

EFFECTS OF GRAPHIC ORGANIZER ON JUNIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN COMPUTER STUDIES

**Authors: 1. Chinyere M.Onyeisi, Enugu State College of Education, (Technical), Enugu
2. Chinyere Omebe, Ebonyi State University, EBSU, Abakaliki**

Abstract

The study investigated the effects of graphic organizer on junior secondary school students' achievement in computer studies. The study employed a pre-test post-test non equivalent control group design. The study was carried out in Enugu Educational Zones of Enugu State. The population of the study is fifteen thousand one hundred and eighty two (15182) JSS II students of computer studies 2014/2015 session in Enugu educational zone of Enugu State. The sample for the study comprised of ninety one (91) Junior Secondary School class II students drawn from two co-educational secondary schools in Enugu Educational Zone of Enugu State. The schools were randomly sampled from a total of 9 co-educational secondary schools in the educational zone. One school was assigned to treatment group while the other school was assigned to the control group. All the intact classes were used for the study. The treatment group was taught computer studies with graphic organizer approach, while the control group was taught computer studies with conventional strategy. Three research questions and three corresponding null hypotheses guided the study. A Computer Studies Achievement Test (CSAT) that is made up of 30 items was used to collect data for the study. The research questions were answered descriptively using mean and standard deviation while the hypotheses were tested using ANCOVA at 0.05 level of significance. The results of the study revealed that graphic organizer approach is superior to the conventional strategy in facilitating students achievement in computer studies. It also revealed that the mean scores for females is higher than that of male for the group taught with the graphic organizer approach. It was also found that there is no interaction between method and gender on students' achievement in computer studies. Based on these findings, recommendations were made which include, that government should organize seminars, conferences and workshops to train computer science teachers on the use of graphic organizer as a teaching approach. The study finally concluded that use of graphic organizer teaching approach is effective in facilitating students achievement in computer studies and therefore should be used to teach students.

**Keywords: Graphic Organizer, Secondary School Students, Achievements, Computer
Studies**

INTRODUCTION

The growth of innovative technologies promotes all areas of the humanity, including the teaching and learning sector. These technologies, such as computer technologies and Information Communication Technologies (ICT) have influence greatly in national development in advanced countries. ICT as cited by Sambo, (2002) is a portion of the global tools used in turning the world to a “global village”. ICT is described as technologies used in gathering, saving, editing, and transmitting information in various forms. This comprises the utilization of computer, communication satellite, radio, television, telephone, tape recorders, video, and fax-machine. Therefore, the developmental potential of computer technologies has been widely used to promote national development (Heeks and Arun, 2006; Madon, 2005). More so, it is imperative that, Computer is an important part of these technologies that has influence greatly in education.

Okolo, (2010) define computer as an electronic device that accepts data through an input units, processes the data through processing units, store the data through storage units, display out results through an output units, it is very crucial for teachers to make use of computer at all level so as to join the technology drive, since it is modernization that could promote educational sector to make it more commending, their easiness of use, the influence and diversity of information transfer allow teachers and students to compete with technological world beyond the classroom. Computer education improves the value of learner’s content by making learning more realistic and relevant to life and has been comprehended as the perfect way to improve educational institutions.

The enclosure of computer education matters in the national curriculum and establishment of these technologies in schools especially in secondary have been worrisome to tutors, parents, and governments. It is very clear that students in schools today will need significant computer education practical knowledge, abilities and awareness to meet up the challenge of the contemporary world. Most importantly, the national economy relies greatly on proficient computer education to meet up the challenge in contemporary world. It is on these notes that mandated the recent inclusion of computer education by the educational bodies in Nigeria curriculum.

Therefore the relevance of computer application in education cannot be over emphasized. These computer application in education refers to the use of some educational media in teaching and learning, these can be used in various way to enhance teaching and learning, they can teach on their own when properly displayed to learners in a favorable situation, unlike the 1970s teaching aids which were supplementary to teachers content. They are supplementary to teaching and can present complete body of information, achieve learning objective even without the human teacher present. In essence, different medium can be combined together to bring the objective in teaching. Therefore, the advantages of one media can complement the disadvantages of another, and because of the disadvantage of some of these affect student achievement in computer science and this requires an innovative teaching method like graphic organizer.

Graphic organizer are described as concept map, entity relationship chart, and story map, which depicts information by using pictorial display to direct information, perceptions, or ideas. More so, Graphical organizer aids learners to classify ideas and communicate more effectively. They would be able to analyze causes and effects, communicate, contract and

develop concepts in details. Hyerle's (2000) views graphic organizers are illustration of detailed demonstration and map with the aim to describe the connections concerning information, expressions, thoughts task to improve learning concepts. These visual organizers can be interconnected with various methods, information can be presented to the learners, such that they produce and expose samples of interrelationships established by students, with the exceptional modeling ability of each student's cognizance (Hyerle, 2000). However, he further analyzed that, visual tools and graphical display are used to re-discover information, thoughts and capabilities that may have develop cognitively disengaged. It is imperative to encourage the utility of the graphic organizers as educational concepts for students especially for high school students to increase learning capability.

In other words, graphic organizer exists as a visual plans of information. They are classified in difference ideas, such as process, list, cycle, hierarchy, relationship, matrix and pyramid. Subsequently, these organizers portrait image of main thoughts and information on a focus and displaying association of portions to the whole. Additionally, when students create their individual material in an illustrative version, they exhibited enhanced appreciative better than students who imitate a design (Gobert & Clement, 1999; Tomkins & Tunnicliffe, 2001; Edens & Potter, 2003).

In essence, graphic organizers in the classroom are visual thoughtful abilities organized to be expressed in many ways. These apparatus are predominantly helpful in actions so as to necessitate problem solving approach and creative thoughtful skills. Therefore, it is important to note that, these methods are one of the current graphical educational approach for learners that can be functional through the national curriculum to improve learning and understanding of content. Most importantly, these methods presented variety of presentations, simplify students' learning by helping them categorize areas of focus within a broad topic, such as scientific perceptions, comprehension and many more.

Christopher, and Hinrich (2008) advocate that graphic organizer is a concepts map which is educational approach to established a large arrangement of thought for investigator . In view of the above, this promote problem solving approach and can help to develop learners in their ability to understand, retain and link the concepts.

Moreover, it is observed that the effect of graphic organizer in teaching environment is very effective in achievement of academic goals. Instructors effectively apply graphic organizers to establish points to the learners and this concretize the student knowledge and improve learners' retention rate. Consequently, it is important to note that every teacher should incorporate graphic organizer in science teaching and learning to enlarge learner's attainment.

