

UNIVERSITY OF EDUCATION, WINNEBA

**THE IMPACT OF THE CONSTRUCTIVIST- BASED INSTRUCTIONAL MODEL ON
STUDENTS' LEARNING OUTCOME IN ICT
(UWR-LAWRA MUNICIPALITY)**



MASTER OF SCIENCE

2020



UNIVERSITY OF EDUCATION, WINNEBA

THE IMPACT OF THE CONSTRUCTIVIST- BASED INSTRUCTIONAL MODEL ON STUDENTS' LEARNING OUTCOME IN ICT (UWR-LAWRA MUNICIPALITY)

YUONAKUU SOLOMON NAABASERU



A dissertation in the Department of Information Technology
Education, Faculty of Technical Education, submitted to the School of
Graduate Studies in partial fulfilment
of the requirements for the award of the degree of
Master of Science
(Information Technology Education)
in the University of Education, Winneba

MAY 2020

DECLARATION

STUDENT'S DECLARATION

I, **YUONAKUU SOLOMON NAABASERU**, declare that this dissertation, with the exception of quotations and reference 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 guidance for supervision of dissertation as laid down by the University of Education, Winneba.

Supervisor's Name: **SAMUEL ADU GYAMFI (PhD)**

SIGNATURE.....

DATE:

DEDICATION

This work is dedicated to the unforgotten God for the many wisdom and blessings bestowed on me to undertake this study. I also dedicate this research project to my family and children Athanacius N and Athanasia Z for their love, support and understanding and my sponsors and love ones for their financial, physical and emotional support during my course of study. I say God bless you.



ACKNOWLEDGEMENT

I acknowledge the power of God, the maker, and the provider of knowledge for enabling me to complete my one-year course in the right spirit.

I would like to thank my supervisor SAMUEL ADU GYAMFI (**PhD**) for his guidance and supportive supervision throughout this period of study, I say God richly bless you. I wish to thank my other lecturers for the skills that have enabled me to come up with this research project

My sincerest thanks also go to all the staffs and students of Eremon and Birifoh SHS for the opportunity to collect the needed data for this study.

I want to sincerely express my gratitude to my sponsors, parents, siblings, and love and friends for the continued emotional, time and financial support towards the completion of this research project. Their encouragement has helped me to forge ahead even in difficult times.

To all, I say a big thank you.

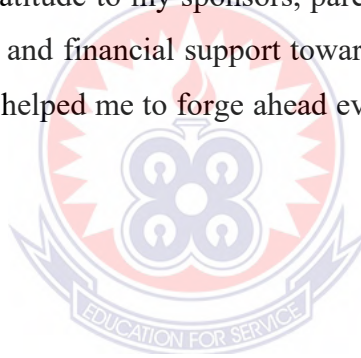


TABLE OF CONTENTS

DECLARATION.....	iii
DEDICATION.....	iv
ACKNOWLEDGEMENT.....	v
TABLE OF CONTENTS	vi
LIST OF TABLES	ix
LIST OF FIGURES	x
ABBREVIATIONS	xi
ABSTRACT.....	xii
CHAPTER ONE	1
1.0 INTRODUCTION.....	1
1.1 Introduction	1
1.2 Background of the Study	1
1.3 Statement of the Problem	6
1.4 Purpose of the Study.....	8
1.5 Objective of the Study	8
1.6 Research Question	9
1.7 Hypothesis	9
1.8 Significance of the Study.....	9
1.9 Delimitations of the Study.....	10
1.10 Limitations of the Study	10
1.11 Organization of the Study.....	11
CHAPTER TWO	12
2.0 REVIEW OF RELATED LITERATURE	12
2.1 Introduction	12
2.2 Theoretical Framework of the Study.....	12
2.3 Conceptual Framework.....	13
2.4 Constructivism and Conceptual Change.....	21

2.5 Teaching Approaches	24
2.6 Simple Ideas to Improve Students Learning.....	25
CHAPTER THREE	28
3.0 METHODOLOGY	28
3.1 Introduction	28
3.2 Philophysical Underpinning Of The Study	28
3.2.1 Epistemology	28
3.2.2 Ontology	29
3.2.3 Axiology	29
3.3 Research Design	30
3.4 Advantages of Experimental Design	32
3.5 Population of The Study	32
3.5.1 Material Used.....	33
3.5.2 Procedure	34
3.5.3 Instructional Procedures	36
3.6 Sampling Technique and Sample Size Determination	42
3.7 Data Collection Instrument.....	43
3.8 Questionnaire.....	43
3.9 Procedure Adopted for Administering the Questionnaires.....	44
3.10 Reliability of Data Instruments.....	45
3.11 Validity of Data Instruments	46
3.12 Method of Data Analysis.....	46
3.13 Ethical Consideration	48
3.14 Summary.....	48
CHAPTURE FOUR.....	49
4.0 RESULTS OF DATA ANALYSIS AND DISCUSSION OF THE STUDY	49
4.1 Introduction	49
4.2 Response Rate.....	49
4.3 Background Information of Respondents.....	50
4.4 Analysis of Socio- Demography of Respondents.....	50

4.5	Result of the Analysis.....	52
4.6	Discussion.....	58
CHAPTURE FIVE.....		61
5.0	SUMMARY OF FINDING, CONCLUSION AND RECOMMENDATION.....	61
5.1	Introduction	61
5.2	Summary of Major Findings of the Study.....	61
5.3	Conclusion.....	63
5.4	Recommendation.....	64
5.5	Suggestion for Improving Teaching and Learning of ICT	65
5.6	Suggestion for Further Studies	65
REFERENCES.....		67
APPENDIX A.....		75
APPENDIX B.....		79
APPENDIX C.....		84



LIST OF TABLES

Table 1. Comparison of the traditional lecture classroom with the Constructivist classroom	17
Table 2. Crosstab of Age Range.....	51
Table 3. Means and Standard Deviations of the students Achievement scores in pre-test.....	53
Table 4. Means and Standard Deviations of the students Achievement scores in post-test	54
Table 5. Means and Standard Deviations of the student's scores of self-concept Post-test	54
Table 6. Pos Hoc Comparison using the Tukey Test.....	55
Table 7. Paired Samples Test.....	56
Table 8. Analysis of Covariance (ANCOVA) on students overall Achievement.....	56
Table 9. Analysis of Covariance (ANCOVA) on student self-concept.....	57



LIST OF FIGURES

Figure 1. Response Gender Distribution.....	51
Figure 2. Response rate of questionnaires	52



ABBREVIATIONS

GLM	Generative Learning Model
ICT	Information and Communication Technology
EPM	Method-Expository Method
SHS	Senior High School
SH/T	Senior High Technical
TMAT'ICT'	Teacher Made Achievement Test in ICT
CLE	Constructivist Learning Environment
TLE	Traditionalist Learning Environment
TLM	Teaching Learning Materials
IPC	Information processing cycle
CPU	Central Processing Unit
SPSS	Statistical Package for Social Science
ANCOVA	Analysis of Covariance
S.D	Standard Deviation
CBIM	Constructivist Based Instructional Method
NaCCA	National Council for Curriculum & Assessment
GES	Ghana Education Service

ABSTRACT

The purpose of this study was to compare constructivist and traditional teaching approaches in enhancing students' use of appropriate ICT learning strategies.

A Teacher Made Achievement Test in ICT (TMAT'ICT') was used. Three sets of these tests were developed I, II and III. Pre-test was administered to both groups to determine their entry level. At the end of the treatment Post-test was administered to both groups to determine their achievement after treatment. The third test was administered after an interval of four weeks to measure students' knowledge retention. The data were analysed using percentage, mean Standard Deviation and frequency counts. ANCOVA statistical technique was also used to analyse the data collected using pre-test as a co-variant.

This study identified 5Es constructivist teaching model to be most appropriate. From the findings, it was very clear that experimental group performed better than the control group. This is an indication that the constructivist-based method is very effective in enhancing meaningful learning among students. Recommendations were made based on the findings.

Key Words: Constructivism, Constructivist Learning Environment, 5Es Constructivist Model and self-reliance

CHAPTER ONE

1.0 INTRODUCTION

1.1 Introduction

This chapter dealt with the background and theoretical framework of the study, the statement of the problem, the purpose of the study, the study objective, research questions, the hypothesis, and the significance of the study and the organization of the rest of the study.

1.2 Background of the Study

Constructivism theory is not a fresh notion in the building of understanding or knowledge construction; it has a lengthy root in philosophy history and has been applied to sociology and anthropology as well as cognitive psychology and education. Constructivism applied to teaching theory as well as epistemology, how individuals learn and the nature of understanding (knowledge) – the most present and fashionable work in today's educational system. The first constructivist philosopher, Giambattista Vico, noted in 1710 treaties as a teaching philosophy that. “You only know something if you can clarify it or construct it” or One can build or construct it by oneself and has played a huge part. Many others worked with these ideas, but the first important researchers to create a definite notion of constructivism that applied to the development of schools classroom and children (Piagets, 1937; Richardson, 1997). Immanuel Kant further explained this concept by claiming that human humans do not passively absorb data or information, but rather meaningful learning includes the active development and alteration of knowledge. In constructivist approach, Learning is not instantaneous, it is an active step-by-step method in which the learner takes the sensory input of knowledge and builds meaning from it or acquires understanding, connects it to earlier assimilated understanding and makes it their own

by building their own understanding. (Cheek, 1992). The learner must revisit the concept, reflect on it and use it as often as possible. Sceptic, who said that if someone described exactly how the world was, they wouldn't have known it was a true description. (Von Glasersfeld, 1990). This significant argument of the sceptics for the last 2500 years assumes that all concepts and knowledge are empiricism, our senses, our actions and our thinking. These concepts continued to emerge in discussions between objectivists who think that things can only be known objectively and that knowledge is beyond the mind and relativists who think that all knowledge is subjective. These concepts were created clear by Vico, who resided from 1688 to 1744 and commented on the building of knowledge. (Von Glasersfeld, 1990) He said "The human mind can only understand what the human mind has done or made of". Sceptics, Vico and other thinkers are sources of constructivism; Piaget is the 'excellent pioneer' (Von Glasersfeld, 1990). In summarising, (Piagets, 1937) contributions argue for two main principles:

- i. Knowledge is actively constructed up by the cognizing subject, but is not passively obtained either through feeling or through communication
- ii. Cognition serves the subject of experiential work organization and not the discovery of objective reality

Besides Piaget (1976), another pioneer in constructivism who usually calls his ideas "constructivism," "social or cultural constructivism" is Vygotsky. Vygotsky believe in the primacy of culture in shaping development. His opinion of training was that communication with adults or more developed colleagues was essential for growth, requiring the active participation of all respondents. He presumed that interaction affected growth, that the teacher can deliberately nurture and educate kids only in cooperation with them, that this method needs the teacher to move forward to what he called a ' zone of proximal growth'. Education research provides

compelling evidence that learners only learn well when they build or construct their own way of comprehension, and constructivist theories are about ' knowledge and how we come to understand '. On the one side, constructivist instruction (learners – centred) provides preeminent importance to the growth of the private learning ideas of the student while on the other side, traditional instruction (teacher – centred) values only defined teaching methods and concepts. In constructivist training, learners are motivated to use their own techniques to solve problems. Students are not requested to embrace someone thinking but to refine their own thinking through interaction with subject tasks and other students, the learners ' own intuitive thinking gradually becomes more abstract and stronger. In the constructivist view of learning in school or college, it can point to a multitude of different teaching techniques. Usually, it encourages learners to use efficient techniques (testing, solving real-world issues), create understanding and then reflect on and talks about what they are doing and how their perception is changing. The teacher ensures that he or she knows the pre-existing conceptions of the learners and directs the exercise to tackle them and then construct on them (Vygotsky L., 1978).

Furthermore, constructivism believes that for learning to occur collaborative, social interactions and context are necessary because learners cannot discover discrete facts or concepts in an abstract ethereal territory distinct from the actual world scenario. They proposed that social interaction by asking and explaining, stimulating and providing timely assistance and feedback would facilitate comprehension. To learn or teach well, educators or teacher are anticipated to create the school atmosphere more engaging and provide environments that comprehend the mental models' learners use to interpret the environment and the statements they create to promote these models. If it could be feasible for a teacher in our Senior High School to develop such a school or classroom teaching atmosphere, it would have helped learning.

The main reason for this study is that most ICT concepts are generally overwhelmed and abstract in nature and without the necessary learning materials for teachers and students, making it relatively difficult for students to understand, coupled with the fact that the formal expository method of instruction (traditional teaching) often left many of the misconceptions held by some students unchanged which result in the poor performance of students recorded each year in the external examination. If this teacher's pedagogy – centred teaching is shifted to students – centred learning will help students retain their knowledge during examination and can practice confidently that students would become self-confident, self-reliant after graduation and would become a worker when the scientific skills are implemented in society.

Therefore, in order to move to a constructivist teaching approach, it requires creating a context that will help learners (students) build knowledge and/or modify it through negotiation with their peers. In view of this, constructivists have suggested that in order for effective teaching to take place effectively, they are the need to create an effective learning environment in which learners (students) can actively participate and engage with the materials provided

Constructivists also suggested that the constructivist teacher should create a constructivist learning environment (CLE) for a learner (students) to actively engage in and be able to build meaningful (knowledge) learning.

Constructivist learning environment (CLE) refers to the classroom "learning environment that includes the physical, social, psychological and pedagogical context designed on the basis of constructivism principles" (Zuolkernan, 2006) or The constructivist theory that recognizes that knowledge is a social construct and that the teacher is not a transmitter of knowledge, but rather a facilitator and a provider of experiences from which both learners and learners are not

absorbers of knowledge, but active participants in building or construction their own meaning on the basis of strongly held preconceptions. (Taylor, Fraser, & Fisher, 1997).

The underpinnings of the constructivist teaching or instruction setting and how they vary from the traditional classroom-based teaching model is that the present classroom training or teaching, whether basic, secondary or tertiary training level, appears to resemble a ' one-person-show ' with a safe but often comatose crowd.

The classroom is usually driven by "teacher – talk," and the structure of the course depends heavily on the textbooks. This means that there is a little room for students – initiated, questioned, independent thinking or interaction between students. The teacher serves only as a pipeline and seeks to pass his ideas and significance to the passive students. Students must revive the recognized teacher explanation or methodology (Caprico, 1994).

Another role of the teacher is to organize information about conceptual clusters of issues (problems), questions and circumstances in order to engage the student's curiosity. Teachers are only meant to help their learners develop fresh perspectives and connect them with their prior learning. In constructivist teaching pedagogy, the activities are learners – focused and learners are motivated to answer their own questions, carry out their own studies, create their own analogies and come to their own findings.

It has therefore become essential to experimentally ascertain the efficacy of a constructivist-based teaching method that results in improved student results and information preservation.

If teachers in our senior high schools practice the constructivist learning theory, this will invite, encourage and provoke students to experience the world, empower them to ask their own questions and seek their own answers, challenge them to understand the complexities of the world, and inquire into uncertainty (Brook & Brook, 1993) If that is the situation, the practice in

the school or classroom should be compatible with the values of constructivism. In other words, teachers will create a constructivist learning environment in their classrooms. However, presumption in this or that manner will not be useful unless inquiry is carried out into what is genuinely occurring in the classroom.

1.3 Statement of the Problem

Public critics, educationalists, institutional and other organizations argued that many students at all levels of our education system, basic, secondary and tertiary; do not possess the knowledge or skills necessary to ensure their personal success or national economic competitiveness in society (WEAC, 1996). The most critical concern of these critics was the evident inability of many learners to engage in complex problem – solving tasks or applying understanding and skills to actual life issues or situations outside the classroom and after school (Agogo & Naakaa, 2014). They argue that if many learners (students) fail to satisfy such expectations in school or after school, it should not be surprising at all, as traditional school outcome measures and standardized performance tests do not require the implementation of expertise in a fresh dimension or setting (Abida & Muhammad, 2012).

