology programmes on Teaching and Learning of digestion in science with a test conducted to test its effect on students' understanding of the processes of digestion. The first instrument was a structured questionnaire that had a section which was used to collect information on respondents' biodata (gender, age, class). Length of service and academic qualification were included in the teachers' questionnaire. A ten itemized test questions were developed and used in the pre-test and post-test interventions. In Addition, focus group discussions were organized for the respondents to outline their problems with understanding using the CAI method of teaching.

The pre-test and post-test were designed and self-administered to explore the effect of computer assisted instruction on the performance in some selected topics in integrated science on biology.

3.5 Reliability of Instruments

Reliability refers to the consistency and dependability of test results. It is often defined as the degree to which a test is free from errors of measurement (Ebel & Frisbie, 1991). According to Jack and Norman (2003), reliability refers to consistent scores or answers provided by an instrument. In reliability, one seeks to find out how consistent scores obtained are for each individual from one administration of an instrument to another and from items to another. The

reliability of the test items was improved by stating the items in a clear and simple language with no ambiguities.

These techniques did not solve all reliability problems; hence another technique that was adapted to cross-check the reliability of the measure was the test-retest method. In this approach the test items were administered to group of students outside the research area. The same items were re-administered to the same group of students after a period of two weeks. The test-retest results were then compared and the relationship between the scores was noted.

3.6 Validity of Instruments

According to Golafshani (2003), validity describes whether the means of measurement are accurate and whether they are actually measuring what they are intended to measure. Validity primarily aims at determining whether the instruments measure what they intend to measure.

In order to ensure the validity of data collected for this study, two science teachers from a different school were contacted to scrutinize the test items for ambiguity and suggestions were offered for improvement.

3.6 Pre-test intervention

This phase consisted of lesson delivery which was done to ascertain the level of students' performance in some selected topics in science. The first activity was the revision of some of the concepts learnt in the previous term. The lesson was to take place in the first week of the study with most of the learning activities being oral interactions between the researcher and the students. A traditional instruction method was used. The researcher used traditional teaching methods to teach related topics and basic concepts. Basic explanations and discussions method suited the traditional teaching approach where students are completely passive.

The sample class was structured as a unit; notes were written on the chalkboard on the definition of concepts. The fundamental principle is that there is transfer of knowledge from the teacher to the students. Worksheets were developed specifically for each lesson. Written responses were required from the students which were collected and corrected. A teacher made test was conducted with ten itemized questions to be solved in the next lesson.

3.7 Intervention Using ICT assisted Programme

The Digestion and classification of living things topic which were basis for the activities of the study, were taught to the students by using computer assisted instructions or programme. The programme used was Bio-Virtual Lab, which gave students the opportunity to observe animations, watch videos, read textual materials and interact with the teacher through questioning and discussions.

The Bio Virtual Lab is one of the software packages in DNT. Edu. Soft Suit. It is an educational software suit designed by Young Ghanaian Entrepreneurs for the teaching of test of practical topics in Science for both basic schools and senior high schools. The software is still in its evaluation and testing stage in some few selected secondary schools in the Brong Ahafo region.

Students' lack of understanding of concepts in the topic was treated during the interactive lessons with the aid of the programme. The researcher conducted another set of ten itemized quiz test was administered to the students to answer.

Results from this activity served as a basis for evaluating the performance of students and the intervention strategies implemented.

3.8 Data Collection Procedure

The students' pre-test was conducted and the results recorded. A post test was then conducted after computer assisted instruction was used in teaching the class. At the end of teaching using

computer assisted instruction, post-test had been given to students and from that data was collected to test the research questions.

3.9 Data Analysis

The study employed quantitative methods of data analysis. The pre-test and post-test scores of students were analysed statistically using statistical packages for social science (SPSS) and MS Excel and these include: Simple percentages, Chi – Square with < 0.05 level of significance, to ascertain if any significant differences existed the pre-test and post-test.