Abonyi (2013) noted that students based method of science obviously resolve cognitive conflicts in young learners but warned that such approaches may be gender sensitive. This is obviously because of the masculinity and feminist concerns in experimental knowledge and conception particularly when atmosphere and capabilities of culture are involved. It is very imperative for effective use of graphic organizer method, to ensure that it does not take gender attentions for granted. Even current studies on graphic organizer approach to science instruction tends to reveal an enhancement in concepts development, researcher's struggles did not focus on computer science within our educational context. Consequently, the authentic influences of graphic organizer in computer science classroom are still uncertainty and necessitate experimental authentication. Researchers in computer science education are therefore faced with trial of exploring and confirming the genuine effects of graphic

organizer in computer science students' achievement in computer science subjects. In responds to these encounters, the researcher considers it indispensable to verify empirically the effects of the graphic organizer on junior secondary schools students' achievement in computer science.

The persistent poor achievement of secondary school students in junior and senior secondary school certificates examination in computer science is an issue of great concern to teachers, the educational ministry and the society at large, Jenkins (2006). This increases the uncertainty on the prospect of realizing the visions of computer literacy for all as enshrined in the new government policy for basic and upper basic education. This condition becomes most worrisome when we comprehend the indispensability of computer literacy in education, business transaction, industries and day to day activities in the society, the sad situation is aptly described by Adeinyi (2008).

However, the overall problem of keeping students in the science pipeline especially in computer science requires the need of providing innovative teaching method exercises like graphic organizer approach to enable students to face challenge in scientific investigation and discovery. These will upgrade student interest and increase student retention rate of the science lessons presented (Billmeyer & Barton, 1998). Because of the challenges of 21st century other methods like lecture methods can no longer meet the demand of the educational goals Abonyi (2013).

Although educators have been making effort to advance science instruction by using different instructional methods in other area of science. But the status of science education in our secondary schools continues to diminish (Abonyi, 2013). Contemporary emphasis on science instruction was geared towards incorporating graphic organizer in teaching and learning to improve student learning and retention rates. Campell (2010) noted that outdated teaching approaches do not sufficiently equip teachers with current views of student aptitude and their enormous learning competences. Many factors may have contributed in one way or the other to this ugly situation. Therefore, this research work intends to investigate the effect of graphic organizer on junior secondary schools student in achievement in computer studies.

This research work looked at the effect of graphic organizer on junior secondary students' achievement in computer science. It specifically sought to:

1. Find out the effect of graphic organizer on student's achievement in computer studies.
2. Ascertain the effect of graphic organizer on mean achievement scores of male and female students in computer studies.
3. Find out the interaction effect of teaching method and gender on students' achievement in computer studies.

The result of this study will be beneficial to the curriculum planners, teachers, students and the society at large. Curriculum development will benefits greatly from the findings of this study and the finding will help them to organize suitable curriculum materials that will improve learners skills in understanding of science concepts especially computer studies.

On the part of the teachers, it will help them to know the appropriate teaching method to incorporate when teaching and it will also help them to re-examine their teaching methods for greater effectiveness in conveying those science skills which students are found to be deficient in. Therefore, this result might also lead to immense prospects for student's achievement in computer studies.

On the part of the students, the results will make them more interested in the learning activities as graphic organizer fosters critical thinking and promote independent learners.

On the part of the society, the finding, will enlighten the society on the importance of learning by oneself. The finding of this study generally will guide education policy makers and all those interested in computer studies.

The study will be delimited to investigating the effect of graphic organizer on junior secondary schools students' achievement in computer studies. It centers on junior secondary schools in Enugu Educational Zones of Enugu State, Nigeria. It takes into consideration the interaction effects of the teaching method and gender of the students.

The content scope of this study consists of topics from computer studies curriculum for JSS11. The topics cover includes basic computer operations, concepts of computer problem solving skills and Information and Communication Technology. (ICT) in JSS1 -3 curriculum of computer science (see appendix 13).

The study is guided with the following research questions :

1. What are the mean achievement scores of students taught computer studies with graphic organizer and those taught with conventional teaching method?
2. What are the mean achievement scores of male and female students taught computer studies with graphic organizer ?
3. What are the interaction effect of teaching methods and gender on achievement, of computer studies students.

The following null hypotheses were formulated to guide the study.

Ho1: There is no significant difference in mean achievement score of computer studies students taught using graphic organizer and those taught using the conventional method (lecture method).

Ho 2: There is no significant difference in the achievement score of male and female computer studies students taught using graphic organizer.

Ho 3: There is no significant interaction between methods and gender on students mean achievement in computer studies.

REVIEW OF RELATED LITERATURES

Computer science education expand into various fields of explanation emanates from dearth of compromise on the scope of the focus. At one end, computer science education is seen as being apprehensive with almost all aspect of education, from the national educational system in which it activates. At the other thrilling, some restrict it to instructional materials or audio

– visual aids. Hunt (2004) argues that computer provides an amazing speed at which the capacity of accessible of information rises, and access to a developing series of information , it is imperative to note that, computer is an indispensable tools and it is becoming clearer because the ability to find appropriate material and use it proficiently is of larger worth than being capable to recollect facts. The abilities of discovering, assessing and using facts efficiently from a diversity of sources establish the Information skill s which are desired for individuals to become computer literate, permitting them to participate in actual decision making, problem -solving and research (Hunt, 2004). Regardless of these problems of lack of a largely acknowledged description of computer science education, it is indispensable that we have a collective vision of what computer science education is. Indeed, there is substantial agreement by educators that computer science education is a field that applied appropriate knowledge to solve educational problems.

As already noted, numerous efforts have been made to express the term computer science education. The definitions vary from one scholar to another. Agun and Imogie (1988) identifies three notions of computer science education which epitomize three different approaches to computer sciences education: computer science as hardware, computer science as software; and computer science as systems approach.

Graphic organizers are concepts of science. Science incorporates enormous parts of examined facts that broaden crossways of many areas. Graphic organizers (GO) are crucial framework that help learners ascertain vital facts, outline knowledge, recognize associations and most importantly, make sense of all this information. (Chang, Sung, and Chen, 2008), believe that, graphic organizers enhance better understanding. Therefore, it is indispensable to adopt such educational system, promote the use of this graphic organizer in Nigeria and integrate the methods in all sectors of education especially in secondary school. In view of the above “A graphic organizer contains of spatial arrangements of words (or word groups) proposed to represent the abstract organization of text”. The main drive in all graphic organizers is to organize arguments in such a way that text are establish for a reader. There are large collections of graphic organizers with a wide collection of patterns, shapes and formats that can be altered around by the student and the teacher to fit the concept being taught. Chang, Sung, and Chen, (2008) advocates that graphic organizer are connected with many concepts like concept maps, vee map. And many more and they can be formed digitally with specific software, and can be display to create a concepts to facilitate learners knowledge.