Educators, educationist and others must know that learning is a system in which every element is essential, change in one element affects the other element, and change in student results in and after school must be backed by parallel curriculum modifications and our teaching pedagogy. However, it is evident that many of today's educators (teachers) are caught in the middle of a shift for which they may not have been adequately ready (e.g. GES lately introduced the 2019 New ICT curriculum and other subjects' curriculum). Many teachers were trained in schools where the role of the students were to memorize information, conducting well-regulated

experiments, performing some calculations using a specific algorithm or process, and then being evaluated for their capacity to repeat these tasks or remember these particular task or facts and if goal not successful, they ended up blaming the students (Abida & Muhammad, 2012). The most difficulty challenge facing school experts is that the reform approaches in curriculum, training and evaluation structured around the concept of "constructivism" are informed by distinct assumptions and views about the nature of understanding and the human ability to learn as practiced in the traditional classroom. In this research, I define competence as the capacity of the student to apply their understanding and abilities to unfamiliar issues (problems).

The suggested solution to this problem is to prepare students to become excellent adaptive learners. That is, learners should be prepared to apply what they learn in school to the different and unpredictable circumstances or issues they may experience or encounter during their lifetime job (Ekon, Ekwueme, & Meremikwu, 2014). Obviously, the traditional teacher – as data or information given – has failed to deliver the necessary outcome of thinking students. A much-heralded option of this is to alter the focus of the classroom from teacher-dominated or teacher-centred instructions to students-centred with a constructivist instructional strategy. This sort of school setting could help ICT teachers and other subject teachers meet their students' future requirements, as many educationists and the public have criticized it. In reality, there has been no research exploring whether the constructivist basic teaching strategy is more efficient in ICT education in the upper-western region preciously, the Lawra Municipality compared to the traditional teaching strategy. The aim of the present studies was to determine the effect of the constructivist-based instructional method to the traditional lecture / teaching method on learner's outcome and knowledge retention and the sense of difficulty or challenge in ICT in the upper west region.

1.4 Purpose of the Study

The purpose of the study was:

1. To determine whether there was a distinction in the accomplishment of expertise by students instructed by the constructivist-based technique of instruction (co-operative learning) and those instructed by the traditional technique of instruction (with teacher).
2. To determine whether there is impact in the retention of understanding (knowledge) of learners before and after the involvement of both constructivist-based instruction and the traditional method of instruction.
3. To evaluate the degree to which the ICT classroom teaching environment is compatible with the main concept of constructivist approaches to student learning.

1.5 Objective of the Study

The primary goal of this research was to compare the performance or achievement of learners educated using the constructivist teaching strategy (student-centred learning) and the traditional (teacher-centred teaching) method of teaching the use of learning techniques and knowledge retention by the student. Based on this general objective, the study is aimed at;

1. Investigating whether there is a substantial distinction in students learning strategies between the two groups of learners taught using constructivist-based teaching methods and traditional teaching methods.
2. Investigating whether there is a substantial distinction in students' knowledge retention before and after the intervention of both constructivist-based teaching methods and traditional teaching methods.

1.6 Research Questions

Based on the above stated objectives, this research seeks to answer the following basic questions as shown below:

1. What is the mean achievement scores of students taught through traditional teaching approaches (with teacher, which is teacher-centred) and those taught through constructivist-based teaching approaches (co-operative learning, which is student-centred)?
2. What are the students' mean self-concept scores of learning before and after the intervention of both traditional and constructivist groups?

1.7 Hypothesis

The following Null hypothesis was formulated to guide the study and was stated at level 0.05 of significance.

HO₁. There is no significant distinction in the achievement of students taught through traditional teaching approaches (with teacher, which is teacher-centered) and those taught through constructivist-based teaching approaches (co-operative learning, which is student-centered)

HO₂. There is no significant distinction in student's use of learning strategies before and after the intervention of both constructivist and traditional group of students.

1.8 Significance of the Study

With the application or implementation of the constructivist learning or teaching strategy to education, it is of paramount significance to evaluate its efficiency for policy makers, teachers, students and other educators with regard to the educational process. This study will either alter

our instructional methods or at least continue to assist educators (teachers) and learners by raising awareness of the right status of the teaching setting in the classroom. It will indicate whether the constructivist theory of learning is being properly implemented or practiced. The results of this research will make educators (teachers) and learners conscious of their instructional methods so that they challenge their approaches to teaching in the classroom.

The research will also contribute knowledge to teaching and learning and introduce a paradigm shift from teaching to learning centred for learners. The research results also help educators (teachers) recognize the instant use of constructivist teaching approach in actual classrooms. The outcome will also benefit educational offices at distinct rates to design training packages that are suitable to the real classroom context.

1.9 Delimitations of the Study

This study is delimited to identifying students learning strategies in ICT and knowledge construction in students in the public Senior High Schools in the upper west region – lawra Municipality.

1.10 Limitations of the Study

In this study, the researcher acknowledges a number of limitations which form the basis of his studies. The study covers both groups in each of the selected schools in the upper west region of Ghana – lawra Municipality that demanded a huge resource in terms of time, energy and finance. Additionally, the teaching assistances (teachers at the selected schools) were reluctant and even demanded to be paid for their service. It is therefore obvious that not all the test sent out to the target group were retrieved, however the researcher ensured that as much as possible,

at each stage of the data collection (test), the impact of these challenges is reduced to its barest minimum.

1.11 Organization of the Study

The study report is categorized into five chapters.

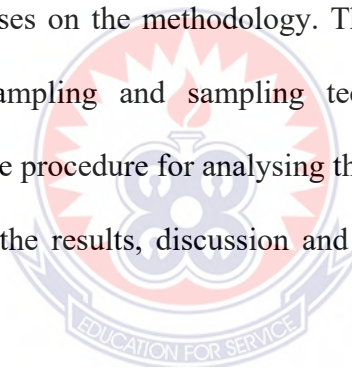
Chapter 1 is the introduction – will deal with the background to the study, statement of the problem, purpose of the study, research question, hypothesis, educational significance of the study and finally the organization of the study.

Chapter 2 is the literature review – covers review of the relevant literature on the study.

Chapter 3 is methodology – focuses on the methodology. The methodology is made up of the research designs, population, sampling and sampling techniques used, instruments, data collection procedures as well as the procedure for analysing the data.

Chapter 4 is analysis – presents the results, discussion and summary of main findings of the study.

Chapter 5 is conclusion – presents the conclusion, recommendations and suggestions for further studies on the problem area.



CHAPTER TWO

2.0 REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter reviews relevant literature to the study. The chapter reviews empirical studies on the constructivism Approach in ICT Teaching Strategies and Assessment of ICT understanding and Sense of challenge. This section also addresses the theoretical framework and empirical bases of the study. Finally, a conceptual framework is reviewed to explain the linkages among key variable in the study.

2.2 Theoretical Framework of the Study

Research has shown that learners taught using constructivist methodology achieved better examination grades (Caprico, 1994). Supporting this finding is, Saigo (1999), whilst (1999) Concluded that “the constructivist model was discovered to have a slight beneficial impact on the accomplishment of the students” (Saigo, 1999). The constructivist model is capable of involving learners (students) more in learning. Kurt & Somchai (2004) in their research study. Constructivism also discovered that learners (students) used for the study participated more in classroom activities and acquired understanding of content when using a constructivist teaching strategy (kurt & Somchai, 2004). (Hayes, 2000), discovered in his researcher that, learners (students) in constructivist instruction had a greater degree of academic achievement than learners in traditional training under all circumstances

In a research study by Gatlin, (1998) he discovered that there was no important distinction in the results of learners at the post-test between learners of the constructivist community and the traditional group (Gatlin, 1998). He noted that the results of learners who got the constructivist

method showed a slight reduction in delayed post-testing, while learners taught using the traditional method showed a higher reduction over time. Students who received the constructivist instructional approach have a higher relation over time. It can be said that learners (students) taught by traditional means who depend on memorization to pass exams often do not remember much of the information learned over time. Makanong (2000) linked Gatlins (1998) finding in his research study that there was no important distinction in accomplishment between learners in the constructivist group and the tradition group (Makanong, 2000).

Kurt & Somchai (2004) reported that there was no important distinction in accomplishment between Thailand learners exposed to traditionalist teaching approach and constructivist teaching strategy in vocational electronics programs. They found, however, that the constructivist instructed learners had greater ratings on the post-test and delayed post-test relative to those of the traditionally instructed learners. This means that learners in the constructivist group maintain the ideas taught better than their peers in the traditionalists group.

2.3 Conceptual Framework

Constructivism theory is not a fresh notion in the building of understanding (knowledge); it has a lengthy background in philosophy and has been applied to sociology and anthropology as well as cognitive psychology and education. The most up-to-date and fashionable work in today's instructional system is constructivism that applies to both learning theory and epistemology-both how individuals learn and the nature of information (knowledge). The first constructivist philosopher, Giambattista Vico, remarked in treaties in 1710 as a philosophy of teaching that "one only understands something if one can explain it or one can build it by himself and has played a huge part. Many others worked with these ideas but the first major contemporaries to develop a clear idea of constructivism that applied to classrooms and children

development were (Piagets, 1937; Richardson, 1997). Immanuel Kant further explained this concept by claiming that human humans do not passively absorb data (information), but rather meaningful learning includes the active development and alteration of knowledge.

In constructivist teaching strategy, learning is not instantaneous, it is an active step-by-step method in which the learner takes sensory information input and builds meaning from it or takes understanding (knowledge), connects it to earlier assimilated understanding (knowledge) and makes it their own by building their own understanding (knowledge) (Cheek, 1992). The learner has to revisit principle, reflect on and used them as often as possible. Sceptic, who said that if someone described exactly how the world really was, they would not have known it was a real description. (Von Glasersfeld, 1990). This significant argument of the sceptic over the last 2500 years assumes that all concepts and knowledge are empiricism, our senses, our actions and our thinking. These concepts continued to emerge in discussions between objectivists who think that things can only be known objectively and that knowledge is beyond the mind and relativists who think that all knowledge is subjective. These concepts were produced explicit by Vico, who lived from 1688 to 1744 and wrote on the building of wisdom. These concepts were produced explicit by Vico, who lived from 1688 to 1744 and wrote on the building of knowledge. (Von Glasersfeld, 1990); He said "the human mind can only understand what the human mind has done or made". Sceptics, Vico, and other thinkers are sources of constructivism; Piaget is 'the excellent pioneer' (Von Glasersfeld, 1990). In summarising (Piagets, 1937) contributions Von Glasersfeld argues for two main principles:

- i. Knowledge is actively constructed up by the cognizing subject, but is not passively obtained either through feeling or through communication

- ii. Cognition provides the subjects organization of experiential work and not the discovery of objective reality

Aside from Piaget (1976), the other pioneer of constructivism whose ideas are generally referred to as constructionism or social or cultural constructivism is (Vygotsky, 1978). Vygotsky believes in the primacy of culture in influencing growth. His opinion of training was that communication with adults or more developed colleagues was essential for growth, requiring the active participation of all respondents (participant). He presumed that interaction affected growth, that the teacher can deliberately nurture and educate children only in cooperation with them, that this method needs the teacher to move forward to what he called a 'zone of proximal growth'. Education research provides compelling evidence that learners only learn well when they build their own way of comprehension, and constructivist theories are about 'knowledge and how we come to understand'. On the one side, constructivist instruction (learners – centered) provides preeminent importance to the growth of private learning ideas of learners, while on the other side, traditional instruction (instructor or teacher – centered) values only established teaching methods and concepts. In constructivist training, learners are motivated to use their own techniques to solve problems. Students are not asked to adept someone thinking, but to refine their own thinking through interaction with ICT tasks and other students; the students' own intuitive thinking gradually becomes more abstract and powerful.

Constructivists also argue that learners should discover their personal significance in their research, share control over their learning, and feel free to convey their worries about their learning, regard science as ever altering, and communicate with each other to build and/or alter understanding (Taylor, Fraser , & Fisher, 1997). This means that the constructivist teacher should make the topic relevant to learners outside of school by linking the topic with students'

life experiences, engaging learners in reflective negotiations and with their peers and others by offering possibilities to clarify and justify their new thoughts and to reflect on the viability of their own knowledge, enable learners to express concern about the quality of teaching and learning activities and provide possibilities for learners to experience the uncertain nature of understanding (knowledge)

The constructivist perspective of learning in the classroom can point to a number of distinct teaching methods. Usually, it promotes learners to use active methods (experiments, real-world problem solving), generate knowledge and then reflect on and speak about what they are doing and how their perception is changing. The teacher ensures that he or she knows the pre-existing conceptions of the learners and guides the exercise to tackle them and then construct on them (Vygotsky, 1978).

Traditionally, learning has been thought to be nothing but a repetitive activity, a process that involves students imitating newly provided information interest. Traditional instruction leads students to believe they are not interested in particular subject area. The constructivist teaching practice, on the other hands, helps learners to internalize and transform new information. Transformation of information occurs through the creation of new understanding that results from the emergence of new cognitive structures. The principles of constructivist teaching are: posing problems of emerging relevance to students; structuring learning around primary concepts; seeking and valuing students point of view; adapting the curriculum to address students' suppositions; and assessing students learning in the context of teaching (Brook & Brook, 1993).

The constructivist paradigm holds disinterest less as a function of a particular subject area than as a function of the ways in which students have been taught. A look at the table below shows a comparison of the traditional lecture classroom with the constructivist classroom.

Table 1. Comparison of the traditional lecture classroom with the Constructivist classroom

S/N	Traditional Classroom	Constructivist Classroom
1	Begins with parts of the whole-Emphasize basic skill	Begin with the whole-expanding to parts
2	Strict adherence to fixed curriculum	Pursuit of student question/interests
3	Textbooks and workbooks	Primary sources/ manipulative materials
4	Instructor gives/ students receive	Learning is interaction-building on What students already know
5	Instructor assumes directive, authoritative role	Instructor interest/negotiates with students
6	Assessment via testing/correct answers	Assessment via student works, observations, points of view, test.
7	Students work individually	Knowledge is dynamic/change with experiences
8	Knowledge is inert	Knowledge is dynamic/change with experiences

Source: (Brook & Brook, 1993)

In constructivist classroom in which the teacher is using constructivist teaching, students are encouraged to discover for themselves how things work. They do this first by making simple observations, from which they then go on to test. Pre-testing allows a teacher to determine what knowledge students bring to new topic and thus will be helpful in directing the course of study. In CLEs, learning is driven by the problem to be solved; students learn content and theory in order to solve the problem. This is different from traditional objectivist teaching where the theory would be presented first and problems would be used afterwards to practice theory.

Depending on students' prior experience, related cases and scaffolding may be necessary for support. Instructors also need to provide an authentic context for tasks, plus information resources, cognitive tools, and collaborative tools. In the constructivist classroom, the teacher's role is to prompt and facilitate discussion. Thus, the teacher's main focus should be on guiding students by asking questions that will lead them to develop their own conclusions on the subject (Udogu & Njelita, 2010).

The constructivist classroom is characterized as follows: the learners are actively involved; the environment is democratic; the activities are interactive and students-centered and the teacher facilitates a process of learning in which students are encouraged to be responsible and autonomous. This is contrary to the traditional classroom in which students work primarily alone, learning is achieved through repetition, and the subjects are strictly adhered to and are guided by a textbook (Abida & Muhammad, 2012)

The following activities are encouraged in constructivist classrooms: Experimentation; Research projects; Field trip; Films and Class discussion. Class discussion is used in all of the methods described above. It is one of the most important distinctions of constructivist teaching methods and this study adopted class discussion activity for the study.