The results were presented in frequency tables, figures and bar graphs.

3. 10 Ethical Consideration

Since academic performance of students a key issue and critical to school stakeholders, the researcher sought a formal permission from all the headmasters and headmistresses in the participating schools before the questionnaire was administered. A letter of introduction was obtained from the Faculty of education from the University to headmaster/mistress and the head of the General Arts department. The purpose of the study was explained to the head of institutions and respondents. They were allowed to ask any question for clarification. The consent of the respondents was also sought and they were assured of confidentiality of their responses.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

This section deals with the analysis and interpretation of the data collected from the study. The presentation is organized along the thematic areas of the study objectives. The data was analysed and discussed in this chapter of the study.

4.1.1 Bio Data of the Respondents

The analysed data of the demographic information of respondents are indicated in figures and frequency tables.

The age distribution of respondents (student) is shown as Figure 4.1

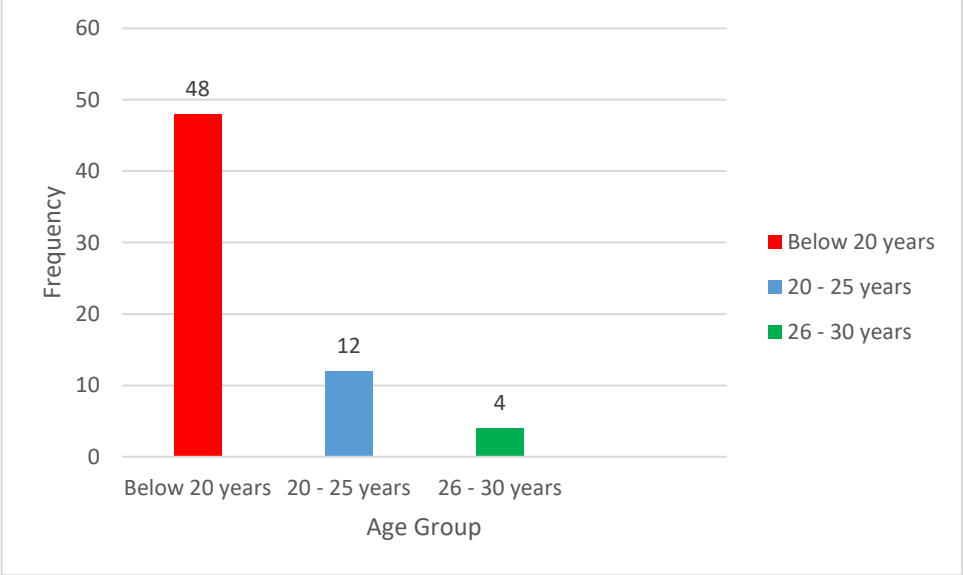

Figure 4.1: Age distribution of respondents

The survey revealed that 48 of respondents interviewed are within the age below 20 years and the ages between 20-25 years represent 12 of the sample. However, four of the

sample of the respondents between the age group 26-30 years. This shows that, it is the youth who mainly form the schooling population.

In addition, according to the study, the gender distribution of respondents interviewed made up of 67% females and 33% males. This is a general reflection of the proportion of genders in senior high school general Arts programme where the females outnumber the males.