Hoskins, Stevens, & Nehm (2007) noted that, G O are “visual representation of knowledge” concerning convinced idea. This is because since the instructional tools come in a divers formats from moveable webs to organized grids that aid learners to understand a key concepts of information that they have gathered and to organize their ideas. More so, The usage of graphic organizers helps learners in linking newly added information to previous knowledge. (Robinson, 2003) pronounced that, the line effect of graphical organizer are very easy to comprehend. Therefore it is vital that educator ought to be well-informed about how to use this material and integrate it in the classroom activities. Consequently, it is very imperative to keep learners in activities where they will be cognizant of the large image. Since this approaches enable students to link image to words. Ellis and Howard (2005) refer Graphic Organizers as “Pictorial strategies that portray material in a divers ways. Most frequently, they engage lines, circles, and boxes, to form pictures which describe four common ways material can be structured: hierarchic, cause/effect, compare/contrast, and cyclic or linear

sequences. These descriptions aid as pictorial cues intended to ease message and thoughtful of material by presenting how vital material about a topic is prepared." It is learner's centered because it permits learners to work vigorously to build their understanding and they are actively involved in it. Graphic organizers play important role in science instruction and have great impacts on the students. Some of the challenges of using graphic organizers in teaching and learning are the gender gap and achievement testing.

THEORETICAL REVIEW

Some of the theories related to graphic organizers are Ausubel's theory of learning, Jerome Brunner's theory of learning and Schema theory. Ausubel's theory lays emphasize on connection between the previous knowledge and new concepts in learners knowledge. He consequently advocate that, new knowledge will only take place if there is a connection between the previous knowledge and the new concepts. Which implies that what the learner knows could help or obstruct new learning. He believes that significant knowledge occur when there is suitable connection between previous information and new knowledge task. More so, Ausubel (1960) highlights that students ought to construct new concepts arrangement to achieve fresh knowledge. In his Ausubel (1963), he distinguishes what the students require to replicate on diverse measure to build significant knowledge and demonstrate to creative thinking.

Advance organizers have be existing as style passageway, as outlined by Baron (1969). Baron describe them as diagrammed illustration of the fundamental expressions of a unit idea, so as to show associations among the concept represented by those words. The implication of Ausubel's theory relate to computer science instruction by means of graphic organizer approach is that instruction ought to start with new knowledge in a chronological approach. Which implies that, computer science teacher should not present any new material on computer science instruction in anticipation of the students readiness. Therefore it is important for the educators to present the suitable link to the student. These technique of instruction of computer science will connect the interaction linking the learners' and suitable element in the information that previously exist and the new material to be learnt. While there are no such relationship, no knowledge arises.

On Jerome Brunner's Theory of Learning, Brunner initiates the perception of knowledge by discovery. These theory emphasizes on cognitive efficiency. For the reason, Brunner's theory of learning can also be regarded as Brunner's theory of cognitive improvement. Brunner assumed that knowledge by discovery start as soon as the instructor persistently generate predicament and present to learners by initiating some irregularity (i.e. contradictions) among basis of information which are specified in the progression of teaching. In view of Brunner, such irregularity direct to academic uneasiness that will inspire the learners to begin individual finding through cognitive reformation (i.e. internal reorganization).

The academic uneasiness created by the irregularity challenged the students, where by bring order out of this uncertainty by engaging in psychological processes, through discovery activities using graphic organizer tools such as relationship, metrics, process, cycle etc. Through mental process, the student can generate facts from his desperate experience. Experiences gained during the mental development facilitate the learners achievement.

Bruner as cited in Akanbi & Opasina (2000) , there are two types of discovery processes, which are assimilation and accommodation.

Assimilation arise as soon as a learners distinguish a new situation with the intention of being familiar to one of the essentials in his existing composition of information (i.e. cognitive structure) and he simply assimilate it. Accommodation arise as soon as a new situation (i.e. a new knowledge) is unable to coexist to the existing structure of information (i.e. cognitive structure) the students first restructures (i.e. reorganizes) his cognitive structure in other to accommodate the new knowledge. Cognitive structures present the foundation for explanation of the characteristics of graphic organizers that maintain the knowledge process. For over three decades, researchers have observe the efficiency of graphic organizers for helping the leaning capability of learners in comfortable classrooms.

The implication of this theory is to appraise the effects of the category and requirement of graphic organizer prompt on the accomplishment of cognitive knowledge of learners and how these graphic organizer prompts influence the memory processing strategy use by educators during teaching

Discovery knowledge, when encouraged in the computer science class also helps problem solving since knowledge by discovery starts with problem solving (Akanbi & Opasina, 2000). In addition, discovery learning also promote creativity in the learner which is one of the major objectives of graphic organizer instruction.

Schema theory of recollection is concepts of network that facilitate information. This theory assist information structure and convoy or facilitate to intellectual development. They prepared a structure to aid the existence of information in the memory for long term benefits. Schemas are dynamic because new knowledge are achieved, incorporated as an obtainable knowledge to actualized learning objective.

Dye (2000) noted that “the graphic organizer has its roots in schema theory”. When learners discover new concepts, they ought to preserve knowledge for future use. However, information are accumulated in a scaffold hierarchy as categorized knowledge. Robert (1991), believes that people instruct, accumulate, and recover educated information based on this hierarchy. Information to facilitate fits into a learner’s obtainable schema is more easily understood, learned can retain the information for future use .

The implication of schema theory believe that message are instruct, saved, and retain for future use and knowledge are learn base on hierarchy, that is why educators agreed that these theory are dynamic. In addition, new knowledge can easily be incorporated, more importantly, there must be connection or link between previous information and new information using an instruction techniques in a scaffolding formats from simple to complex.

REVIEW OF EMPIRICAL STUDIES

Review of empirical section presents the previous studies, their methods, analysis and results of their finding and recommendations. Some empirical literatures are reviewed below:

Chin-Wen (2012) examines on “the Use of Graphic Organizers in a Language Teachers’ Professional Development Department of English Instruction, National Hsinchu University of

Hsinchu City, Taiwan”. The research works discussed the usage of GO in English teachers’ professional growth, different technique of GO were used such as Venn diagrams and T-charts were utilized by the teacher to support English instructors appreciate the intellectual concepts. More so, English teachers anticipated and use the GO format in the classroom teaching, this aid the English learners understand English language. These prerequisite of GO help the involving instructors to discover and practice the concepts . Two involving teachers apply T-chart and bubble maps, as GO techniques instigated in the study, Recommendation on successfully usage of GO were made for the study. The results of the study reveals the efficiency of GO, if incorporated in the classroom and also supported with the intention of instructors would always make use of these GO into teaching and learning process for successful education.