Constructivist teaching is based on constructivist learning theory (Vygotsky, 1978; Piaget, 1976). This theoretical framework holds that learning always builds upon knowledge that a student knows; this prior knowledge is called a schema. Because all learning is filtered through pre-existing schemata, constructivists suggest that learning is more effective when a student is actively engaged in the learning process rather than attempting to receive knowledge passively. The constructivist teaching relies on some form of guided discovery where the teacher avoids

most direct instruction and attempts to lead the student through question and activities to discover, discuss, appreciate and verbalize the new knowledge. Constructivist learning theory says that all knowledge is constructed from a base of prior knowledge. Learners are not blank slate and knowledge cannot be imparted without the learner making sense of it according to his or her current conceptions. Therefore, learners learn best when they are allowed to construct a personal understanding base on experiencing things and reflecting on those experiences. Today, it is essential to organize the learning environments in a student centered and democratic way facilitating the student development in various respects. The traditional learning in which students memorize information as it is without questioning and researching result in negative consequences. Some of the problems that arise from traditional learning environments are that the learned information cannot be permanent, just memorized for the examinations and are forgotten later on, most information is understood either imperfectly or wrongly and that students cannot apply learned material into real life (Agogo & Naakaa, 2014). To eliminate that kind of problems student approaches should be taking into consideration. Recently, one of the approaches that closely influence the organization of learning environment is constructivist approach. Constructivist teaching is a teaching strategy which holds the view that knowledge is personally constructed and reconstructed by the learner base on his prior knowledge or experiences. It is a strategy of learning base on the believe that knowledge is not a thing that can be simply given or transferred by teacher in front of the classroom, to learner seated at their desks. Rather, knowledge should be constructed by the learners through an active mental developmental process. It also allows the students to interact with themselves, explore and work groups, making meaning tasks and setting out to solving problems that are perplexing to them (Ekon, Ekwueme, & Meremikwu, 2014). The constructivist instructional model gives importance

to the students' constructing knowledge themselves and developing higher order thinking skills. For students to construct knowledge, different principles are applied in constructivist learning environments compared to traditional learning environments. Traditional learning environments are teacher-centred (Akinyemi & Folashade, 2010).while teacher has the role of transferring information and directing the students, students are active in constructivist learning environments. Their roles are to organize knowledge and the learning environment, carry out the learning activities and to monitor their own learning (Ekon, Ekwueme, & Meremikwu, 2014). In such an environment, teacher's role is to guide the students in the learning process and do various evaluations based on various techniques such as diaries, research reports, etc. In constructivist instructional model, teachers design classroom activities that will develop students' higher-order thinking skill, enable them to learn new concepts and unify the previously learned information with the new one.

Organizing learning environments based on the constructivist approach is important for realizing the higher order aims (Akanwa & Ovute, 2014). When the students participate in the learning process actively, their learning becomes meaningful and they can develop themselves in various respects. Learning, in this approach, is reinterpreting the previous knowledge in the light of new experiences.

There are several constructivist instructional models as cited in (Ekon, E, 2013) that are useful in helping learners reconstruct knowledge based on their experiences which include the five phases of constructivist model is activity-based, students interactive oriented. The five phases (5E) of constructivist instructional models are:- Engagement stage which is problem identification stage; Exploration stage which is experimenting and problem solving stage;

Explanation stage which is the classification stage; Elaboration stage which is the generalization stage; Evaluation stage which is the signal feedback stage which will be discuss in chapter three.

2.4 Constructivism and Conceptual Change

Recent study in education has been predominated by a constructivist perspective of teaching. According to constructivist theory or perspective of learning, teachers are not a transmitter of knowledge, but rather a facilitator and supplier of experience from which learners will learn and that learners (students) do not passively absorb knowledge or data, but participate actively in the teaching process, building their own significance on the basis of strong preconceptions; Significant learning includes the active development and alteration of knowledge structure (Carey, 1985). When learners learn, they use their current understanding, beliefs, interests and objectives to interpret any fresh information they come across, and this may result in their concepts being changed or revised. Although the constructivist view is preeminent in this model instructional system, there is a variety of opinions as to how the method of knowledge building takes place. Phillips found that the versions differed in the extent to which they concentrated on knowledge building within people rather than knowledge building within fields, and also varied in the extent to which they suggested that knowledge is either produced or discovered. With regard to people studying in classrooms, however, the two main types of constructivism were those suggested by Piaget and Vygostky, which are "cognitive constructivism" and "social constructivism."

The "cognitive constructivist" point of perspective is created from Jean Piaget's concept and the proponent of this perspective argues that people strive to create sense of the world (Von Glasersfled, 1987), and the metaphor of the "child as scientist" is often used to describe how

children investigate the world around them (Driver & Erickson, 1983). This sort of learning can be caused by experiences that can be physical, mental or social; physical experiences include physical contact with objects in the setting; mental experiences require thinking about things they have experienced; and social experiences include interaction with adults and colleagues. Individuals interpret these experiences in order to create significance and create their own private understanding.

The "social constructivism" is created from Lev Vygotsky's thoughts and emphasizes the significance of society, culture and language (Lemke, 2001; Vygotsky, 1978). In this view, knowledge is socially constructed and learning takes place in specific social and cultural contexts. Social interaction offers children with ways to interpret the physical and social world and thus inculcates learners into ways of thinking that are prevalent practices in that particular society.

The cognitive constructivist and social constructivist view emphasizes distinct routes towards knowledge building, but they both have some commonalities of significance. (Marin, Benarroch, & Jimenez Gomez, 2000); compare the two perspectives and found that one source of common ground was the characteristics of students conceptions, or way of perceiving reality. According to cognitive and social constructivist, learning is also seen as an active participation rather than a passive process, and the building of meaning requires effort on the part of the learner as well as motivation. Motivation is a prerequisite and co-requisite for learning (constructivist theory). Constructionism, an ontological position often referred to as constructivism. Constructivism believes that learning is a learner-focused and the learner has the capacity or chance to build understanding actively as he / she learns in lieu of being passively assimilated. It emphasizes that knowledge is a building of truth in the learner mind because knowledge is a vibrant adaptation to

an interpretation of experience. (Dewey, 1966); Considers constructivist teaching as one that promotes diverse interpretation of reality-based empiricism. This focuses on knowledge building rather than consumption – as the learner builds knowledge from mental beliefs and experiences, interpreting occurrences outside the mind. Thus, we do not describe the world we see but we see the world we describe. The setting consists of socially mediated operations anchored in a teaching environment where knowledge is produced on the basis of learners' capacity to build understanding from the surroundings. (Fullan, 1995), noted four constructivist dimensions, trivial, radical, social and cultural. (Becta, 2002), Also notes some keen values of constructivist teaching that include.

1. Learning itself is a system whereby each element is essential, the change in one element affects the other. Learner, teacher, educational material and teaching environment, all interacting to accomplish the objective;
2. Learning is not instantaneous, but takes time (step by step) – as students need to revisit values, reflect on them and use them as often as possible;
3. Learning is an active method and consists of building significance and building system for significance;
4. Language significantly affects what we learn;
5. Learning is a social activity connected with the links that the learner makes with others;
6. Learning is contextual – since learners cannot learn isolated facts or concepts in abstract ethereal territory, separate from real-world circumstances meaning building and the development of meaning systems;
7. Motivation is a key to learning how to use the understanding acquired;
8. Knowledge building is mental – as it occurs in the learner's mind; and

9. Knowledge is important (knowledge is not objective) – since we cannot understand fresh thoughts without building on some framework created from previous knowledge.

2.5 Teaching Approaches

Constructivist theory is based on the concept of encouraging learners to confront, build and create their own fresh understanding through active participation in the teaching and learning process through social interactions. In order for learners to develop and generate their own understanding, they must engage completely in a sequence of activities intended by a knowledgeable adult or teacher to provide different learning possibilities for the individual student. According to Zaho (2003) the "The features of constructivist teaching models include encouraging learners to observe and formulate their own questions, enabling various interpretations and learning expressions by enabling learners to work in organizations and using their colleagues as learning tools".

Aristotle wrote, "Man is a social animal that we define ourselves in terms of our interactions with other individuals. Our destinies are determined by our relationships with others and with us. We only learn who we are and understand about ourselves through interacting with other individuals.

In perspective of this, constructivist teaching methods are designed to stimulate learning through exploration and research, categorized as open or discovery techniques, constructivist teaching methods are student-centred (co-operative learning) and not teacher-centred (with-teacher), with emphasis on creating an enabling learning atmosphere for student techniques.

Constructivism is one of the most significant concepts in the present psychology of education. According to constructivism, expertise cannot be transmitted and teachers can not merely offer

knowledge to learners. Instead, the understanding of learners must be built in their own minds. In perspective of this, we can take a motivational perspective of the constructivist learning learners.

Some of the fundamental motivation assumptions are:

- i. Learning is nearly impossible without students' motivation; and
- ii. Teacher pedagogy only impacts the learning capacity of the learners.

Harmer writer in his book 'English language teaching' that "motivation is some kind of internal drive that drives someone to do something to accomplish something" (Harmer, 1988). Harmer describes the motivation as something that motivates the individual to achieve their objective.

2.6 Simple Ideas to Improve Students Learning

Some easy concepts that can enhance students' learning are:

Adopt a supportive style: -Teacher guidance is essential for learners and motivates and develops the interest of learners in teaching. It supports teaching style that enables student autonomy to promote enhanced student interest, pleasure, motivation and achievement. Supporting teacher behaviours include listening, providing hints and encouragement, responding to student issues and displaying student empathy.

Healthy environment: -The environment also affects the learning motivation and interest of the student. Healthy environment motivates learners to learn. Teacher can create the healthy class during the teaching. Do not threat the student in any negative way. Teacher should appreciate students during the class and lesson and understand student's problems. If teacher understand the student's problem, he can motivate the students for learning.

Arrange for trip: - students learn so many things in the classroom and at some moment become comatose for sitting a long time in class. So, school can arrange field trips according to student's curriculum. Student's interest increases in subject and they are motivated for learning.

Develop student competition: -Student competition motivates learners to learn, so there is a need for beneficial student competition. It develops hard work and increase the student knowledge. Competition in the students is a good thing, student learning more with their peer as we know learning is a social activity.

Rewards: -Students like rewards because it develops learners ' motivation. Teacher should offer the students for reward it is an excellent way for motivation in students. Award may be simple like sweets, stickers on a paper or any gift.

Give praise when earned: -There is no other motivation that works quite as well as encouragement. Even as adults we crave recognition and praise, and students at any age are on exception. Teachers can give students bounty of motivation by rewarding success publicly, giving praise for a job well done, and sharing exemplary work.

Encourage self-reflective: -One way to motivate your learners is to get them to look closely at themselves and determine their own strengths and weaknesses. Students are often much more driven by generating these types of criticism by themselves than by having a teacher do it for them, as it makes them feel responsible for developing their own goals and objectives.

Make objective high but achievable: -You have to push your learners to do more. If you don't push your students to do more than their bare minimum, most of them won't try to push themselves. Students like to be challenged and will work hard to attain elevated expectations as they believe these objectives are within reach and provide feedback and opportunities for improvement. Feedback can enhance learning for learners; learners who struggle with class work can sometimes feel frustrated and get motivated. In these circumstances, it is critical that teachers help learners learn precisely where they went incorrect and how they can enhance next time.

Finding out from learners where they want to be can also assist them remain motivated to work hard.

Motivate learners for achievement: -students struggling with bad academic results, low self-efficacy or low motivation, one strategy that can assist enhance learning for learners are to teach them less to learn. That is, to outline specific strategies for completing an assignment, note-taking or reviewing for an exam. (Margolis and McCabe, 2006). Teachers should motivate students for hard work. Student, even the best student in the school can become frustrated when they feel like they are struggling or failing to recognize that other learners are. Teacher should offer equal opportunities for success in a class



CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This chapter discusses how the research was conducted. It is broken into the following sub-headings; it discusses the philosophical underpinning of the study, the research design, population, sample and instruments used to gather the data. How the data was collected and analyzed is also discussed and also discusses the validity and reliability relating to quantitative studies.

3.2 Philosophical Underpinning of the Study

Research philosophy relates to the growth or development of knowledge and the nature of that knowledge. Research philosophy of the student includes significant assumptions about how they perceive the environment. The philosophical questioning of life, knowledge and value has an important impact on the layout of studies (Koetting, 1996). Justification of philosophical underpinning is helpful for research design in order to make informed choices concerning the methodology and strategy to be used for the study. The conceptual framework that characterized the situation of axiology, ontology (belief about the fundamental nature of the thing being studies) and epistemology (belief about the nature of the knowledge) can lead to methodological choices that are more accurate in finding responses to the research question.

3.2.1 *Epistemology*

Epistemology concerns what represents appropriate understanding or knowledge in the field of study (Saunders, Lewis, & Thornhill, 2007). Saunder et al. (2007) explain these philosophical traditions into three: "positivism," "realism" and "interpretivism." Positivism refers

to the natural scientist's philosophical position. It involves "life with an observable social reality and the end result of such studies can be law-like generalization comparable to those generated by the physical and natural scientist" (Remenyi, Williams, Money, & Swarts, 1998). Realism is another epistemological stance that refers to science inquiry. The "core of realism is that what the senses show us as reality is the truth: that items have a presence autonomous of the human mind" (Saunders et al., 2007). (Saunders et al., 2007). Interpretivism also emphasizes the distinction between undertaking studies among individuals rather than artifacts (Saunders et al., 2007), where the social scientist should welcome and understand the distinct views and meanings that individuals position on their experiences.

3.2.2 *Ontology*

Ontology is a branch of philosophy concerned with the existence of social phenomena as objects. Ontological hypothesis is (another) significant element of study psychology (Saunders et al., 2007). It also increases the question of the researchers' hypothesis of how the universe operates and their dedication to these particular opinions. Ontological assumption is based on the social entities. Ontological assumption existence is known as "objectivism" (Saunders et al., 2007). This is "the ontological stance that maintains that personal beings occur outside social actors in fact."

3.2.3 *Axiology*

In the study philosophy, axiology includes the study of a philosophy's principles, morality and beliefs structures. Axiology is the area of philosophy that researches quality judgments (Saunders et al., 2007). Axiology concerns the assumptions about the value the investigator (researcher) attaches to the information or knowledge is of excellent significance to you if your

study findings are to be reliable. Interpretivism "social constructionism" proposed that study is value-laden whereas positivism indicates that the investigator (researcher) should maintain a value-free perspective. In value-free studies, the decision of what to study and how-to study is determined by objective requirements and the decision is determined by human beliefs and feelings. In this sense, this research is a value – laden position.

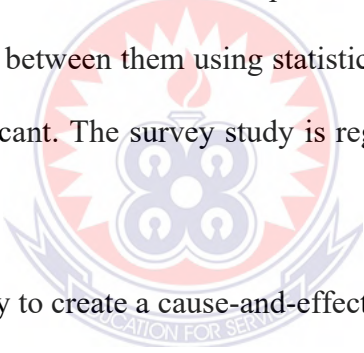
3.3 Research Design

The research frame work adopted is experimental survey. Quasi-experiment comprises of pre-test, post-test and post-test non-equivalent experimental and control group layout. This is a Quasi-Experimental research design that was used. The word “Quasi” which indicates resemblance. Its scientific nature demands a systematic process to aid data collection and analysis. The methodology or uniform exercise for producing understanding (knowledge) includes an epistemological basis and standards of proof for creating a statement, as well as a range of methods for generating proof of the assertion.