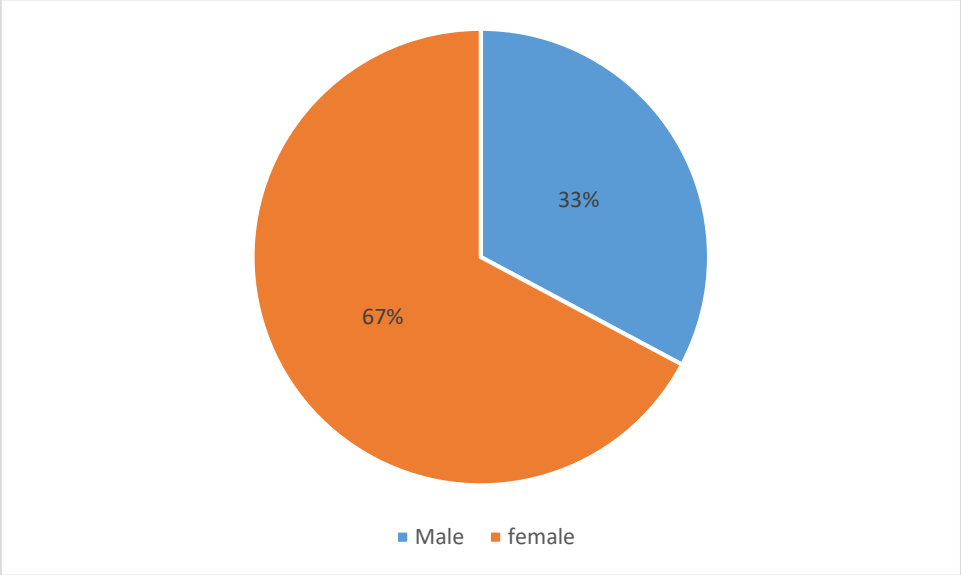

Figure 4.2: Gender Distribution of Respondents.

4.2 Performance of Students Exposed to Computer Assisted Instruction Compared to Traditional Learning Methods

The test performance of the students with computer assisted instructions compared to the traditional method of instructions is presented in Table 4.1

Table 4. 1: The results of t-test analysis of control and experiment groups mean scores integrated science achievement test

Test	Sample size	Mean	SD	t-value	p-value
Pre-Test	60	2.100	1.729		
Post Test	60	1. 566	1.381	1.320	0.192

From Table 4.1, there is no clear difference between the control and experimental groups' Integrated Science Achievement Test pre-test score (t=1.320; p>0,05). In the experiment group students' Integrated Science Achievement Test pre-test average is X = 2.100; in the control group students' average is X = 1.566. There was no difference between the groups before the test. According to the result, it can be said that before the application of CAI the pre-test and post-test of the students are similar to each other about the topic.

Post-test mean-score of the students, who were taught "digestion in human" with Computer-assisted programme and traditional educational methods was carried out to investigated if their post-test integrated science achievement test points were different.

Table 4.2 student's competencies on achievement scores bases on:

Lesson	Comprehension of Question (CQ)		Explanations on questions (E)		Transfer of knowledge (TK)		Mean	
	Pre- test	Post test	Pre- test	Post test	Pre- test	Post test	Pre- test	Post test
1	11	15	6	12	5	9	7.3	12.0
2	8	18	10	19	3	12	7.0	16.3
3	10	18	7	18	6	16	7.7	17.3
Total	**29**	**51**	**23**	**49**	**14**	**37**	**22.0**	**45.6**

With regard to qualitative achievements there was a steady increase in the number of students who gained as the lessons went on, though the percentage mean (post-test) for the first lesson was quite low 7.3. This was a reflection of students' lack of readiness and unserious attitudes towards the lesson during the initial stages. They had also not progressed into higher-order thinking as was expected of them and remained only at the lower levels of thinking such as recalling facts and definitions. They avoided challenging questions that called for application of concepts they had learnt during the lessons, thus resulting in only few of them achieving the competencies. However, from the second lesson onwards, the students were able to grasp concepts through the interactive nature of the intervention, leading to an improvement in the number of students gaining the comprehensive competencies. Even though most of the students understood the questions and provided good explanations to them, majority of them could not aptly apply the knowledge gained through the intervention to solve the test questions, especially for the

first lessons. Thus the average number of students achieving transfer of knowledge (TK) for all the lessons was relatively low compared to the other two competencies. However, there was a general improvement in all the post-test results compared to the pre-test results, and this could be attributed to the use of the computer aided programme for the experiment.