Zakiah (2013) investigated on the “influence of graphic organizers on students’ Text comprehension in Faculty of Education Universiti Teknologi Malaysia.” The work observe influence of GO on learners’ text comprehension, thirty (30) learners were chosen from SMK Gudang Rasau in Kuantan Pahang. These learners were subsequently divided into two groups control group and experimental group. The first group is refereed as treatment group used graphical organizer method of reading and the second group is control group used traditional approach as a method in reading text comprehension. The research was done over four weeks. Data gathered through pre-test and post-test were analyzed. The outcome were discovered and learners who obtain graphic organizers method skilled has a great improvement in their comprehension question and summary writing. In addition, learners’ observation shows that they favored graphic organizers procedure much better. They also declare that this graphic organizers procedure has positive influenced on their reading text comprehension capability.

Guastello, (2000) conducted a research on “the effects of concept mapping on a science unit with low-achieving seventh graders in urban Brooklyn, New York.” every learners participating established beneath standard attainment in the science and reading based on uniform evaluation. Students were at random assigned to either a concept mapping group or a read and discuss group. The concept mapping group assemble organizational maps of the unit material with the help of the teacher as the students read the section in the book. The read and discuss group read the chapter in sections and contributed in discussion and questioning follow each reading. The research was examine with in time one week leaner’s’ constant programmed of science skills. However, the outcome specify two groups attain likewise on pretests and posttest on science lesson and reading attainment. Moreover, the pretest significantly interconnected to posttest scores ($r = 0.18$, $p < .05$), an investigation of covariance (ANCOVA) with pretest scores as the covariate be accomplished. The ANCOVA finding established a statistically significant main result ($p < .0001$) sustaining the GO group in place of that instructional techniques using graphic image have an additional proficient better than chalk and board technique. The study recommends that concept mapping, if apply in teaching science concepts, will help to improve the learners achievement.

Kristina (2010), examine the Usage of GO in promoting knowledge concepts . The study try to explore how GO can be use to promote science knowledge. GO create achievable knowledge of the subject matter by given those understandable illustration of thoughts and make possible learners expression to be achieved. The study use class six science with 25 learners throughout a study, and it was revealed with the intention of using GO in science lesson, learners understanding was highly improved using GO techniques and this increase

an additional detailed perceptive on the subject matter. Therefore, it was observed that using literacy strategies like graphic organizers in the subject matter, learners knowledge and individualized learning were highly improved at their own pace.

Andrew (2013) investigated on “The Effect of Vee Maps and Laboratory Reports on High- and Low-Order Content–Knowledge Achievement in Science Education in University of Florida”. This work intended for progress of proper evaluation tools with the intention to improve upgraded skills and are simply integrated also required in higher schools. The study use quasi-experimental study to examine the design. The Vee map were quantify as a higher standard laboratory report in six (6) diverse higher schools crossways of state of Illinois. The study make use of learners pretest score as a covariate, with the statistically considerable disparity among the groups on the high-order thinking posttest. More so, the findings point out that after two weeks learners that use of the Vee map approach assimilate and retain the lesson concepts more than those who make use of the normal lab report. This work suggest the usage of Vee map as a successful evaluation techniques to promote science teaching.

George (2008) examined “The effect of graphic organizers on the academic achievement of high school students in United States history who receive instruction in a blended, computer-based learning environment in Liberty University United States of American.” The intention of this work were examine the effect of GO on the educational attainment of secondary school learners receiving instruction through online learning concepts. The study use (60) observer, the learners were grouped into two uniformly thirty (30) observer as treatment group, and the other 30 observers as a control group. A two-tailed t-test were achieved, and two posttests were not significantly unlike at a probability level of .05. Finally, outcome pointed out with the intention of secondary school students that acknowledged teaching in United States History through online format with the usage of GO attain extensively better than students that did use GO.

Sheila (2002) experimented “on teachers’ and students’ perceptions of the impact of content literacy strategy instruction on teaching and learning In University Of North Texa, ” The purpose was to examine the instructors’ and learners’ opinion on the effect of GO techniques on education Instructional sector. The work intend to achieve a greater perceptive of the graphic organizer approach of the teaching. Three corresponding research and purpose of were used for the work. numerous data basis were use to investigate the instructors’ and learners’ observation. The result reveal that graphic organizer approaches increased student understanding and learning of subject matter; improve instructional approach and is easy to use, improve student involvement in class work, and promote individualized learning concepts. The limitation of the study was time and teachers confidence. The finding it was noted that most of the participants indicated would persist on usage of the graphic organizer strategies in future. Learners confirmed their desirable requirement to sustain the use graphic organizer on educators as long as it will provides direct instruction, educators also acknowledged the practice and determination as significant to supporting graphic organizer strategy instruction.

In view of Stephen (2005) examined “the effects of using graphic organizers with middle school students with LD on student attainment of relational knowledge”. Twenty four (24) learners with LD partake in the study and were selected from three pullout resource room programs for students with mild disabilities and accidentally allocate to (2) two different groups. Group 1 were regarded as the experimental group using graphic organizers as a post

reading concepts, led by the instructor. While the other group used as control group using conventional approach. Learners received teaching for four weeks using intact class. The study used 20 item multiple choice tests to determine factual information. The finding point out with the intention of using graphic organizers did not drastically affect factual information as measured by multiple choice tests ($p = .2641$). More so, the finding of the learner written essays exposed that students in the graphic organizer group had extensively an additional understanding of knowledge statements ($p = .0007$) than learner's in the control group. The outcomes pointed out that graphic organizers helps learners with LD in their remember and retaining of relational information but did not appear to help the learners' remember of factual information.

Yusuf and Afolabi (2010), conducted an experiment on usage of Computer Aided Instruction (CAI) as an additional tools to chalk and board method in USA. The work intended to observe if CAI generate greater accomplishment than the usage of chalk and board alone, More so, the study is uncertain concerning the efficiency of chalk and board method alone and CAI alone, CAI and other computer applications generate greater accomplishment than chalk and board alone. Finally, the finding of the study reveal with the intention that learners learn educational content easier at a high speed with CAI than with chalk and board alone, the leaner remember what they have learnt with CAI than with chalk and board.

Spotts et al. (1997) investigated the gender and usage of computer technologies on boys understanding and knowledge through some modern technology superior than that of the girls. The study indicated that there is no significant differences in using computer technology, of which girls indicate the usage with the intention of slightly extra frequent, both agreed that the technologies is as imperative to teaching. Other limitation of the use of the technology include time factor, power supply and population the finding indicate that ,there is no statistically significance endorse gender disparity in using modern technology among boys and girls learner's .

Achuonye and Olele (2009), experimented on Internet usage method on Nigerian teacher training institute, the study find out that more girls learners was individually linked on the internet more often than boys counterpart; but was observed that boys used the internet often better than girls . This specify boys domination in skills. This finding revealed that gender disparity can also be regarded as a factor in this study.