The investigator (researcher) implemented this model because it is hard to randomly pick learners and assign an experimental study and control groups to educate for a lengthy span of instruction / time. As a result, students were taken from the already available section (class). Quantitative research describes a phenomenon through the collection of numerical data, evaluated by statistically oriented techniques (Creswell, 1994). The use of quantitative research is focused on a positivist paradigm centered on the premise that knowledge is an objective truth (Greene et al., 2009). This enabled the compilation of quantitative data and the use of quantitative methods in data analysis. Surveys were defined by the compilation of information or data from big amounts of learners (students) to define or clarify the features or views of a population using a representative sample. (Mary, 1997). According to (Ferber, Sheatsley, Turner,

& Waksberg, 1980), a survey is "a technique of collecting data or information from a set of people, a ' sample ' to know something about the bigger population from which the sample is taken".

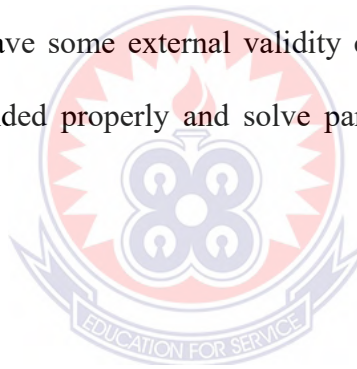
Furthermore, surveys are efficient ways of gaining information or data on attitudes, problems and causal relationships. However, largely, surveys are statistical association between variables. They do not account for modifications in attitudes and opinions over moment, nor do they ensure that the questions are properly understood by the participants (May, 1997). Essentially, since surveys evaluate facts, attitudes or conduct through question, hypotheses must operationalize into processes and interventions through questions that participants can comprehend and can reply (Spertor, 1981). These responses must then be capable of categorization and quantification to examine models of interactions between them using statistical analysis methods, the results of which must be statistically significant. The survey study is regarded appropriate for this studies because:

- 
- It provides you the capacity to create a cause-and-effect connection;
 - Survey research includes collecting information from learners (students) and generalizing the study results to forecast the behaviour of the population of concern;
 - The study questionnaire test is intended to obtain data from the population of concern in a systematic and unbiased way;
 - In information compilation, it is quicker than other techniques,
 - It is comparatively cheap in information compilation and
 - It provides access to a broad spectrum of respondents.

3.4 Advantages of Experimental Design

The main benefit of an experimental research design is the capacity to create a cause-and-effect relationship. Although some scientists claim that we can never understand with certainty whether one variable creates a shift in another, tests offer us the instruments to discover the environment around us and create informal inferences. The degree of control over conditions provided by certain experimental design allows the researcher to determine causation rather than correlation between variables. In experiments, the conditions under which they are performed, the manipulation of the variables and how the variable is quantified are all clearly spelled out to enable future replication. The concept that others may repeat the practice indicates that the data generated is empirical or autonomous, objective, material truth.

Although tests or experiments have some external validity constraints, they can give a strong amount of command when intended properly and solve particular problems better than most other techniques.



3.5 Population of The Study

Since the research design is based on answers (responses) from participants from whom data or information will be requested, it was necessary to identify / define the target population from which the sample would be taken. (Sekaran, 2000), Defines population as any group of individuals, activities or items that are of interest to researcher that they wish to explore. A population is generally a well-defined set of people or items recognized to have comparable features. The target population for the study was students because they could provide the necessary and sufficient information to achieve the study's objectives and provide answers to the research questions they were asked. The target groups were students at the government high schools in Lawra Municipality. Of the three (3) schools, two (Eremon Senior High / Tech and

Birifoh Senior High School) were specifically chosen for the research based on the larger number of learners/students. A total of 165 SHS 2 students are the sample of the study because the teachers in these schools volunteered to participate in the study and teach both groups. Both schools were mixed schools. Before the teachers in these two schools began to teach, the investigator (researcher) directed them on the essence of the two teaching methods, the traditional teaching method (teacher-centered) and the constructivist-based teaching method (student-centered, collaborative learning). Simple random sampling technique was employed in this study. From the total of 24 SHS 2 classes in Eremon SH/T and 18 SHS 2 classes in Birifoh SHS, only two classes (total 81 students) were selected in the Business department in Birifoh SHS and two classes (total 84 students) from the Home economics department at Eremon SH/T were also considered for the study. One class (students) from each school were randomly grouped under experimental group (treatment) and were taught using constructivist- based instructional teaching method for three weeks and serve as a superior group while the other one class from each school (students) were grouped and taught using traditional- lecture way of teaching and served as the control group. The selection of experimental and control groups in each school was done using lottery method.

3.5.1 Material Used

The researcher and his assistants (teachers at the selected schools) carried out the teaching of the students on each topic for three consecutive weeks respectively. The materials used are as follows:

- i. A scheme of work consisting of selected ICT topics which were taught for a period of three consecutive weeks. The students had not been exposed to these topics before the

- study.
- ii. An educational package using constructivist-based instruction.
 - iii. An educational package with traditionalist instruction.
 - iv. A set of thirty (30) multiple – choice ICT test questions and two theory questions on the subject were used to assess students' performance.

3.5.2 Procedure

Pre-test session

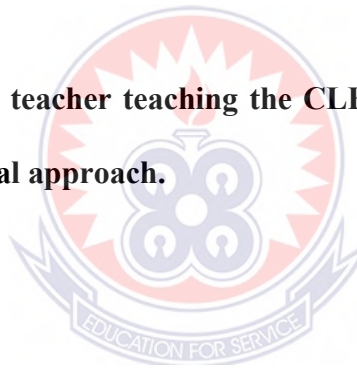
The design used for this study was pre-test, post-test and delayed post-test control group. One class in each one of the two schools was exposed to the constructivist teaching strategies and was designated 'Constructivist Learning Environment (CLE)' while the remaining classes were designated as 'Traditionalist Learning Environment (TLE)'. Before subjecting the groups to treatment, pre-test was administered to both experimental and control groups to determine the group's previous knowledge on the various selected topics in ICT. The test instrument covered aforementioned topic which both CLE and TLE classes will be introduced to and taught for the period of the study. At the end of each of the three weeks, the same test was administered to both as a post-test. Three weeks after the administration of the post-test, a delayed post-test was administered to measure students' knowledge retention. At each stage of the test, pre-test, post-test and delayed post-test administration, the questions of the test were re-arranged to give students the impression or believed that the questions on each stage, the pre-test, post-test and the delayed post-test were different questions altogether. The delayed post-test was used to

determine students' knowledge retention and to justify whether there was students' memorization of facts and information or whether students really understood the concepts (topics) taught by the teachers, using the two different instructional methods and to see which of the method affects students' knowledge retention.

Treatment session

In all the topics mapped out for the study, the experimental groups were made to build or construct meaning from the concepts and activities provided through teacher guidance using the five-phase constructivist learning method (CLM), refer to as the 5Es, and will be discussed below.

A sample Lesson Guide for the teacher teaching the CLE (a selected topic) using the 5Es constructivist-based instructional approach.



Date:

Class: SHS 2

Duration:

Topic: INFORMATION PROCESSING

General Objectives: At the end of the lesson, student will be able to: -

- i. Define data
- ii. Define information
- iii. Explain the information processing cycle

- iv. Explain how the computer transforms data into information
- v. Discuss the devices used by the computer at every stage of information processing cycle

Entry behavior/R.P. K: It is assumed that students have been hearing the word information and some can say something about it.

Teaching Learning Materials (TLM): maker board, pictures

Entry behavior test: what age are we living in now?

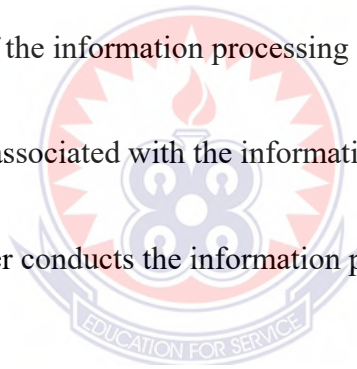
3.5.3 Instructional Procedures

Step I: The Engagement or Invitation phase:

The teacher establishes problems through questions, previous understanding (knowledge) of the learner, thoughts (misconceptions or alternative conceptions) to attract the student's imagination with the fresh teaching assignment in order to eliminate the misconceptions that follow. It is usually accepted that misconceptions occur in all fields of research and actual lives and are mostly common among learners (students) who may be sensitive to standard teaching and may interfere with potential learning. The problem must have some links to the past subjects and the goals of the real subject to be dealt with.

The teacher gives the students the opportunity to attempt the question and at the end guide the students in answering those questions and introduced the new topic (E.g **Information Processing**) to be treated. The teacher relates the previous lesson to the new one. Examples

1. What is data, and what is information?
2. What are the sources of data and how are they acquired?
3. What is the information processing cycle? What is the basic function of the information processing cycle?
4. What are the primary stages of the information processing cycle?
5. Describe the first stage of the information processing cycle.
6. Describe the second stage of the information processing cycle
7. Describe the third stage of the information processing cycle
8. What other processes are associated with the information processing cycle?
9. Describe how the computer conducts the information processing cycle



Step II: The Exploration phase

The students are divided into small groups for exploration, teacher ensuring that every student participates actively in the task given in their group. The teacher specifically assigns each group to investigate a problem. For instance: Group 1 is asked to answer questions **1 and 2**. Group 2 is asked to answer questions **3 and 4**. Group 3 is asked to answer question **5**. Group 4 is asked to answer question **6**. Group 5 is asked to answer question **7** and Group 6 is asked to answer question **9**. The teacher gives each group instructions on what to do and ensures that each individual student in each group has a specific role to play and be active in their group discussion. In this phase, the teacher does not participate entirely in the students' work but only

guides the students in their discussion and encourages them to become active in their various groups. Ideas, suggestions and answers are written down for the whole class discussion.

Step III: The Explanation phase

In this phase, the teacher creates a conducive atmosphere in the classroom to determine the thoughts of the student before generating his / her own concept. Students clarify and interpret the outcomes of their findings through a verbal repertoire with one representative in each group. The teacher engages the students in discussion by asking them to do the following;

- i. Explain your answers to the whole class
- ii. Listen attentively to one another's explanation
- iii. Question one another's explanation
- iv. Listen to the explanation given by the teacher, students share ideas with other students and teacher.

In step III of this phase of the 5E model, the teacher is actively involved in correcting errors and finishing the missing components of the student's results before the next phase. The teacher introduces the topic (Information Processing Cycle) and explains the concept as follows.

- Data can be defined as “raw material” or unorganized facts. Data can be grouped under various types, including numbers, words or symbol.
- Information can be defined as a processed data. It is known to be a collection of data

organized in such a way that it has additional value.

- Data can be obtained in a number of ways, from either primary (internal) sources or secondary (external) sources. Primary sources of data are facts obtained first hand usually through interview, questionnaires and surveys. Secondary data are fact collected or created by someone other than the one who needs the data. The process of turning data into information is what we called information processing cycle.
- Information processing cycle (IPC) is defined as the steps that a data must follow to become useful information. These are the input of data, processing of data into information and out of information.
- ***Stage one: input of data.*** At this stage of the cycle, data is acquired through various methods as discussed earlier. After acquiring the data at this stage, it is then put into a recognizable format that can be processed by the computer. The common devices used to enter the data into the computer include the computer mouse, keyboard, light pen, joystick and scanner. These devices aid the input of data and ensure that the data is transformed into a recognizable format for the computer to read correctly without any alternation to the data.
- ***Stage two: processing data.*** This is the stage where the data is manipulated into information. Before the data is processed into information, the data is edited, added to or removed from; to transform the unorganized facts into something meaningful and useful to the user. The device used to change data into information is the system unit. The system unit contains the Central Processing Unit (CPU) of the computer. Example include AMD processors (which include the AMD A4 or A6 or A8 or A10 processors)

and Intel processors (which include Pentium I-IV or Celeron or Intel i3, i5 or i7 processors.) other computer systems like Apple use a processor produced by a company known as Motorola.

- ***Stage three: output of information.*** This is the last major part of the information processing cycle. At this stage, the processed data is displayed as information. At this stage the organized data known as information is produced in a form that can be used by the computer user. Just as data comes in many different forms, so does the way information can be displayed. Information can be displayed as either text printed on a sheet of paper or displayed on a computer monitor. It can also be shown as charts, graphs, sound or video. The devices that aid in the output of information include the computer monitor, printer and speakers. Etc.
- How the computer transforms data into the information, Computer is capable of transforming data into information using the information processing cycle. Before the computer can complete the information processing cycle, the various devices that make up the computer system must be brought together to work effectively. The computer system is the complete computer setup, includes the keyboard, mouse, system unit and monitor. The computer transforms the data into information by receiving input from the keyboard or mouse. The keyboard or mouse converts data from human language to machine language which the computer will understand and then send it to the system unit for processing. Depending on the speed of the processor, the data is worked on in several ways to make it useful and relevant to the one in need of the information. The computer processor inside of the system unit works very fast in converting the data into information within a matter of milliseconds. The information is then displayed on the monitor.

Step IV: The Elaboration phase

In this phase, learners (students) are provided the opportunity to exercise their fresh gained understanding, generate fresh problems and propose solutions by implementing what they had discussed / learned to other associated problems, likely outside the classroom or school. They also worked in small group in this phase. The teacher guides the students by asking question like.

1. Can you identify the various sources of data in your schools?
2. List at least ten sources of data in your school and describe how they are collected.
3. List as many computer devices that you know of and identify the role the device plays in the information processing cycle.

Step V: The Evaluation phase

In this phase, the teacher provides students the chance to ask questions and enable other learners (students) in the same class to try to answer these questions before the teacher finishes or concludes. The teacher asks the following questions orally to ascertain student's level of understanding of the lesson.

1. What is the different between data and information?
2. What are the two sources of data? Give some examples and explain how they are acquired.
3. What does it mean for data to be described as reliable?
4. What do we mean by information processing cycle (IPC)?

5. What are the various stages in the information processing cycle?
6. What other processes are associated with the information processing cycle?

The control group receives their lessons through ordinary learning (traditional – lecture, instructor – focused) technique.

The above listed opportunities were not given to this group (control group). The teaching lasted for a total of three weeks. Finally, the two groups were post-tested with Test II and three weeks after the post-test, the last Test III (delayed post-test) was administered to assess the survival of understanding (knowledge retention) of the students. The treatment and administration of the exams or test was carried out by the researcher and his aid in each of the chosen schools that described themselves as assisting teachers to prevent jeopardizing the outcomes.

From all the 5Es of the constructivist-based instruction, it is obviously seen that learners were not idle in class, but rather strongly engaged in class activities or debate. It is highly believed that the above lesson can guide and assist teachers in the delivery of the lesson and create students self-confident after graduation. This sort of school or classroom setting could help ICT teachers and other subject teachers meet their students ' potential requirements (at a very healthy proportion), as many educators and the public have criticized it.

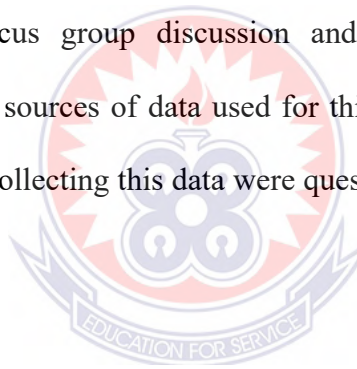
3.6 Sampling Technique and Sample Size Determination

The sample size is a tiny set of individuals selected from the target population. It is very essential to get a sample in a study. This is because it is impossible to explore all participants of the research region. (Moss, 1994) is of the view that one cannot study everyone everywhere

doing everything (Moss). In determining the sample size, a total of 165 students were used for the study from the two selected school, two classes (81 students) were selected in the Business department at Birifoh SHS and two classes (84 students) from the Home economics department at Eremon SH/T.