4.2.1 Test of Hypothesis

H_0: There will be no significant difference in the academic performance of student using computer assisted programmes

Table 4.3. The results of control and experiment groups' post-test points of integrated science achievement test

Group	Sample size	Mean X	SD	t-value	p-value
Post Test	60	20.766	4.553		
Pre-Test	60	14.466	4.994	5.105	0.000 P<0,05

Table 4.3, between the control and experiment groups' students' integrated science achievement test post-test points are statistically different (t=5.105; p<0,05). In the experiment group students' 'achievements (X = 20,766) were higher than the control group's students (X = 14.466). This difference is in relation to the experiment group. This fact shows that the Computer-assisted programme method and traditional education methods have a clear different effect on the students' integrated science achievements. This result shows that experiment group's students with computer-assisted programme methods increase their achievement level and show a higher performance more than the control group of students.

The students' attitudes towards integrated science were investigated before and after the application about "Relation, function and operation" learning in control groups which had the traditional education methods and the experiment group which had computer-assisted programme.

The t-test of the hypothesis H_0 shows that the achievement between the control and experiment groups' students' integrated science achievement test post-test points are statistically different ($t=5.105$; $p<0,05$) as shown in table 4.3 above. Hence, H_o is nulled and rejected whiles *H_1: There will be significant difference in the academic performance of student using computer assisted programmes in teaching is accepted.*

A significant difference was found at the end of the application on behalf of the experiment group between the integrated science achievements of the control group who had traditional programme methods and the experiment group who had computer-assisted programme. But, a significant difference was not found between their attitudes on integrated science.

This situation shows that, computer-assisted programme method is more effective on the students' performance in integrated science achievements than the traditional programme methods.

In support of the findings, a number of researches that compared achievements of groups who are on traditional programme and the computer-assisted programme method on different fields (Table 4.1, 4.2 and 4.3). In most of the researches there were found significant differences about achievements on behalf of the computer-assisted programme experiment group (Akinsola & Animasahun,2007) as cited by Özmen, (2008).

On the other hand, in some researches, there weren't found any differences about achievements between the computer-assisted programme experiment group or the traditional programme group (Maher,2008).

However, majority of studies revealed that experimental group on the use of computer-assisted programme materials show positives attitudes towards the lesson, Kaçar, 2008; Kutcha, (2009); and in another group the computer-assisted programme materials do not show any or provide, Buran, (2005); Klein, (2005); Sarıçayır, (2007); Çepni and et. al (2006) positive effects on the attitudes.

From the effect on the students' attitude in integrated science, it was revealed that materials which are well-designed and appealing to their sense organs will increase their interests and so the lessons can be taught more effectively.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Overview

This section of the study provides the review of the findings and summarizes the result of the study and also suggests some possible ways to curb or improve upon the existing information of the findings.

5.1 Summary

The main purpose of this study was to assess how the use of computer assisted programme would improve the performance of senior high school form one students in integrated science. The study was conducted at Sacred Heart Senior High School, Nsoatre with sample size of 60 first year students.

The major finding in this study revealed the CAI has a positive effect of CAI on achievement of the first year students in science. In the application, the students received approximately lessons with CAI: 45 minutes per day, for 3 days in three weeks. The effect of this instruction was to raise student achievement scores relative to traditional method of instruction by 0.47 standard deviations.

Thus, at the end of the study it was detected that of the two tests (pre and post Tests) whose successes were the same at the beginning, experiment group students on whom CAI method was applied came out more successful than control group on whom traditional method was applied.

This effect is similar to that reported in earlier reviews about a positive correlation between student's achievements with CAI. The result can be summarized that the use of CAI in teaching integrated science has the potency to increase the academic achievement of students.

5.2 Conclusion

The main aim of this study was to investigate the effects of the computer-assisted instructions on the achievements and problem solving skills in integrated science by first year students in SAHESS. The result of the post test score revealed that students with computer-assisted instructions methods increased their problem solving level, achievement and show a higher performance than the pre-test students' scores. A significant difference was found at the end of the application on behalf of the Post-test results between the educational statistics achievements of the Pre-test students who had traditional instruction methods and the experiment group who had computer-assisted instruction. This study showed that, computer-assisted learning method was more effective on the students' academic achievements than the traditional instruction methods.