This chapter summarizes the literature on the conceptual framework, theoretical framework and empirical review. In conceptual frameworks, the work highlighted various concepts relevant to the study such as Computer science Education, Graphic organizer, Role of Graphic Organizer on Science Instruction, Impact of Graphic Organizer on Student, Concepts of Gender, Concepts of Achievement, Achievement in Computer Science, Methods of Teaching Computer Science, Lecture Method of Teaching and Factors militate the use of graphic organizer and necessary strategies to implement and advance the use of graphic organizer.

We got to understand that computer education has been described by many authors as computer science as hardware, computer science as software and computer science as systems approach. The root of computer education is based on work of Agun and Imogie (1988), Yeoman &Zamorski. (2008), McCracken, (2008).

The work also described some learning theories deemed to be relevant to the study. These theories include Ausubel’s Theory of learning, Jerome brunners theory of learning, and Schems theory of memory. This work is anchored on Ausubel’s theory of learning which advocates that meaningful learning will only occur when there is a link between the pervious knowledge and new knowledge .

The empirical review covered the empirical studies on graphic organizer, science instruction, achievement in science concepts, gender and computer science. The gap advocates in the literature review, that Pervious researchers have review so many results on the effect of graphic organizer in academic achievement in other areas of science such as chemistry, biology and mathematics and has identify that using graphic organizer can aid retention rate and improve students ability and achievement in science lessons, but there was no study in computer science, that is why the researcher consider it necessary to find out the effect of graphical organizer on junior secondary schools student’s achievement in Computer Science in Enugu State.

RESEARCH METHOD

This chapter deals with the procedures the researcher adopt in carrying out the study. The sub heading includes design of the study, area of the study, population of the study, sample and sampling techniques, instruments for data Collection, validation of the instrument, reliability of the Instrument, experimental Procedure, method of data collection and method of data analysis

RESEARCH DESIGN

The research adopts a quasi-experimental design. Quasi experimental design according to (Ali, 2006) is that type of design that uses non- random assignment of the subject, intact classes, pre test, and post test non equivalent control group. The researcher found the design very useful because is used when subjects are pre- tested and the randomization of subjects in a study is not feasible.

It is a school -friendly type of design in that it can be used in schools without any disruption to the school’s class structure or timetable of academic events. The quasi- experimental design can be symbolic represented as follows.

Table 1: The Pre-test, Post- test Design with Non- Randomized Experimental and Control Groups.

GROUPS	PRE-TEST	EXPERIMENTS	POST-TEST
EI	Q1	X	Q2
C	Q1	O	Q2

- Where E1 = represent treatment group1
- C = represent control group
- X = Treatment or Experiment
- O = conventional method (lecture method)
- Q1 = Pre-test score
- Q2 = Post-test scores

AREA OF THE STUDY

The study was conducted in Enugu State. Enugu State is a state in southeastern Nigeria, that share borders with Abia State and Imo state to the south, Abonyi state to the East, Benue state to the northeast, Kogi state to the northwest and Anambar state to the west. Enugu State comprises of six educational zones which include, Agbani, Awgu, Enugu, Obolloafor, Udi and Nsukka. Specifically, the study will be carried out in 3 education zones of Enugu State; Udi, Enugu and Nsukka .

POPULATION OF THE STUDY

The population of this research is made up of 15,182 J.S.II computer science students in three Educational Zones of Enugu State 2014/2015 Session (i.e. Udi:2596, Enugu: 6750 and Nsukka: 5836) (Post Primary School Management Board, 2016). The researcher chose J.S II because the J.S.III are already in the examination class preparing for their Junior WASSCE and the J.S.I students have not been well groomed in computer science.

SAMPLE AND SAMPLING TECHNIQUE

Two co-educational secondary schools are drawn out of nine co-educational secondary school in Enugu Education Zone of Enugu State for this study through simple random sampling. One of the mixed schools was assigned to treatment group while the remaining one was assigned to the control group through the toss of a coin. In each school that was drawn for this study, all the intact classes of JSSII were used for the study.

Group	Male	Female	Total
Treatment Group	19	24	43
Control Group	21	27	48
Grand Total			91

INSTRUMENT FOR DATA COLLECTION

The Instrument the researcher used for data collection is Computer Studies Achievement Test. (CSAT). This instruction is a 30 –item multiple choice test drawn from the topics that were taught during the experiment. The topics are basic computer operation, concept of problem solving skills and information communication technology (ICT).

VALIDATION OF THE INSTRUMENT

The Content validity of the CSAT was achieved using a test blue print see Appendix 2. After the items were generated in line with the specifications of the blueprint copies of Computer Studies Achievement Test (CSAT) were sent to three specialists in Computer Studies, Educational, Measurement and Evaluation for face validation. They examined the test items in terms of clarity, relevance, format and modifications on them as they deemed appropriate.

RELIABILITY OF THE INSTRUMENT

The pilot testing of the instrument was done in two co- educational secondary schools in Enugu Educational Zones of Enugu State. These schools have the same characteristics with the two co-educational secondary school in Enugu educational zone of Enugu State used for this study. The 30- item CSAT was subjected to test of reliability using the K-R 20 procedure. The field testing instrument yielded a reliability index of 0.72. Summary of the reliability test is presented in Appendix 9. The instrument was assessed for stability using test-retest procedure. The data collected from repeated administration of the instrument to 30 students were assessed for reliability using the pearson's product moment correlation procedure. A reliability index of 0.684 was obtained. Summary of the analyses is shown in Appendix 10.

EXPERIMENTAL PROCEDURE

Two instructional techniques were used for the study. The graphic organizer teaching strategy was used to teaching the treatment group, while the conventional approach (lecture method) was used to teach the control group. The researcher used the Computer Science teachers as research assistants in the schools for the study. These teachers were trained on how to use the method. At the onset of the treatment a pre-test were administered to both the treatment and control groups. The various Computer Science teachers in the sampled schools conducted the teaching in their respective classes. The experiment was carried out during normal school hours using the school timetable. At the end of the experiment which lasted for seven weeks, the teachers administered the post test to the students in both the treatment and the control groups. The same test CAST was use for the pretest and the post-test . The scores that were collected from the pretest and posttest were used in answering research questions and testing the hypotheses.

CONTROL OF EXTRANEIOUS VARIABLE

The researcher adopt the following procedure to ensure that extraneous variable which may introduce bias into the study are properly controlled.

TEACHER VARIABLE:

The researcher organize a pre treatment conference for the teachers that were used for the study. Separate conference were organized for teachers in the two groups (treatment and control). This help to establish a common instructional standard among the instructors, the researcher will monitor the teachers to ensure that they adhere strictly to the specifications of the manuals.

INSTRUCTIONAL SITUATION VARIABLE :

To ensure that instructional situation is the same for all the schools the researcher will prepare instructional manuals for the teachers in each group. The teaching were conducted in all classes of JSSII in various schools that were used for the study.