3.7 Data Collection Instrument

Data collection in research is the stage where the necessary data are collected from the field according to the purpose and objectives of the research. (Sikpa, 2011). The ways for gathering these data is what is termed as data collection methods (Sikpa, 2011). In this study, learning strategies, questionnaire-test, focus group discussion and observation were used as data collection instruments. The main sources of data used for this research work were primary and secondary. The methods used in collecting this data were questionnaire-test.



3.8 Questionnaire

The questionnaire was adapted from different source as one of the main data collection instruments. To accomplish the study's goals and objectives, well-structured close-ended questionnaires were intended to collect data from learners (students). Close-ended questionnaires-test was used because of the fact that they are easy for respondents to answer and they are also easy for the researcher to do the data analysis (Gay, 1996). These were used as the instrument for this study. The test were I, II, and III, each made up of 30 multiple-choice questions with four options A – D and two easy questions. Test I was for pre-testing to ascertain the previous knowledge of the students. Test II served as the post-test (achievement) measure on the students after had been exposed to the constructivist pedagogy of instruction. Test III was the

delayed post-test and was used to measure knowledge retention and see whether students could still remember what have been taught some weeks ago and whether students could construct or apply their own knowledge outside the classroom in solving problems in a real life situation. Test I, II and III are the same in terms of material/content but rearranged in three distinct variants. The item in the questionnaire-test was categorized into two parts, the first part sought information on the background characteristics of the respondent's sex, age and the group they belonged to (experimental or control). The second portion of the questionnaire-test concentrated on students' learning approaches or strategy to study ICT abilities. The questionnaire-test, which contains a number of items (questions), was used to evaluate students' use of learning strategy.

The researcher gave out the questionnaires test personally to the respondents, and collected them at the appointed time in order to minimize low responses. It should be emphasized that the questionnaire permitted participants time to think through the question in order to provide precise responses. The questionnaire ensures elevated effectiveness in information collection and strong generalizability of outcomes through more extensive study models.

3.9 Procedure Adopted for Administering the Questionnaires

The test was distributed personally and collected by the researcher. A total of 165 questionnaires-tests were administered to students at each of the three stages I, II and III. A letter of introduction was obtained from the head of department of the researcher to carry out the research work in the selected study area. The researcher visited the school and the permission was granted, the researcher administered the questionnaires personally and gave them appropriate time as recommended by (Nachmias & Nachmias, 1996). Structured questionnaires test containing close ended questions were administered to respondents. All the participate were

able to read the questionnaire test items and therefore completed the questionnaire independently.

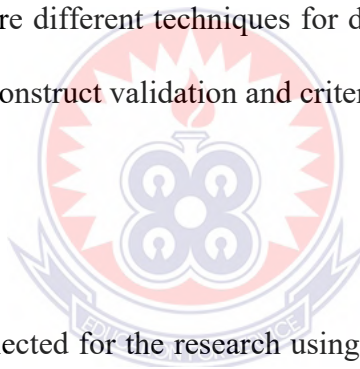
3.10 Reliability of Data Instruments

In order for the research to be successful, the instruments must be able to measure what they intend to measure and, if they produce the same results over and over again, they are reliable. Reliability relates to how reliable or coherent a tool (instrument) is. Also, according to (Polit & Hungler, 1985) "The quality of a tool (instrument) is the degree of accuracy that influences the characteristic, it should be measured." (Cooper & Schindler, 2001) Considers that the final test of a sample design is how well it reflects the features (characteristics) of the population, is intended to portray it in terms of evaluation, and the sample must be true. The validity of a sample relies on two factors: precision and accuracy. "Precision is the degree to which bias is excluded from the survey" (Cooper & Schindler, 2001) whereas "Precision is evaluated by the normal estimate error, the sort of variation distribution: the lower the normal estimate error, the greater the test accuracy" (Cooper & Schindler, 2001). The test was validated by two specialists in measurement and assessment in the ICT department (my supervisor) to give his opinions on the significance of sample questions. My supervisor indicated whether each question on the test was relevant or not and even adjusted the objectives of this study to suit the test. Based on his suggestions, question that were considered invalid were removed from the test. Therefore, reliability was made to determine the assessment scale that had been established to determine if coherent outcomes would be obtained if repeated measurements were carried out. Finally, Pearson's product moment correlation and split-half, odd-even reliability methods were

used to verify the accuracy of the experiment. Thus, the reliability coefficient of the leaning inventory strategy test was 0.78 and this was accepted.

3.11 Validity of Data Instruments

Validity implies the state of validity, authenticity or genuineness. To achieve validity and reliability therefore, the test was provided to a number of peers for criticism. They were subsequently evaluated using colleagues and adjustments were provided. They were then shown to the supervisor for further corrections before being put to use. The most important criterion of research is validity. Validity is concerned with the integrity of the conclusions that are generated from a piece of research. There are different techniques for determining validity and reliability: face validation, content validity, construct validation and criterion-related consistency.



3.12 Method of Data Analysis

Quantitative data were collected for the research using test questionnaires. The data were coded and fed into Statistical Package for Social Science (SPSS) software, version 25, Microsoft Office Excel 2016, for Windows to obtain graphs and Tables. The research questions were analyzed using mean and standard deviation. The t-independent test was used to test hypothesis about the difference of the two means. The t-test is used to determine whether there is a difference between the mean of the two samples or whether there is a relationship between two variables. A level of significance is a boundary in sampling distribution for making this decision. A significance level (alpha level) is a probability level that reflects the maximum risk that is willing to take when there is any observed differences are due to chance (Crewell, 2002). It is typically set as 0.05 (5 out of 100 times it will be due to chance) social science research.

Therefore, the null-hypotheses were analyzed and tested at 0.05 significant level (Alpha level) using ANCOVA (Analysis of Covariance) with critical value of (F-critical=3.182). This was to identify trends that appeared from responses. Analysis was undertaken to generate a descriptive picture of the data gathered. The analysis (presented in the next chapter) is organized under themes derived from the data and the research questions that guided the entire investigation.

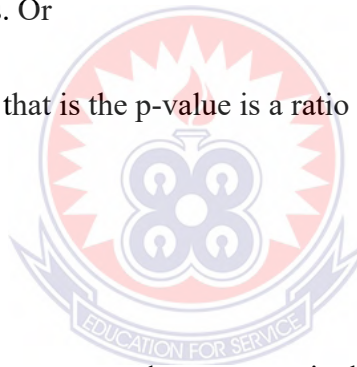
In ANCOVA these mean squares are used to produce an F- statistic or F – ratio by dividing an estimate of the variability between groups by the variability within groups.

$$F = \frac{\text{Variance between } (MS_M)}{\text{Variance within } (MS_R)}, \text{ while } MS_M \text{ for variation between the groups and } MS_R$$

for the variation within the groups. Or

The formula for two sample t-test that is the p-value is a ratio and it is as follows:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$



Where \bar{x}_1 and \bar{x}_2 is the mean of group one and two respectively.

s_1^2 and s_2^2 is the variance of group one and two respectively

n_1 and n_2 is the number of cases in group one and group two respectively

The degrees of freedom that go with the distribution is $n_1 - 1$ plus $n_2 - 1$, that is the degrees of freedom, that is $df = n_1 + n_2 - 2$

The mean (\bar{x}) which is in ordinary language we call the 'Average'. Mean (M) is the sum of all observations divided by the number of observations. $x_1, x_2, x_3, x_4, \dots, x_n$ is given by

$$(\bar{X}) = \frac{1}{n} \sum_{i=1}^n x_i \text{ . And}$$

The Standard Deviation (S.D) measures how the items in a sample are dispersed around the

mean. The Standard Deviation (S.D) is given by $SD = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{X})^2}$ and Variance

$s^2 = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{X})^2$ while \sum is the Sum sign, V is the Variance and N or $n-$ is the total number of Observations (respondents).

3.13 Ethical Consideration

The school's consent was requested in writing before gathering information for this research. Personal details of the participants were not included in the interview to ensure anonymity. They were ensured of confidentiality that this research would be used exclusively for scholarly purposes.

3.14 Summary

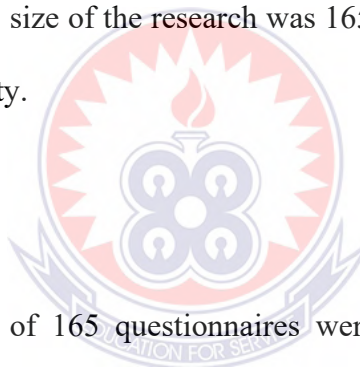
This section addressed the research method used for this study and how information or data were gathered. It also described how information for this research was analyzed and how it would be submitted. Issues of ethical concern that underpin the research were also resolved.

CHAPTER FOUR

4.0 RESULTS OF DATA ANALYSIS AND DISCUSSION OF THE STUDY

4.1 Introduction

This chapter presents the empirical aspect of the study, which involves analysing the data collected and interpreting the data collected on the basis of the literature reviewed. This chapter is grouped into sections: descriptive analysis and discussion of the results based on the literature. The descriptive assessment shows the socio-demographic features of the interviewees. Descriptive assessment was used to calculate the mean and standard deviation. The final chapter focuses on the discussion of the outcomes based on the literature reviewed for the research. As stated in chapter three, the sample size of the research was 165; learners from government senior high schools in Lawra Municipality.



4.2 Response Rate

During the pre-test, a total of 165 questionnaires were sent to both schools to collect information from the participants to determine their prior expertise. However, after the data collection exercise, it was realized that, 164 tests were retrieved from both schools whilst 163 test- questionnaires were deemed good (81 from Birifoh SHS and 82 from Eremon SHS) to be used since it gives a response rate of 98.88%.

A total of 165 test questionnaires were sent out during post-testing section to collect data from the respondents to measure knowledge achievement on students instructed using the constructivist-based teaching approaches and the traditional teaching approaches. 163 tests-questionnaires papers were returned from both schools whilst some of the test- questionnaires that was returned, key variables in the questionnaire that were critical in meeting the study

objective were not answered on some of the returned test- question. In spite of this, 160 test-questionnaires (78 from Birifoh SHS and 82 from Eremon SHS) were deemed good to be used since it gives a response rate of 98.16%. According to Bowling (2011), a response rate of 75.0% is good in social science research and admits that the higher the response rate, the better the analysis. The last test was the delayed post-testing, which is used to measure knowledge retention of students. 165 test questionnaires were sent out for both participating schools, 163 retrieves from both school and all 163 test- questionnaires were deemed good (80 from Birifoh SHS and 83 from Eremon SH/T) to be used since it gives a response rate of 97.58%. The last test was the delayed post-testing, which is used to measure knowledge retention of students

4.3 Background Information of Respondents

This chapter describes the age of participants, gender. The background of the participants was essential to allow the investigator to define the specific characteristics of the participants. Understanding the characteristics of the participants is useful and will assist the researcher to understand the precise group of people he / she is researching and how to cope with the situation. The selected schools for the study were mixed schools, consisting of male and female students from two (2) public schools in the Lawra Municipality in the Upper West region of Ghana. Their age was range between 15-21years.

4.4 Analysis of Socio- Demography of Respondents

This chapter starts with the presentation and analysis of the information on the age, the gender distribution of participants and the group to which they belong. As indicated in table 2 below, majority of the respondents representing 120(75%) were between the ages of 16-20years while

32 representing (20%) were between 21-25years of ages and 8 students were between the ages of 10-15years. Out of the total 160 responses, only 52 representing 32.5% indicated that they study ICT as a core subject at the basic level and write the subject in the BECE whilst 108 students representing 67.5% indicated No. it is clearly that most students have weak background of ICT in the basic level.

Table 2: Crosstab of Age Range

		Age Range			Total
		10-15	16-20	21-25	
Do you study ICT as a core subject at the basic level?	Yes	0	40	12	52
	No	8	80	20	108
Total		8	120	32	160

Source: Field Survey, 2019

Gender Distribution of the two groups for both schools

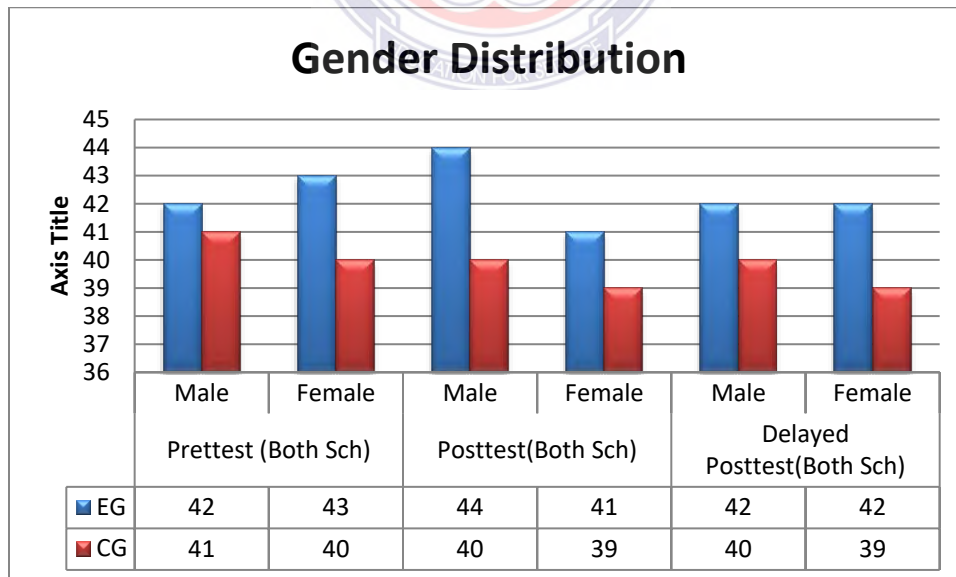


Figure 1: Response Gender Distribution

As shown in figure 1 above, it could be observed that out of the 165 participants whose opinions were requested for the research, eighty-three (83) of the participants representing 50.3% were male while eighty-two (82) of the participants representing 49.7% were female. As identified in figure 2 below, you could see that 83 students were taught in a constructivist learning setting while 81 students were taught in the traditional teaching setting.

Distribution of questionnaire by the two groups for each school

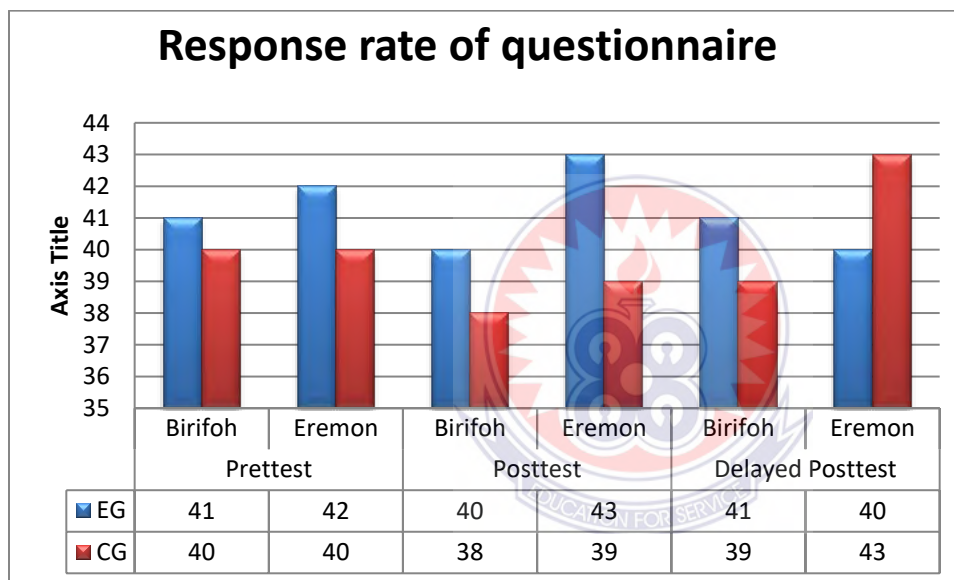


Figure 2: Response rate of questionnaires

4.5 Result of the Analysis

Presentation of means and standard deviation scores of both Experimental and Control groups on pre-test, post-test and delayed post-testing after three weeks.