5.3 Recommendation

From the findings of this study, the following recommendations are offered.

- The management board of the school should empower the implementation of the New Educational Reform with innovation in teaching.
- The procurement officers and internal and external auditors of the school should also help by providing the needed school materials regularly to motivate school children to be in school.
- Expansion in using computer assisted learning to other theoretical curriculums and stressing the use of computer as an educational tool in teaching and learning.

- The management board of the school should seek for assistance from Non-governmental organizations (N.G.Os.) to the aid the school with innovative teaching skills.
- Science teachers should be encouraged to employ the use of computer assisted programme method of teaching in the delivery of their lesson so that student can perform better.
- The ministry of education through GES should organize workshops, in-service training frequently for science teachers on the practical use of computer assisted programme in their teaching.
- Science teachers are encouraged to get personal training on the use of computer assisted programme and other e-learning methods that could enhance their teaching.

5.4 Areas for further studies

1. The attitude of SHS science teachers on the use of computer assisted programme in the delivery of their lessons.
2. ICT knowledge base of science teachers and students in improving their teaching learning of science.
3. A study should be carried out to find out the number of science teachers who are familiar with of computer assisted programme, uses of computer assisted programme and the number of times they use it in the delivery of their lessons.

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APPENDICES

APPENDIX A

The Integrated Science Achievement Test

This assessment consists of 10 pairs of questions which examine your knowledge on digestive system of humans. Each question is followed by four options lettered A to D. Find the correct option for each question.

Test Questions

1. Where does digestion begin?

A. In the stomach

B. In your mouth

C. In your large intestines

D. In your small intestines

2. What are enzymes?

A. Enzymes are tiny food particles that cannot be digested.

B. Enzymes are fruits and vegetables.

C. Enzymes are chemicals that help break down food.

D. Enzymes are breads and candy.

3. What does saliva play in digestion?

A. Enzymes in saliva help to break down food.

B. It coats your stomach with protective lining.

C. It moves food through the intestine.

D. Saliva does not help with digestion.

4. Where does most digestion in the small intestine take place?

A. Most digestion in the small intestine takes place in the duodenum.

B. Most digestion in the small intestine takes place in the pancreas.

C. Most digestion in the small intestine takes place in the liver.

D. Most digestion in the small intestine takes place in the colon.

5. What is the main role of the large intestine?

A. The main role of the large intestine is to churn food around with enzymes.

B. The main role of the large intestine is to break down solid food.

C. The main role of the large intestine is to absorb water.

D. The main role of the large intestine is to mash and cut foods.

6. The liver's role is to _____

A. Mash up food.

B. Turn water into food.

C. Help the stomach.

D. Remove the harmful substances from the blood.

7. Bile is made in the _____.

A. Large intestine.

B. Stomach.

C. Liver.

D. All of the above.

8. How does bile aid in digestion?

A. It neutralizes the acid from the stomach.

B. It breaks down fats to smaller particles in chemical digestion to prepare for absorption.

C. It breaks down proteins in chemical digestion to prepare for absorption.

D. It breaks down carbohydrates into smaller molecular chains in chemical digestion to prepare for absorption.

9. Which organs help with the absorption of nutrients?

A. The pancreas, liver, and gall bladder.

B. The liver, heart, and spleen.

C. The gall bladder, kidneys, and appendix

D. The kidneys, liver, and gall bladder.

10. Where does the chemical digestion of protein occurs.

A. Mouth

B. Stomach

C. Small Intestine

D. Large Intestine

APPENDIX B

MARKING SCHEME FOR PRE AND POST-TEST

1. B

2. C

3. A

4.A

5. C

6. D

7. C

8. B

9. A

10. B

APPENDIX C

SAMPLE OF STUDENTS'S RESPONSES TO PRE-TEST ITEMS

Sample 1