INTER- GROUP VARIABLE :

This study used intact classes. As such it is implied that initial equivalence cannot be attained for the treatment and control groups. In order to control for errors that may arise from comprising effects of treatment on two unequal groups the researcher utilized a statistical approach (Analysis of Co Variance) to filter off the errors of initial equivalence and ensure that only the effects of the treatments formed the basis for inference.

SUBJECT INTERACTION:

The treatment and control group were not drawn from the same school. This ensure that the students in the treatment and control groups do not mix up at all. This reduce the errors that might arise from the exchange of ideas among research subjects from the two groups with regards to the experiment.

TESTING EFFECT

The same test were used for the pretest and posttest. To ensure that students do not recall answers the items were reshuffled in the posttest so that the numbers do not correspond with that of the pretest. In addition, the colours of the papers for the pretest and posttest were not the same. This make it difficult for the students to recognize that it is the same test they took as the pretest that is given to the post test.

METHOD OF DATA COLLECTION

At the onset of the experiment, the research assistant (classroom teacher trained for that) administer the pretest to the entire students in both the treatment and control groups. Scores of the students on the pre-test were recorded for use after the experiment. At the end of the experiment, the post test were administered to the entire members of the class. The scripts were marked by the class teachers who submitted the scores to the researcher. The scores were kept separately for use during data analysis.

METHOD OF DATA ANALYSIS

Research questions were answered descriptively using mean and standard deviation while the hypotheses were tested at 95% confidence level using the analysis of co-variance

RESULTS

This chapter contains the results of data analysis based on the three research questions and three null hypotheses that guided the study. The results are presented in tables according to the research questions and hypotheses.

RESEARCH QUESTION 1

What is the effect of graphic organizer on student achievement in computer studies?

Data collected with the Computer Studies Achievement Test (CSAT) for both the pretest and posttest were used to answer this research questions. Descriptive procedures involving adjusted means and standard deviation were utilized. The summary of the result is shown in Table 1.

Table 1: Adjusted Mean achievement scores of students taught computer studies using the graphic organizer and those taught using the conventional approach

Groups	Adjusted Mean	S.D	N
Graphic organizer (Treatment Group)	64.42	8.26	43
Conventional Lecture Method (Control Group)	47.67	9.09	48

Summary of data analysis in Table 1 shows that the adjusted mean for the graphic organizer (64.42) is greater than those taught with the conventional method (47.67). The graphic organizer approach is superior than the conventional (lecture method) in facilitating students' achievement in computer Studies.

RESEARCH QUESTION 2

What is the effect of graphic organizer on the mean achievement scores of male and female students in computer studies?

The computer studies achievement scores of male and female students in the treatment group were used to answer this research question. Summary of result is presented in Table 2.

Table 2: Mean achievement scores of male and female students taught computer studies using graphic organizer approach

Gender	Adjusted Mean \bar{x}	S.D	N
Male	64.42	7.23	19
Female	64.50	9.14	24

Summary of data analysis shown in Table 2 reveals that the mean scores for females (64.50) is higher than that of the males (64.42) for the group taught with the graphic organizer teaching approach.

RESEARCH QUESTION 3

What is the interaction effect of teaching methods and gender on achievement, computer studies students?

The data achieve from the computer studies achievement test administer to male and female students taught using graphic organizer approach and those taught using the conventional approach were used to answer this research question. The summary of the result is shown below in Table 3.

Table 3: Interaction effect of methods and gender on students achievement in computer studies.

Gender Category	Method	
	Graphic organizer	Conventional
Male	64.42	47.67
Female	64.50	64.42

Summary of result point out that the graphic organizer approach is superior to the conventional method at the two levels of gender indicating that there is no interaction between method and gender on students achievement in computer science

HYPOTHESES

H₀₁: There is no statistically significant difference in the mean achievement scores of students taught computer studies using graphic organizer teaching approach and those taught using the conventional method.

H₀₃: The interaction effects of method and gender on students mean achievement in computer studies is not statistically significant.

The data collected with the Computer Studies Achievement Test (CSAT) for both the treatment and control group were subjected to analysis of Co-variance so as to test hypothesis 1,2 and 3. Summary of the analysis is presented in Table 4.

Table 4: ANCOVA test of significance for method and interactions between method and gender on achievement in Computer Studies.

Sources of variation	Sum of square	Df	Mean square	F	Significance of F
Covariates	4287.940	1	4287.940	189.988	.000
Pretest	4287.940	1	4287.940	189.988	.000
Main effect	6866.315	2	3433.158	152.115	.000
Methods	6854.163	1	6854.163	303.691	.000
Gender	11.122	1	11.122	.493	.485
2-way Interactions	16.895	1	16.895	749	.389
Methods Gender	16.895	1	16.895	.749	.389

Explained	11171.150	4	792.788	123.788	.000
Residual	1940.982	86	22.570		.
Total	13112.132	90	145.690		

For hypothesis 1, the alpha level (0.05) is greater than the significance of F (0.000), therefore, the researcher rejects the null hypothesis and concludes that there is a significant difference in the mean achievement scores of students taught computer studies using graphic organizer teaching approach and those taught using conventional method.

For hypothesis 2 summary of data analysis shown in table 5, indicates that the significant of F at an alpha level of 0.05 is .913, since 0.05 is less than the F probability of (.913), the researcher upholds the null hypothesis and concludes that there was no significant interaction between methods and gender on students mean achievement in computer studies.

H0₂: There is no statistically significant difference in the mean achievement scores of male and female students taught using graphic organizer teaching approach. The table below is use to answer hypothesis 2.

Table 5. ANCOVA test of significance of difference for method by gender for treatment group only

Sources of variation	Sum of square	Df	Mean square	F	Significance of F
Covariates	1387.118	1	1387.118	37.619	.000
Pretest	1387.118	1	1387.118	37.619	.000
Main effect	445	1	.445	0.12	.913
Gender	445	1	.445	0.12	.913
Explained	1387.563	2	693.782	18.816	.000
Residual	1474.902	40	36.873		
Total	2862.465	42	68.154		

Summary of result in Table 5 shows that the F. value is 0.12 while the significance of F- is .913. Since the alpha level (0.05) is less than the significance of F (.913). The researcher upholds the null hypothesis and concludes that there is no significant difference in the mean achievement scores of male and female students taught computer science using graphic organizer teaching approach.

SUMMARY OF RESULTS

Results of data analysis reveal that:

The Graphic organizer approach is superior to the conventional approach in facilitating student's achievement in Computer studies.