E₁ and C₁ are data from Birifoh SHS and **E₂ and C₂** are data from Eremon SHS.

Generally, the lowest mean score of all the tests in table 3 below, except the pre-test in Birifoh SHS, belonged to the students who were exposed to constructivist instruction ($X=10.56$, $SD=0.564$).

Means and standard deviations for each method with respect to pre-test, post-test and delayed post-test are presented in the following tables below. As indicated in table 4 below, students in both schools whose were exposed to constructivist instructional had higher mean scores than student whose were exposed to traditionalist instructional method ($X=27.50$ and $SD=0.089$) as compare to traditionalist instructional method ($X=24.76$ and $SD=0.215$) and delayed post-test ($X=30.59$ and $SD=0.232$) as compare to traditionalist instructional method ($X=18.31$ and $SD=0.549$) for Birifoh. Also, in table 5 below students in constructivist group had higher mean score for both post-test ($X=27.09$, $SD=0.089$) and delayed post-test ($X=31.60$, $SD=0.207$) as compare to traditionalist instructional method post-test ($X=23.95$, $SD=0.189$) and delayed post-test ($X=17.34$, $SD=0.543$) for Eremon.

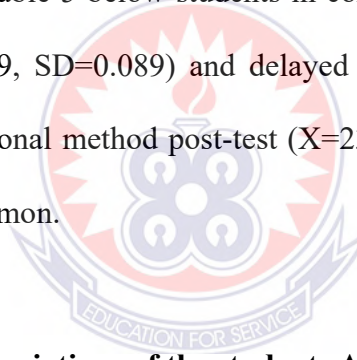


Table 3: Means and Standard Deviations of the students Achievement scores in pre-test

GROUPS	Mean(X)	S.D	N
Experimental E₁	10.56	0.564	41
Control group C₁	11.20	0.557	40
Experimental E₂	11.02	0.539	42
Control group C₂	11.58	0.537	40

Source: Field Survey, 2019

Table 4: Means and Standard Deviations of the students Achievement scores in post-test

GROUPS	Mean(X)	S.D	N
Experimental E₁	27.50	0.089	40
Control group C₁	24.76	0.215	38
Experimental E₂	27.09	0.089	43
Control group C₂	23.95	0.189	39

Source: Field Survey, 2019

Table 5: Means and Standard Deviations of the student's scores of self-concept Post-test

Means and Standard Deviations of the student's scores of self-concept in ICT taught with lecture Method and constructivist Method after 3 weeks

GROUPS	Mean(X)	S.D	N
Experimental E₁	30.59	0.232	41
Control group C₁	18.31	0.549	39
Experimental E₂	31.60	0.207	40
Control group C₂	17.34	0.543	43

Source: Field Survey, 2019

Where N=No. of respondents; X=Mean; SD=Standard Deviation; CG=Constructivist Group (Experimental) and LM=Lecture Method (Control)

Generally, the above Tables 3, 4 and 5 provided answers to the research questions and shows clearly that experimental groups performance better than the control group as indicated by the raw scores.

Table 6 below shows the t-test values for pre-test, post-test and delayed post-test with respect to the two methods of teaching; at the present level, the exact probability level is .000 which is less

than p-value (.005). This implies that there is significant difference in the mean scores of students in constructivist group ($E_1=10.56$) and students in traditional group ($E_1=11.02$). Also there is no significant difference in mean scores at pre-test level between students in constructivist group ($E_1=11.20$) and Students in traditional group ($E_2=11.58$), the p-value at this level is .468, which is greater than p (.005). At the post-test level, the p-value is .000 which is less than p(.005) this implies that there is significant difference in mean scores at this level, for both schools, between students exposed to constructivist learning method ($E_1=27.50$, and $E_2=27.09$) and students in traditional group ($C_1=24.76$ and $C_1=23.95$). At the delayed post-test level, the level, the p-value is also .000 (both school) which is less than p (.005). Hence, there is significant difference in mean scores, in both school, between constructivist group students ($E_1=30.59$, and $E_2=31.60$) and students in traditional group ($C_1=18.31$ and $C_1=17.34$).

Table 6: t-tests for equality of means

Results for the independent samples test on pre-test, post-test and delayed-post scores from group 1 and 2

t-tests for equality of means				
Tests	t	df	Sig. (2-tailed)	Decision at $P < 0.05$
Pre-test	-4.8781	161	.468	NS
Post-test	24.6086	158	.000	S
Delayed Post-test	8.3106	161	.000	S
S-Significant				
NS-Not Significant				

Source: Field Survey, 2019

Table 7: Paired Samples Test

				Std. Error			
		Mean	Std. Deviation	Mean	t	df	Sig. (2-tailed)
Pair 1	Pretest-Posttest	-0.30189	.6821	.0541	-5.58	158	.000
Pair 2	Pretest-Delayed-Posttest	-0.26250	.6867	.0543	-4.84	159	.000
Pair 3	Posttest-Delayed Posttest	-0.08176	.6653	.0543	-1.55	158	.123

Source: Field Survey, 2019

Table 7 above presents paired t-test for pretest-posttest, pretest-delayed posttest and posttest-delayed posttest with respect to the two instructional methods. In pair 1 and 2, the p-value for the two pairing is .000. This implies that there is significant difference in the mean scores, at all levels of pairing, between students in constructivist group and the students in traditionalist group, except the posttest-delayed posttest pairing which is at .123 which is not significant at level 0.05.

H₀₁: The mean achievement scores of students taught through traditional teaching approaches (with teacher) and those taught through constructivist-based teaching approaches (co-operative learning) do not differ significantly ($P < 0.05$)

Table 8: Analysis of Covariance (ANCOVA) on students overall Achievement

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.296	1	6.296	29.585	.000
Within Groups	33.414	157	0.213		
Total	39.711	158			

Source: Field Survey, 2019

Decision at $P < 0.05$ is Significant

$F_{cal} = 29.585$ and $F_{critical} = 3.182$

The research questions were analyzed using mean and standard deviation. The null-hypotheses were analyzed and tested at 0.05 significant level (Alpha level) using ANCOVA (Analysis of Covariance) with critical value of (F-critical=3.182).

Table 8 above showed that experimental group performed significant better than the control group since F-value of 29.585 obtained which greater than F-critical that is $F\text{-critical} < F_{\text{cal}}$ ($3.07 < 29.585$) is significant at .000.

Data presented on the above table 8 show that teaching method as a main effect on students' achievement in ICT is significant. This is because the probability value of .000 at which this main effect is shown to be significant is lower than the level of 0.05 at which it is being tested. This implies that teaching methods have statistically significant effect on students' mean achievement score in ICT. In other words, the null hypothesis No1 of no statistically significant effect is rejected at 0.05 level of confidence.

H₀₂: The students' mean self-concept scores of learning before and after the intervention of both traditional and constructivist groups (students taught using the Lecture method or the constructivist method) do not differ significantly at post-test after 3 weeks

Table 9: Analysis of Covariance (ANCOVA) on student self-concept

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.414	1	1.414	7.197	.000
Within Groups	30.85	157	0.196		
Total	32.264	158			

Source: Field Survey, 2019

Decision at $P < 0.05$ is Significant

$F_{\text{cal}} = 7.197$ and $F\text{-critical} = 3.182$

The research questions were analyzed using mean and standard deviation. The null-hypotheses were analyzed and tested at 0.05 significant level (Alpha level) using ANCOVA (Analysis of Covariance) with critical value of (F-critical=3.182).

Table 9 above showed that experimental group performance significant better than the control group. The F-value of 7.197 obtained which greater than $F_{cal} > F_{critical}$ ($7.197 > 3.07$) is significant at .000.

Data presented on the above table 9 show that teaching method as a main effect on students' self-concept in ICT at post-test is significant. This is because the probability value of .000 at which this main effect is shown to be significant is lower than the level of 0.05 at which it is being tested. This implies that teaching methods have statistically significant effect on students' mean self-concept score in ICT. In other words, the null hypothesis No2 of no statistically significant effect is rejected at 0.05 level of confidence.

4.6 Discussion

The Effect of Teaching Methods on Students' Achievement in ICT at Post-test

Findings from the study show that the constructivist group performed significant better than the traditional lecture group. This was indicated by the value of F_{cal} and $F_{critical}$ (see table 7 and 8 above). This implies that the constructivist model is superior to traditional lecture method of teaching ICT in Senior High School level in the upper west region. The difference may be attributed to the fact that constructivist model provides an opportunity for students to play active role in building their own knowledge. This agrees with (Agogo & Naakaa, 2014) who is of the view that constructivist model is a veritable tool for shifting science teaching from the traditional talk and chalk method to the hand-on method which is learner centred. (Akinyemi & Folashade, 2010), also supported this by saying that constructivists of different persuasion hold a

commitment to the idea that the development of understanding requires active engagement on the part of the learner.

The result of the finding also indicates that there was improvement in academic performance of students in constructivist group on post-test and delayed post-test. Their mean scores as indicate in table 4 and 5 the post-test and delayed post-test were higher than their scores at the post-test level compares to their colleagues in the traditionalist group. During post-test, students in constructivist group were able to retain 65.77% whilst traditionalist group retain 62.45% of the concept taught. The same trend occurred at the delayed post-test stage, students in the constructivist group were able to retain 75.5% (increase) of the concepts taught compared to their colleagues in the traditionalist group who could only retain 43.48% (decrease) of the concept taught.

In view of the afore-mentioned findings, the study has been able to establish that there was a statistically difference for the samples post-tests and delayed post-test where the students who received the constructivist pedagogy scored higher than their colleagues in the traditional group. The finding of the study are in line with the research finding of (Caprico, 1994); (Saigo, 1999) (White, 1999) and (Hayes, 2000) Though (Kurt & Somchai, 2004) found that there was no significant difference in achievement between constructivist instructed students and traditional instructed students, they concluded that the constructivist group of student had higher scores on the post-test and delayed post-test compared to those of the traditionally instructed students. This implies that the finding of this study is also in line with (Kurt & Somchai, 2004) conclusion.

The Effect of Students' self-concept scores by the two teaching Methods at Post-test after 3 weeks

Data presented on table 9 clearly show that teaching method is significant on students' self-concept of learning after the intervention of both traditional and constructivist groups. The mean self-concept scores of students at post-test were compared with their achievement scores in the two groups. It was found that self-concept of the students taught with constructivist method was much higher than the students taught with traditional lecture method. This could be as a result of students solving problems themselves and by doing so students develop understanding of subject matter. The students apply and represent their ideas in a manner similar to the way in which experienced individuals in the field generate and use knowledge (Akanwa & Ovute, 2014) these researchers observed that the adoption of learner-centred strategy based on constructivist model can improve learners' academic achievement and self-concept and do not allow knowledge to fade away easily from the memory. This result is also in line with the finding of (Udogu & Njelita, 2010) who remarked that in accordance with the constructivist model, students now need opportunities to apply their knowledge in new retention of knowledge gained. The construction of knowledge is a lifelong process and at any time. The body of knowledge the individuals have constructed makes sense and helps them interpret or predict events in their experiential worlds

CHAPTER FIVE

5.0 SUMMARY OF FINDING, CONCLUSION AND RECOMMENDATION

5.1 Introduction

The purpose of this chapter is to summarize the discussion of the study finding and implications of the study and their significance and contribution to the theory and practices. The chapter is divided into five sections. In the first section, the summary of the major finding of the study are discussed, this is followed by conclusions which include the contribution that the study made to knowledge, the third section presents the recommendations of the study, the four section presents suggestion for improving teaching and learning of ICT and the final section deals with suggestions for future research.

5.2 Summary of Major Findings of the Study

The purpose of the study was to Examining the impact of the constructivist- Based Instructional Model on student's learning outcome in ICT and to find out how best these methods of instruction could be applied to improved learning and knowledge construction on students in SHS in Lawra Municipality in the Upper West Region of Ghana. The research frame work adopted is experimental survey. Quasi-experiment comprises of pre-test, post-test and post-test non-equivalent experimental and control group layout. The description survey was the main deign used for this study and is the exploration and descriptive of phenomena in real life situation. The target population for the study was students in Lawra Municipality. The sample size were 165 students from the two selected school, two classes (81 students) were selected in the Business department at Birifoh SHS and two classes (84 students) from the Home economics department at Eremon SH/T. the research instrument used for the data collection was

questionnaire-test. The data were analyzed using Statistical Product for Scientific Solution version 25, Microsoft Office Excel 2016 for windows for descriptive statistics that made up of mean and standard deviation as well as frequencies and simple percentages. The results were presented in tables and charts.

The primary goal of this research was to compare the performance or achievement of learners educated using the constructivist teaching strategy (student-centered learning) and the traditional (teacher-centered teaching) method of teaching the use of learning techniques and knowledge retention by the student.

Based on this general objective, the study was aimed at:

- Investigating whether there is a substantial distinction in students learning strategies between the two groups of learners taught using constructivist-based teaching methods and traditional teaching methods.
- Investigating whether there is a substantial distinction in students' knowledge retention before and after the intervention of both constructivist-based teaching methods and traditional teaching methods.

Based on the above stated objectives, the following null hypothesis was developed to direct the research and was state at level 0.05 of significance

HO₁. There is no significant distinction in the achievement of students taught through traditional teaching approaches (with teacher, which is teacher-centered) and those taught through constructivist-based teaching approaches (co-operative learning, which is student-centered)

HO₂. There is no significant distinction in student's use of learning strategies before and after the intervention of both constructivist and traditional group of students.

Hypothesis was tested at level 0.05 of significance.

Result from the study revealed that experimental group performed significantly better than the control group. Analysis of Covariance (ANCOVA) on student achievement, F-value of 29.585 obtained which greater than F-critical. $F\text{-critical} < F_{cal}$ ($3.07 < 29.585$) is significant at .000.

Also, Analysis of Covariance (ANCOVA) on student self-concept that is knowledge retention. It revealed that, experimental group performance significantly better than the control group. The F-value of 7.197 obtained which greater than $F_{cal} > F\text{-critical}$ ($7.197 > 3.07$) is significant at .000.

5.3 Conclusion

The findings from this study show that Constructivist Based Instructional teaching strategy led to improved achievement of students in ICT as well as enhance self-concept of the students. Over the years, students have shown that the use of good instructional model facilitates to a large extent the process. Students taught with constructivist method show evidences of higher self-concept than those taught with the traditional lecture method. The teacher duty is to provide the enabling environment that will facilitate learning and knowledge construction. This is because constructivist does not see education as what the teacher gives but a natural process spontaneously carried out by individual and is acquired not by listening to words but experiences upon the environment.

If teachers are to improve students' ICT conception or the learning of ICT, they must know that:

Students come to class with their own ideas;

- These ideas often differ from those of scientists;

- These misconceptions are held tenaciously and resistance to change; and
- The traditional method of teaching sometimes left these misconceptions unchanged.

With these in mind, teachers should provide a learning environment that engages students in an active search for new knowledge and enable them modify their existing cognitive structure by employing constructivist instructional method in their lesson delivery which has the potential to draw out misconception in students.

5.4 Recommendation

Based on the findings of the study, the following recommendations were made.

- The classroom needs to be a human community that prepares learners to live in the real world and students tend to retain ideas generated by themselves than those memorized from textbooks or from the teacher. ICT teacher should create a learning environment that is invigorating, interactive and informative. The ICT teacher provides learners with choices, tools and constructs, help them learn and not merely instruct them;
- When teachers use constructivist based instructional method to teach, students will be held accountable for learning since the students are fully involved in the whole learning process that enhance knowledge and their self-concept;
- When teachers use constructivist based instructional method to teach, learning reached all students since all students are fully involved in the interaction and production of their own individual foldable;
- The constructivist-based instructional model has positive effect on students' conceptual change hence teachers should be encouraged to employ it more in the teaching of ICT and other related subject;

- ICT teachers and other subjects' teachers should be encouraged to use this method to facilitate in students the exchange of idea, views and challenge students to compare ideas including those of the scientific perspective; and
- ICT teacher should always use this method of instruction to ascertain students' prior ideas, expectations and explanations before instruction.