The graphic organizer approach does not discriminate across gender in facilitating students achievement in Computer Studies

There is no interaction effects between method and gender on students achievement in Computer Studies

DISCUSSION OF RESULTS

This chapter presents discussion of the results based on the three research questions and the three null hypotheses that guided the study. Results are presented in themes as Follows:

- 1 Effect of graphic organizer on student achievement in computer studies?
1. Effect of graphic organizer on the mean achievement scores of male and female students in computer studies.
2. The interaction effect of teaching methods and gender on achievement, computer studies students

EFFECT OF GRAPHIC ORGANIZER ON STUDENT ACHIEVEMENT IN COMPUTER STUDIES

The results of the data analyses presented on table 1 of chapter four indicates that those taught computer studies with graphic organizer performed better than those taught with conventional method. This finding exposed that the graphic organizer method is superior to the conventional approach in facilitating student's achievement. This finding is in line with the study of (Chang, Sung, and Chen, 2008), stress that, since the use of graphic organizers improve better thoughtful in developed country like America. Therefore, it is indispensable for developing country like Nigerian to embrace such method in their educational system and incorporate the methods in all sectors of education especially in secondary school. This study also agreed with the findings of (Shankland (2010) comments on the importance of prior knowledge as it aid in retention rate of the student. to stored in long-term memory,

EFFECT OF GRAPHIC ORGANIZER ON ACHIEVEMENT OF MALE AND FEMALE STUDENT IN COMPUTER STUDIES

The result of the data analysis presented in table 2 indicates that the mean scores of female is higher than that of male for the group taught with graphic organizer strategy. In this study the differences in scores between female and male is not much. The study of Asssf (2009) shows that students' accepting was improved through pictorial clarification of key relations and concepts and the associations among them and that graphic organizer teaching environment helps to reduced gender differences. The present study also showed that there was no significant difference in the mean achievement scores of male and female students taught basic science using graphic organizer teaching strategy. This study is also in support of the study of Boulware, and Jones. (2009), the finding of their study revealed that there is no significant difference in academic achievement of male and female student at the pretest, posttest and delayed posttest levels respectively. They also revealed that graphic organizer approach is effective for both boys and girls in improving achievement and attitude towards science.

INTERACTION EFFECT OF METHOD AND GENDER ON STUDENT ACHIEVEMENT IN COMPUTER STUDIES

The outcome of the data analysis presented in table 3 of chapter four point out that graphic organizer approach is better than the conventional approach at the two levels of gender, which means that there is no interaction between method and gender on student's achievement in computer studies.

The research work support the effective use of graphic organizer as an additional tools to chalk and board method of teaching yield higher attainment than the use of chalk and board alone, research is unsatisfying concerning the relative effectiveness of conventional teaching alone and graphic organizer only, and that computer educational concepts (graphic organizer and other computer applications) yield higher achievement than conventional teaching only. In addition, learners learn instructional content faster with graphic organizer than with conventional instruction only, they recollect what they have learned better with graphic organizer than with conventional teaching only.

In addition, the research also supported the view of Spotts et al. (1997) on gender and usage of computer technologies on boys understanding and knowledge through some modern technology superior than that of the girls. The study indicated that there is no significant differences in using computer technology, of which girls indicate the usage with the intention of slightly extra frequent, both agreed that the technologies is as imperative to teaching. Other limitation of the use of the technology include time factor, power supply and population the finding indicate that ,there is no statistically significance endorse gender disparity in using modern technology among boys and girls leaner's .

More so, Achuonye and Olele (2009), also agree with the above view on Internet usage method on Nigerian teacher training institute, the study find out that more girls learners was individually linked on the internet more often than boys counterpart; but was observed that boys used the internet often better than girls . This specify boys domination in skills. This finding revealed that gender disparity can also be regarded as a factor in this study.

SUMMARY, CONCLUSION AND RECOMMENDATION

EDUCATIONAL IMPLICATIONS

This study revealed that the graphic organizer approach is superior to the conventional approach in facilitating students' achievement in computer science. This finding has motivating suggestions for science curriculum review and pedagogy. It informs the Curriculum developers will benefit greatly from the findings of this study and the finding will help them to organize suitable curriculum materials that will improve learners' skills in understanding of science concepts especially computer science.

This study also has implications for teacher education and retraining. It will help them to know the appropriate teaching method to incorporate when teaching and it will also help them to re-evaluate their teaching schemes for greater effectiveness in conveying those science skills which students are found to be deficient in. With the revelation that graphic organizer approach is effective in facilitating student's achievement in computer science, emphasis should be placed on training teachers that could utilize the approach effectively and efficiently.

Additionally, the result of this study will benefit the students by being inventive, thoughtful, imaginative, and goal directed learners since students are actively involved.

6.2 Recommendations

The results of this study need the following recommendations :

Computer studies instructors ought to make use of graphic organizer strategy because it facilitates teaching and learning.

The graphic organizer approach should be used for both male and females because the approach does not discriminate across gender.

To improve students' achievement in computer studies, graphic organizer teaching strategy should be introduced into computer science teaching.

The government should organize seminars, conference and workshop to train basic science teachers on the use of graphic organizer strategy through the help of science teachers association of Nigeria (STAN) and research institution.

6.3 Limitations of the Study

The findings of this study are subject to the following limitations:

The pretest and posttest were administered to students in the respective schools by different teachers at different times. Although the tests were the same the testing conditions may not be exactly the same and this could influence the outcome.

Although training was organized for the teachers in the treatment and control group it could not be assumed to have completely eliminated the teacher differences and consequently the outcome of the treatments.

6.4 Suggestion for Further Studies

Further research and investigation should be made on the following:

1. Effects of graphic organizer teaching strategy on student's achievement and retention in computer studies
2. Effects of graphic organizer on senior secondary school achievement in computer.
3. Effects of graphic organizer on senior student's achievement and interest in physics.

6.5 Summary

The purpose of this study was to determine the effects of graphic organizer teaching approach on junior secondary school student's achievement in computer studies. The population of the study is one fifteen thousand one hundred and eight two (15182) Jss II students of 2014/2015 session. The Junior secondary two students (Jss2) of two co-educational secondary schools out of 6 Educational zone of Enugu State were used for this study. One of the co-educational schools was assigned to the treatment group while the other school was assigned to the control group. The treatment group was taught using the graphic organizer teaching method and the control group was taught using the conventional teaching strategy. The research design employed for this study was a quasi-experimental design. The specific design the researcher use for this study was a pretest posttest non equivalent control group design. The instrument used for this study was a computer studies achievement test (CSAT), the instrument is a 30-item multiple choice test. At the onset of the treatment, a pre-test was administered to both the treatment groups and the control groups. The scores were collected from the pretest and posttest which was later used in answering research questions and hypotheses. The 30 – item CSAT was subjected to test of reliability using K-R 20 procedure and it yielded a reliability index of 0.72. The instrument was also assessed for stability using test- retest and the data collected from the repeated administration of 30 students using pearson's moment correlation procedure, it yielded a reliability index of 0.684. The experiment was carried out during normal school hour using the school time table and it lasted for seven (7) weeks. The research questions were answered using mean and standard deviation while the hypotheses were tested using the analysis of co-variance.

CONCLUSION

The study concluded that:

The Graphic organize strategy is superior to the conventional strategy in facilitating students achievement in computer studies and there is a significant difference in the mean scores of students taught using graphic organizer method and those taught using conventional method.

The study reveals that the mean score for females is higher than the mean scores of males for the group taught with the graphic organizer but there is no significant difference in the mean achievement scores of male and female students taught computer studies using constructivists based teaching strategy.

The graphic organizer strategy is superior to the conventional strategy at the two levels of gender meaning that there is no interaction between method and gender on student's achievement in computer studies.

REFERENCES

- Abonyi, O. S (2013). *Ethnoscience and sustainable science education for Africa: In B. Akpan (ed) Science Education: A global perspective. Abuja: Next Generation Education Ltd.*
- Achuonye KA, Olele CN (2009). *Internet using patterns of Nigerian teacher-trainees: Implications for teacher education in Nigeria. Journal of. Science. Teachers. Association of. Nigeria, 44(1&2): 103 108.*
- Adeniyi (2008) *A survey of Factors Responsible for Student's Poor performance in Computer Studies in Senior Secondary School Certificate Examination. (SSCE) www.tycomputer.com.ng.*
- Agun, I. & Imogie I. (1988). *Fundamentals of educational technology. Ibadan: Y Books.*
- Akanbi I.A & Opasina, M.A. (2000). *Science method in teaching methods. Tonu Andrian publication series.*
- Andrew C. Thoron, T. (2013). *The effect of vee maps and laboratory reports on high- and low-order content-knowledge achievement in science education. Journal of Agricultural Education, 54(3), 198–208*
- Ausube l, D. P. (1963a). *The psychology of meaningful verbal learning. New York: Grune & Stratton.*
- Ausubel, D. P. (1960). *The use of advance organizers in the learning and retention of meaningful verbal materials. Journal of Educational Psychology, 51(5), 267-272.*
- Ausubel, D. P. (1960). *The use of advanced organizers in the learning retention of meaningful behavior. Journal of Educational Psychology, 51, 267-272. <http://dx.doi.org/10.1037/h0046669>*
- Ausubel, D. P. (1963b). *Cognitive structure and the facilitation of meaningful verbal learning. Journal of Teacher Education, 14, 217-222.*
- Baron, M. E. (1969). *A note on the historical development of logic diagrams: Leibniz, Euler, and Venn. Mathematical Gazette, 53, 113-125.*
- Chang, K., Sung, Y., & Chen, I. (2008). *The effect of concept mapping to enhance text comprehension and summarization. Journal of Experimental Education, 71(1), 5- 23.*

- Chin-Wen, Chien (2012). *Use of graphic organizers in a language teachers' professional development. (Unpublished M.Ed Thesis). National Hsinchu University of Education, Hsinchu City, Taiwan.*
- George, K. C. (2008). *Thesis on The effect of graphic organizers on the academic achievement of high school students in United States history who receive instruction in a blended, computer-based learning environment (Unpublished M.Ed Thesis). Liberty Univesity, Lynchburg.*
- Guastello, E. F. (2000). *Concept mapping effects on science content comprehension of low-achieving inner-city seventh graders (Unpublished M.Ed Thesis). [St. John's University, New York.](#)*
- Hinrich (2008). *On Graphic Organizer Technology and Communication in construction. Curriculum for K-12 Computer Science: Report of the ACM K-12 Education Task Force Computer Science Curriculum Committee – Draft. <http://www.acm.org/k12/k12/Draft1101.pdf>.*
- Hinrich, (2008). *On Graphic Organizer Technology and Communication in construction. Curriculum for K-12 Computer Science: Report of the ACM K-12 Education Task Force Computer Science Curriculum Committee – Draft. <http://www.acm.org/k12/k12/Draft1101.pdf>.*
- Hoskins S. G., Stevens L. M., Nehm, R. (2007). *Selective use of the primary literature transforms the classroom into a virtual laboratory. Genetics, 176, 1381–1389.*
- Hunt (2004). *Defining ICT and its role in education. Retrieved from: <http://www.education.auckland.ac.nz/learning/tech/ict/education/it4.asp> Intellectual Software Group (Pty) Ltd: Ahead in Learning, www.cairoo-education.co.za.*
- Hyerle, (1996). *Visual tools for constructing knowledge. Alexandria, VA: Association for Supervision and Curriculum Development.*
- Hyerle. D. (2000). *Thinking maps: Visual tools for activating habits of mind. In A. L. Costa and B. Kallick (Eds), Activating and engaging habits of mind (pp. 46-58). Alexandria, VA.: Association for Supervision and Curriculum Development*
- Jenkins (2006), *A survey of Factors Responsible for Student's Poor performance in Computer Studies in Senior Secondary School Certificate Examination. (SSCE) www.tycomputer.com.ng.*
- Keller, e (1985). *Reflecting on gender and science. New Haven, CT: Yale University Press.*
- Kristina, C. (2010). *The usefulness of graphic organizers in enhancing science learning. Education Masters, Paper III. Retrieved online from: http://fisherpub.sjfc.edu/cgi/viewcontent.cgi?article=1110&context=education_ETD_masters*
- National Research Council. (2006). *America's lab report: Investigations in high school science. Washing-ton, DC: National Academies Press*

- Okolo, (2010). Introduction to computer application and appreciation education. Enugu: Prince Digital Press.*
- Sambo, J. D. (2002). The what and how of reading instruction. Network – IRA.*
- Sheila Maher, B.S., M.S (2000). Teachers’ and students’ perceptions of the impact of content Literacy strategy instruction on teaching and learning. Unpublished Ph.D Dissertation, University of North Texas.*
- Spotts. T.H., Bowman, M.A. & Mertz, C. (1997). Gender and use of instructional technologies: A study of University Faculty. Journal of Higher Education, 34(4), 421-436. Retrieved on 14-07-2010 from <http://pdfserve.informaworld.com/662676-7512>.*
- Yeoman K. & Zamorski B. (2008). Investigating the impact of skill development of an undergraduate scientific research skills course. Bioscience Education, e-Journal. 11. doi: [10.3108/beej.11.5](https://doi.org/10.3108/beej.11.5)*
- Yusuf ,M.A. & Adigun J. T. (2010). The influence of school location & type on student academic performance. Inc. Journal Education Science, 2(2), 81-85.*
- Yusuf MO (1998). A Study of the dimensions of teachers’ attitudes towards computer education in Nigerian Secondary Schools. Nigerian Journal of Computer Literacy, 2(1), 47-58.*
- Yusuf, M.O. & Afolabi, A.O. (2010). Effects of Computer Assisted Instruction (CAI) on secondary school students’ performance in Biology. The Turkish Online Journal of Educational Technology, 9(1), 62-69.*