5.5 Suggestion for Improving Teaching and Learning of ICT

It is the belief of the present research that presenting ICT and other subjects' concepts in this approach is a critical resource for teaching improvement and better learning outcome. Based on the research conducted, the researcher suggests the following:

- Preparation of a teacher guide containing the 5Es step by step activities will equip ICT and other subjects' teachers in adoption of the 5Es model;
- School administrators should support and encourage ICT and other teachers to embrace the constructivist pedagogical practice in ICT and other subjects' classrooms; and
- Professional bodies such NaCCA and GES should endeavor to organize academic workshops views to equip and inform the teacher on the new methods adopted in teaching ICT and other difficult concepts. ICT teachers should change in practice and embrace the change in practice and persist in it to enhance teaching of ICT concepts.

5.6 Suggestion for Further Studies

- Based on the limitation of the study, the study could not cover all SHS in the Municipality; the researcher suggested that if a similar study should be conducted to broaden the scope of the study to cover all the SHS in the Lawra Municipality.

- Also, if further research could be undertaken in other Municipalities and Metropolis in the Region and in the country for comparative purposes.



REFERENCES

- Abida, K., & Muhammad, A. (2012). Constructivist Vs Traditional: Effective instructional approach in teacher education. *International journal of Humanities and Social Science*, 2, (5): 170-177
- Abonyi, O. (2005). "Cultural constructivism in science education: issues of 21st century in Nigeria," Lagos: NERDC.
- Agogo, P. O., & Naakaa, D. A. (2014). Effects of 5es constructivist instructional strategy on students' interest in senior secondary genetics in Gwer Local Government Area Benue State, Nigeria. *Global Journal of Environmental Science and Technology*, 1(2), 015-019.
- Akanwa, U. N., & Ovute, A. O. (2014). The effect of constructivist teaching model on SSS Physic students' achievement and interest. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, 4, (1): 35-38.
- Akinyemi, O. A., & Folashade, A. (2010). *Constructivist practices through guided discovery approach: The effect on students cognitive achievement in Nigerian senior secondary school Physics*. Eurasian J. Phys. Chem. Educ.
- Aldridge, Jill M, Fraser, Barry J, Taylor, Peter C, et al. (2000). Constructivist Learning Environment in a Cross-national Study in Taiwan and Australia. *International Journal of Science*. *International Journal of Science*, 22, 37-55.
- Bandura, A. (1994). Self-Efficacy. *Encyclopedia of human behavior*.
- Becta, G. (2002). "Impact of Information and communication technologies on pupil learning and attainment," ICT in school research and evaluation series -No 7, DFES.

- Bouffard, T., & Couture, N. (2003). Motivational profile and academic achievement among students enrolled in different schooling tracks. *Educational studies in Mathematics*.
- Brook, J. G., & Brook, M. G. (1993). The case for constructivist classrooms. *Alexandria, Va.: Association for Supervision and Curriculum Development*.
- Bruner J 1986. (1986). *Actual Minds, Possible worlds, Cambridge*. MA: Harvard University Press.
- Caprico, R. (1994). Easing into Constructivism, Connecting Meaningful Learning with Students Experience. *Journal of College of Science Teaching*. 23(4), 210-212.
- Carey, S. (1985). *Conceptual change in childhood*. Cambridge: MA:MIT Press.
- Cheek, D. (1992). *Thinking Constructively About Science, Technology and Society Education*. . Albany, NY: State University of New York Press.
- Cooper, D. R., & Schindler, P. S. (2001). *Business research methods*. New York: McGraw-Hill Companies.
- Creswell, J. W. (1994). *Research design: Qualitative and Quantitative approaches*. Thousand Oaks,. CA: SAGE Publications.
- Crewell, J. W. (2002). *Education Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research*. Upper Saddle River,. NJ: Merrill/Prentice Hall.
- Deci, E. L., & Ryan, R. M. (2000). The "What" and "Why" of Goal Pursuits: Human needs and the Self-Determination of Behavior. *Psychology Inquiry*,.
- Dewey, J. (1966). *"Democracy and education," west African Journal of Industrial and Academic Research*, 5.

- Dewey, J. (1983). *How We Think. A Restatement the Reflection of Reflective Thinking to the Educative Process*. Boston: DC.
- Driver, R., & Erickson, G. (1983). Theories-in-action: some theoretical and empirical issue in the study of students conceptual frameworks in science. *Studies in Science Education* 10, 37-60.
- Ekon, E E. (2013). *Effects of Five-Step Conceptual Change Instructional Model on student Perception of their Psychosocial Learning Environment, Cognitive Achievement and Interest in Biology*. An Unpublished Ph.D thesis. Nsukka: Faculty of Education, University of Nigeria.
- Ekon, E. E., Ekwueme, C. O., & Meremikwu, A. (2014). Effect of Five Phases of Constructivist Instructional Model (CIM) on Junior Secondary School Two (JSS) Students' Cognitive Achievement and Interest in Basic Science and Mathematics in Cross River State of Nageria. *Education*. 4, (3): 74-77.
- Ferber, R., Sheatsley, P., Turner, A., & Waksberg, J. (1980). Washington, DC:: American Statistical Association.
- Fullan, M. (1995). "School as a learning organization: Distant dreams.". In *Theory in Practice* (pp. Vol. 34 (4), 234-235).
- Gatlin, L. S. (1998). *The effect of Pedagogy Informed by Constructivism: A Comparison of Student Achievement Across Constructivist and Traditional Classroom Environment*. New Orland: Unpublished Doctoral Dissertation.
- Gay, L. R. (1996). *Educational research* (Vol. 5th ed.). Englewood Cliffs, NJ: Prentice Hall.

- Greene, J., Morelli, S., Lowenberg, K., Nystrom, L., & Cohen, J. (2009). Cognitive load selectively interferes with utilitarian moral judgment. In *Cognitive* (pp. p.1144-1154).
- Hannula, M. S. (2006b). Motivation in mathematics: Goals reflected in emotions. *Educational Studies in Mathematics*.
- Harmer, j. (1988). The practice of English Language Teaching. Edinburgh gate Harlow. In j. Harmer, & j. Harmer, *The practice of English Language Teaching*. (p. p.51). England: Longman.
- Hayes, B. (2000). Teacher-Centered Instruction versus Student-Centered Instruction. *American School Board Journal*, p.1-5.
- Hulleman, C., Schweigert, A., & Harackiewicz, J. (2008). Task Values, Achievement Goals and Interest; An integrative Analysis. *Journal of Educational Psychology*. 22,415-435.
- Jones, G. R. (2000). Contemporary Management. In G. R. Jones, *Contemporary Management* (p. P.427). Boston, USA: McGraw-Hill Higher Education.
- Kaplan, A., & Midgey, C. (1997). The effect of achievement goals: does level of perceived academic competence make a difference? *Contemporary Education Psychology*. 22, 415-435.
- Koetting, J. R. (1996). In *Philosophy, research, and education*. In D. H. Jonassen (ED.) *Handbook of research for educational communications and technology* (pp. 1137-1147). New York: Simon & Schuster Macmillan.

- kurt, H. B., & Somchai, M. (2004). A Comparison of Student's Achievement and Attitudes Between Constructivist and Traditional Classroom Environments in Thailand Vocational Electronics Programs. *Journal of Vocational Education Research*, 29(2), 1-3.
- Kyle, J., & Abell, S. (1989). *Enhancing Prospective Teachers Conceptions of Teaching and Science* *Journal of Science Teacher Education*.
- Lemke, J. L. (2001). Articulating communicaties: Sociocultural perspectives on science education. *Journal of Research in Science Teaching*. 38, 296-316.
- Makanong, A. (2000). *The Effects of Constructivist Approaches on Ninth Grade Algebra Achievement in Thailand Secondary School Students*. Minneapolis: Unpublished Doctoral Dissertation, University of Minnesota.
- Margolis, H., & McCaba, P. (2006). International in School and Clinic. In H. Margolis, & P. McCaba, *International in School and Clinic* (pp. p 218-227).
- Marin, N., Benarroch, A., & Jimenez Gomez, E. (2000). What is the relationship between social constructivism and Piagetian constructivism? An analysis of the characteristics of the ideas within both theories. *International Journal of Science Education*. 22, 225-238.
- Mary, T. (1997). *Social research: issues, methods and process*, Buckingham. Open University Pres.
- Melucci, N. (2010). *E-Z Psychology*. New York: Barron's Educational Series, Inc.
- (1994). In P. Moss.
- Moss, P. (1994). Can there be validity without reliabilty? *Educational Researcher*. In Moss, *Educational Researcher* (pp. 23(2), 5-12).

- Myers, D. (1996). Exploring Psychology. In D. Myers, *Exploring Psychology* (p. 297). New York: Freeman.
- Nachmias, C., & Nachmias, D. (1996). *Research Methods in the Social Science*. New York: St.Martin's Press.
- Ojugo, A. A., Aghware, F. O., Okonta, E. O., Igbunu, R. O., & Onochie, C. (2008). *"Constructivism: Aid to teaching/learning of computer science in Delta State, (Vol. Vol.5(2). Nigeria: ASSEQEN,ISN:0331-4790.*
- Pajares, F., & Graham, L. (1999). Self-efficacy, motivation constructs, and mathematics performance of entering middle school students. *Contemporary Educational Psychology*. 24, 124-139.
- Pantziara, M., & Philippou, G. (2007). Students Motivation and Achievement and Teacher's Practices in Classroom. In J.Woo, H.Lew,K.Park & D. Seo (Eds.), *Proceedings of the 31th Conference of the International Group for the psychology in Mathematics Education., Vol. 4, pp. 57-64.*
- Piaget, J. (1976). *To understand is to invent: The future of education*. New York: Penguin Book.
- Piagets, J. (1937). *La construction du reel chez l'enfant*. Neucatal: Delachaux et Niestle [Cook, M. (trans) 1954. *The construction of reality in the child*.New York: Basic Books] (cited in Von Glasersfeld 1989). New York: Penguin.
- Pintrich, P. R. (2003). A Motivational Science Perspective on the Role of students Motivation in Learning and Teaching Contexts. *Journal of Education Psychology*. 95(4), 667-686.
- Polit, D. F. (1985). *Research principles and method, (1st ed.)*. JB Lippincott: Philadelphia.

- Remenyi, D., Williams, B., Money, A., & Swarts, E. (1998). In *Information System Management: the Need for a Post - Modern Approach, International Journal of Information Management* (Vol. 17, pp. 421-435).
- Richardson, V. (1997). Constructivist teaching and teacher education: Theory and practice. In V. Richardson (Ed). *Constructivist teacher education: Building a world of new understandings*. london: Palmer Press.
- Ryan, R. M., & Deci, E. L. (2000a). In *Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. Contemporary Educational Psychology* (pp. 25, 54-67).
- Saigo, B. W. (1999). *A Study to Compare Traditional and Constructivism Instruction of a High School Biology Unit on Biosystematics*. University of IOWA, IOWA City: Unpublished Doctoral Dissertation.
- Saunders, M., Lewis, P., & Thornhill, A. (2007). *Research Methods for Business Students*. (5th Ed ed.). London: Pearson Education Limited.
- Sekaran, U., & John, W. S. (2000). *Research Methods for Business*. New York: NY.
- Sikpa, C. (2011). *Handbook of Survey Research*. Academic Press, New York: NY.
- Spector, P. E. (1981). *Research designs*. Beverly Hills, CA: Sage.
- Taylor, P., Fraser, B., & Fisher, D. (1997). Monitoring constructivist learning environments . *International Journal of Education Research*, 27: 293-302.

- Udogu, M. E., & Njelita, C. B. (2010). Effect of constructivist-based instructional model on students' conceptual change and retention on some difficult concepts in Chemistry. *African Research Review: An International Multi-Disciplinary Journal*, 4, (2): 219-229.
- Von Glasersfeld, F. (1990). *Constructivism in education*. In HUSEN, Torsten and Postlethwaite TN(Eds.) *The international encyclopaedia of education: Research and studies* (Vol. Supplementary Volume). Oxford UK, New York: Pergamon Press.
- Von Glasersfeld, E. (1987). Learning as a constructive activity. In C. Janvier (Ed.), *Problems of representation in the teaching and learning of mathematics*. Hillsdale: NJ: Erlbaum.
- Vygotsky LS. (1962). *Thought and Language*. (Edited and Translated by Eugenia Hanfmann and Gertrud Vakar). Cambridge: Massachusetts Institute of Technology Press.
- Vygotsky, L. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.
- WEAC. (1996). *Teaching for Understanding: Educating students for Performance*.
- White, J. H. (1999). *Constructivism in College Biology Classroom: Effects on Content Achievement, Cognitive Growth, and Science Attitude of act-Rik Students*. Raleigh: North Carolina State University: Unpublished Doctoral Dissertation.
- Zaho, Y. (2003). *The use of a constructivist teaching model in environmental science at Beijing Normal University*. China: China Papers.
- Zuallkernan, L. A. (2006). A framework and a methodology for developing authentic constructivist- Learning environments. *Educational Technology & Society*.

APPENDIX A

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION – KUMASI

DEPARTMENT OF INFORMATION TECHNOLOGY – EDUCATION

Preamble: The researcher, a student of UEW- Ksi Campus, is seeking information relating to the topic: The impact of constructivist – Based Instructional Model to the Traditional Lecture/Teaching Method on student’s learning outcome and knowledge retention in ICT UW/R

(Senior High Schools in Lawra Municipality in the Upper West Region of Ghana)

Please mark (√) where necessary

SECTION A: Demographics

1. SEX MALE [] FEMALE []
2. AGE 10-15 [] 16-20 [] 21-25 []
3. Have you study ICT at the JHS Level? Yes [] No []
4. Group Belong to: Control Group (CP) [] Experimental Group (EP) []

SECTION B:

Assessment of the two groups of students taught through constructivist – based instructional method and traditional instructional method on student’s achievement and knowledge retention using **thirty (30) MCQ in ICT question and two theory questions.**

Please circle ○ where necessary the correct answers

1. Mathematical calculations in a spread sheet application are called?
A. Tablets B. Formula C. Numbers C. Value
2. A chain of words, phrase or graphic (images) that a user clicks to access a new webpage or website on the internet is called?
A. Link B. Hyperlink C. Hypertext D. web address
3. Which of the following excel screen components cannot be turned on or off?

- A. Formula bar B. Status bar C. Toot bar D. None
4. The transferring of data from a remote computer to local computer is called?
A. Uploading B. Unlinking C. Downloading D. Loading
5. Which of these is not a function in Microsoft Excel?
A. SUM () B. SUB () C. AVG () D. PI ()
6. The act of transmitting data from one's own computer to a remote computer on the internet or other network is called?
A. Downloading B. Uploading C. loading D. Internet
7. Assume $A1=2$, $B1=4$, $C1=4$, $C1=7$, $D1=3$, and $E1=5$. If F1 contains the formula $C1-E1*B1+D1$, i.e $F1=C1-E1*B1+D1$, what will be the value of F1?
A. 121 B. -100 C. 256 D. -4
8. All the following are components of URL except
A. Web Name B. Network Type C. Domain Name D. Domain Extension
9. What is the correct formula you need in order to add the numbers up in cells C3 to C6
A. =SUM (C3,C4,C5,C6) C. =SUM (C3:C6)
B. =SUM (C3+C6) D. =SUM (C3;C6)
10. The mode of communication between communication devices is called?
A. Protocol B. Internet Protocol (IP) C. Protocol Address D. URL
11. What does the error message #DIV/0! Mean?
A. The formula is trying to include a cell that does not exist
B. The answer is less than zero
C. The formula is trying to include a cell that has text instead of a number
D. The formula has tried to divide a number by zero
12. The format of communication between computers on the internet is called?
A. Protocol B. Internet Protocol (IP) C. Protocol Address D. URL
13. Which cell is referred to as the Home cell in Excel?
A. A1 B. A5 C. B1 D. B5
14. An example of a generic domain extensions is
A. .uk B. .us C. .edu D. .gh
15. Each excel file is a workbook that contain different sheets. Which of the following connate a sheet in workbook?

- A. Worksheet B. Module sheet C. Data sheet D. Chart sheet
16. All the following are reasons that will make a webpage not to load except
- A. You've typed in an incorrect web address (URL)
B. You're connected to the internet
C. The computer or server where the web page is stored is down
D. Too many users are trying to view the same web page at the same time?
17. By default, an excel file is made of how many sheet(s).
- A. 1 B. 2 C. 3 D. 4
18. All the following are Domain Extensions in Ghana except
- A. .com.gh B. .edu.gh C. .gov.ksi D. .mail.gh
19. The fifth row and seventh column in a Microsoft excel will create a cell with address as.
- A. E5 B. D7 C. F7 D. G5
20. The main folder where incoming mails get stored in is.
- A. Office box B. Inbox C. Outbox D. Spam
21. Book1 is an example of how.....are numbered and named during each work session. A. Column B. Programs C. Title bars D. Workbooks
22. An unsolicited but identical email messages sent to numerous recipients which normally contains promotion and adverts is called?
- A. Draft B. Spam C. Inbox D. Trash
23. Which of the following displays the contents of the active cell?
- A. Active cell B. Formula bar C. Menu bar D. Name box
24. A folder where e-mail messages that are being composed or yet to be sent are stored is
- A. Draft B. Spam C. Inbox D. Trash
25. To open an existing workbook, you can click the open button on the toolbar.
- A. Drawing B. Formatting C. Forms D. Standard
26. A rule of acceptable behaviour on the use of the Email is called?
- A. Email Protocol B. Email Etiquette C. Email polite and courteous D. Email behaviour
27. Thefunction tallies the number of values in a range.
- A. AVERAGE B. COUNT C. COUNTA D. SUM
28. A rule of acceptable behaviour on the use of the internet is called?

- A. Internet Etiquette B. Phishing C. Flame D. IPR

29. The intersection of a column and a row is called?

- A. Row B. Column C. Cell D. Name

30. Spread sheets are often used for all the following except.

- A. Decision making C. Cash flow analysis
B. Financial report D. Job financial

SECTION B (10MARK)

1. Before, anyone should use the internet; there are some rules and regulation that one needs to know of before using it. Can you mention some, at least 5 of them will do.

- i.
- ii.
- iii.
- iv.
- v.

2. We used internet at home, in school and many more places. Can you at least state 5 uses of it?

- i.
- ii.
- iii.
- iv.
- v.

Please give (if any) suggestion/recommendation on how else you think or whether this methods of instruction can effect on student’s conceptual change and should teachers be encouraged to employ it in teaching other subjects

.....
.....
.....
.....

THANK YOU FOR YOUR TIME AND COOPERATION

APPENDIX B

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION – KUMASI

DEPARTMENT OF INFORMATION TECHNOLOGY – EDUCATION

Preamble: The researcher, a student of UEW- Ksi Campus, is seeking information relating to the topic: The impact of constructivist – Based Instructional Model to the Traditional Lecture/Teaching Method on student’s learning outcome and knowledge retention in ICT UW/R

(Senior High Schools in Lawra Municipality in the Upper West Region of Ghana)

Please mark (√) where necessary

SECTION A: Demographics

1. SEX MALE [] FEMALE []
2. AGE 10-15 [] 16-20 [] 21-25 []
3. Have you study ICT as core subject at the JHS Level. Yes [] No []
4. Group Belong to: Control Group (CP) [] Experimental Group (EP) []

SECTION B:

Assessment of the two groups of students taught through constructivist – based instructional method and traditional instructional method on student’s achievement using **thirty (30)** ICT Test Questions.

Please circle  where necessary the correct answers

1. Thefunction tallies the number of values in a range.
A. AVERAGE B. COUNT C. COUNTA D. SUM
2. Which of these is not a function in Microsoft Excel?
A. SUM () B. SUB () C. AVG () D. PI ()
3. A section of text or graphic that is capable of linking up with all the webpages on a website or another is called?
A. Link B. Hyperlink C. Hypertext D. web address

4. What does the error message #DIV/0! Mean?
 - A. The formula is trying to include a cell that does not exist
 - B. The answer is less than zero
 - C. The formula is trying to include a cell that has text instead of a number
 - D. The formula has tried to divide a number by zero
5. The act of transmitting data from a remote computer on the internet or other networks to one's own computer is called?
 - A. Uploading
 - B. Unlinking
 - C. Downloading
 - D. Loading
6. Mathematical calculations in a spread sheet application are called?
 - A. Tablets
 - B. Formula
 - C. Numbers
 - C. Value
7. The act of transmitting data from one's own computer to a remote computer on the internet or other network is called?
 - A. Downlinking
 - B. Uploading
 - C. loading
 - D. Downloading
8. Which cell is referred to as the Home cell in Excel?
 - A. A1
 - B. A5
 - C. B1
 - D. B5
9. All the following are components of URL except
 - A. Web Name
 - B. Network Type
 - C. Domain Name
 - D. Domain Extension
10. Each excel file is a workbook that contain different sheets. Which of the following connate a sheet in workbook?
 - A. Worksheet
 - B. Module sheet
 - C. Data sheet
 - D. Chart sheet
11. The set of rules that enable different types of computers and networks on the internet to communicate with one another is called?
 - A. Protocol
 - B. Internet Protocol (IP)
 - C. Protocol Address
 - D. URL
12. Which of the following excel screen components cannot be turned on or off?
 - A. Formula bar
 - B. Status bar
 - C. Toot bar
 - D. None
13. The format of communication between computers on the internet is called?
 - A. Protocol
 - B. Internet Protocol (IP)
 - C. Protocol Address
 - D. URL
14. An example of a generic domain extensions is
 - A. .uk
 - B. .us
 - C. .edu
 - D. .gh
15. By default, an excel file is made of how many sheet(s).
 - A. 1
 - B. 2
 - C. 3
 - D. 4

16. All the following are reasons that will make a webpage not to load except
- You've typed in an incorrect web address (URL)
 - You're connected to the internet
 - The computer or server where the web page is stored is down
 - Too many users are trying to view the same web page at the same time\
17. All the following are Domain Extensions in Ghana except
- .com.gh
 - .edu.gh
 - .gov.ksi
 - .mail.gh
18. Which of the following displays the contents of the active cell
- Active cell
 - Formula bar
 - Menu bar
 - Name box
19. The main folder where incoming mails get stored in is. Or the destination to which electronic mails are delivered is called.
- Office box
 - Inbox
 - Outbox
 - Spam
20. An unsolicited bulk mail, that is email you don't want or needed is called
- Draft
 - Spam
 - Inbox
 - Trash
21. Assume A1=2, B1=4, C1=4, C1=7, D1=3, and E1=5. If F1 contains the formula C1-E1*B1+D1^A1. i.e $F1=C1-E1*B1+D1^{A1}$, what will be the value of F1?
- 121
 - 100
 - 256
 - 4
22. A folder where e-mail messages that are being composed or yet to be sent are stored is
- Draft
 - Spam
 - Inbox
 - Trash
23. What is the correct formula you need in order to add the numbers up in cells C3 to C6
- =SUM (C3,C4,C5,C6)
 - =SUM (C3+C6)
 - =SUM (C3:C6)
 - =SUM (C3;C6)
24. A rule of acceptable behaviour on the use of the Email is called?
- Email Protocol
 - Email Etiquette
 - Email polite and courteous
 - Email behaviour
25. Book1 is an example of how.....are numbered and named during each work session.
- Column
 - Programs
 - Title bars
 - Workbooks
26. The rules and regulations that are laid down to govern the use of the internet are called?
- Internet Etiquette
 - Phishing
 - Flame
 - IPR
27. The fifth row and seventh column in a Microsoft excel will create a cell with address as.
- E5
 - D7
 - F7
 - G5

28. To open an existing workbook, you can click the open button on thetoolbar.
A. Drawing B. Formatting C. Forms D. Standard
29. The intersection of a column and a row is called?
A. Row B. Column C. Cell D. Name
30. Spread sheets are often used for all the following except.
C. Decision making C. Cash flow analysis
D. Financial report D. Job financial

NB: for Experimental Group Only (EP)

Do you wish such method of instruction could be applied in teaching other subjects?

Yes [] No []

SECTION B (10MARK)

1. What are some of the rules and regulation that govern the use of the internet? State any 5 of them.
- i.
- ii.
- iii.
- iv.
- v.
2. Aside from using it to learning. What other 5 things can we used it for. The internet?
- i.
- ii.
- iii.
- iv.
- v.

Please give (if any) suggestion/recommendation on how else you think or whether this methods of instruction can effect on student’s conceptual change and should teachers be encouraged to employ it in teaching other subjects

.....
.....
.....
.....

THANK YOU FOR YOUR TIME AND COOPERATION



APPENDIX C

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION – KUMASI

DEPARTMENT OF INFORMATION TECHNOLOGY – EDUCATION

Preamble: The researcher, a student of UEW- Ksi Campus, is seeking information relating to the topic: The impact of constructivist – Based Instructional Model to the Traditional Lecture/Teaching Method on student’s learning outcome and knowledge retention in ICT UW/R

(Senior High Schools in Lawra Municipality in the Upper West Region of Ghana)

Please mark (√) where necessary

SECTION A: Demographics

5. SEX MALE [] FEMALE []
6. AGE 10-15 [] 16-20 [] 21-25 []
7. Have you study ICT at the JHS Level. Yes [] No []
8. Group Belong to: Control Group (CP) [] Experimental Group (EP) []

SECTION B:

Assessment the two groups of students taught through constructivist – based instructional method and traditional instructional method on student’s achievement using **thirty (30)** ICT Test Questions.

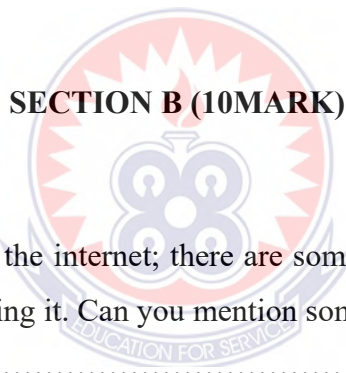
Please circle ○ where necessary the correct answers

- Which of the following excel screen components cannot be turned on or off?
A. Formula bar B. Status bar C. Toot bar D. None
- Spread sheets are often used for all the following except.
A. Decision making C. Cash flow analysis
B. Financial report D. Job financial

3. A chain or section of words/text, phrase or graphic (images) that a user clicks to access a new webpage or website on the internet or that is capable of linking up with all the webpages on a website or another is called?
A. Link B. Hyperlink C. Hypertext D. web address
4. What does the error message #DIV/0! Mean?
A. The formula is trying to include a cell that does not exist
B. The answer is less than zero
C. The formula is trying to include a cell that has text instead of a number
D. The formula has tried to divide a number by zero
5. Thefunction tallies the number of values in a range.
A. AVERAGE B. COUNT C. COUNTA D. SUM
6. The act of transferring or transmitting of data from a remote computer to local computer on the internet or other networks to one's own computer is called?
A. Uploading B. Unlinking C. Downloading D. Loading
7. Each excel file is a workbook that contain different sheets. Which of the following connate a sheet in workbook?
A. Worksheet B. Module sheet C. Data sheet D. Chart sheet
8. The act of transmitting data from one's own computer to a remote computer on the internet or other network is called?
A. Downloading B. Uploading C. loading D. Network loading
9. Mathematical calculations in a spread sheet application are called?
A. Tablets B. Formula C. Numbers C. Value
10. All the following are components of URL except
A. Web Name B. Network Type C. Domain Name D. Domain Extension
11. To open an existing workbook, you can click the open button on the..... toolbar.
A. Drawing B. Formatting C. Forms D. Standard
12. The set of rules that enable different types of computers and networks on the internet to communicate with one another is called?
A. Protocol B. Internet Protocol (IP) C. Protocol Address D. URL
13. By default, an excel file is made of how many sheet(s).
A. 1 B. 2 C. 3 D. 4

14. The format of communication between computers on the internet is called?
A. Protocol B. Internet Protocol (IP) C. Protocol Address D. URL
15. Which of the following displays the contents of the active cell
A. Active cell B. Formula bar C. Menu bar D. Name box
16. An example of a generic domain extensions is
A. .uk B. .us C. .edu D. .gh
17. Which cell is referred to as the Home cell in Excel?
A. A1 B. A5 C. B1 D. B5
18. All the following are reasons that will make a webpage not to load except
A. You've typed in an incorrect web address (URL)
B. You're connected to the internet
C. The computer or server where the web page is stored is down
D. Too many users are trying to view the same web page at the same time?
19. Book1 is an example of how.....are numbered and named during each work session. A. Column B. Programs C. Title bars D. Workbooks
20. All the following are Domain Extensions in Ghana except
A. .com.gh B. .edu.gh C. .gov.ksi D. .mail.gh
21. The main folder where incoming mails get stored in is. Or the destination to which electronic mails are delivered is called.
A. Office box B. Inbox C. Outbox D. Spam
22. Which of these is not a function in Microsoft Excel?
A. SUM () B. SUB () C. AVG () D. PI ()
23. An unsolicited bulk mail or junk e-mail but identical email messages sent to numerous recipients which normally contains promotion and adverts is called?
A. Draft B. Spam C. Inbox D. Trash
24. What is the correct formula you need in order to add the numbers up in cells C3 to C6
A. =SUM (C3, C4, C5, C6) C. =SUM (C3:C6)
B. =SUM (C3+C6) D. =SUM (C3;C6)
25. folder where e-mail messages that are being composed or yet to be sent are stored is
A. Draft B. Spam C. Inbox D. Trash
26. A rule of acceptable behaviour on the use of the Email is called?

- A. Email Protocol B. Email Etiquette C. Email polite and courteous D. Email behaviour
27. The intersection of a column and a row is called?
A. Row B. Column C. Cell D. Name
28. The fifth row and seventh column in a Microsoft excel will create a cell with address as.
A. E5 B. D7 C. F7 D. G5
29. A rule of acceptable behaviour on the use of the internet or the rules and regulations that are laid down to govern the use of the internet are called?
A. Internet Etiquette B. Phishing C. Flame D. IPR
30. Assume $A1=2$, $B1=4$, $C1=4$, $C1=7$, $D1=3$, and $E1=5$. If F1 contains the formula $C1-E1*B1+D1$, i.e $F1=C1-E1*B1+D1$, what will be the value of F1?
A. 121 B. -100 C. 256 D. -4



1. Before, anyone should use the internet; there are some rules and regulation that that one needs to know of before using it. Can you mention some, at least 5 of them?
- i.
 - ii.
 - iii.
 - iv.
 - v.
3. We used internet at home, in school and many more places. Can you at least state 5 uses of it?
- i.
 - ii.
 - iii.
 - iv.
 - v.

Please give (if any) suggestion/recommendation on how else you think or whether this methods of instruction can effect on students' conceptual change and should teachers be encouraged to employ it in teaching other subjects

.....
.....
.....
.....

THANK YOU FOR YOUR TIME AND COOPERATION

