

# Effects of Heuristic Method of Instruction on the Achievement of Senior Secondary School Students in Computer Studies

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## Abstract

This study was carried out to find the Effects of Heuristic Method of Instruction on the Achievement of Senior Secondary School Students in Computer Studies. The study was conducted in Ebonyi North Education, Abakaliki in Ebonyi State. Three Research questions and three Null Hypotheses guided the study. The study adopted a quasi-experimental design and employed a pre-test post-test non-equivalent control group design with one experimental and one control group. Two hundred (200) SSII students were used; one hundred and one (101) male students and ninety-nine (99) female students were drawn from six (6) senior secondary schools (2 boys' schools, 2 girls' schools and 2 co-educational) through simple random sampling. Out of the six schools, three schools (one girl's school, one boys' school and one co-educational) were assigned as the experimental group and the others as the control group. From computer science scheme of work, Basic Concept of Computer Hardware was taught to the students using their respective computer studies class teachers. The experimental group was taught using Heuristic method of instruction while control group were taught using the conventional method. The teaching was carried out during normal school hours using the normal school timetable. At the onset, a pre-test was administered to the students in the two groups and data were recorded. At the end of the experiment, post-test was also administered and data were recorded. The research questions were answered using mean and standard deviation while the Hypotheses were tested using Analysis of Co-Variance (ANCOVA) at 0.05 alpha level. The instrument used for collection of data was Computer Studies Achievement Test (CSAT). The instrument was subjected to both content and face validation with reliability coefficient of 0.98 using K-R 20 approach. The result of the findings revealed that students exposed to Heuristic method of instruction performed better than those taught with conventional method. Also the male students performed significantly better than the female students. Based on the findings of the study, the heuristic method of instruction promoted higher achievement. Hence, it was recommended that Heuristic method of instruction should be adopted in teaching computer studies in secondary schools to enhance students' academic achievement.

**Keywords:** Achievement, Heuristic Method, Quasi-Experiment, Computer Science

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## 1. Introduction

Computers are widely taught and used in schools and the need for advancement and literacy in the educational system has become more relevant. Computer study is the effort or the ability to make the generality of the students/people computer literates (Ajibade, 2006). Computer studies is the study of computer science, meaning of computer and algorithmic processes, including the principles, hardware and software designs, applications and the impact on society.

Computer science is the study of science that deals with the theory and methods of processing data/information in digital computers, the design of computer hardware and software, and the applications of computers. (Stein and Urdang, 2016). Computer science could also be understood as the study of computers and computational systems, human computer interaction, vision and graphics, numerical analysis, programming languages, software engineering, bio informatics and theory of computing (Williams, 2014). Computer is a programmable device that computes, performs high-speed mathematical or logical operations, which assembles, stores, correlates, or otherwise processes information (Stevenson, 2007).

The knowledge of computer studies is not only important and useful to the students or learners, but to everyone who desires to cope with the ever-emerging realities of our time (Mansaray, 2009). The rate of changes brought about by computer (new technologies) have significant effects on the way people live, work and even learn worldwide (Ukpai & Ugah, 2011). Computers constantly create opportunities and provide new solutions which are creative to the process of teaching and learning, though it was not as widely taught in secondary schools as other subjects. It is deemed necessary that secondary school students learn to use computers to improve their knowledge and prepare for careers in a world where computers have become as common as the pencil and paper. It is therefore, very necessary to teach and educate young learners especially in public secondary schools on the use of computer in order to prepare them for external and internal examinations and the new demands of modern technological world. If students are to be adequately prepared for future jobs, then "Computer studies" must become an integral part of their education (Ukpai & Ugah, 2011; Baribor, 2013). Computer studies as a subject is not gender bias, it has positive effects on both male and female learning it and

has the same motivating factors on learners.

It has been observed that a good number of students fail computer studies both in their internal and external examinations and external and internal competitions. They hardly attain the acceptable level of good performance in their results. No wonder in the report of West African Examination Council Chief Examiner on the statistics of entries and results for May/June 2015 (West Africa Senior School Certificate Examination) indicated that candidates' performances varied from subject to subject. Their performances were said to be good in commerce, office practice, physics, encouraging in English Language, French, Igbo, physical education etc. but poor in computer studies.

The required standard expected of the students in computer studies examinations, and their performance assessment in examination was reviewed by the Chief Examiner and was reported as average though no basis for comparison with any other subject(s). Majority of the students/candidates were reported to have shown that they had little or no understanding of the contents of the syllabus; evident in their responses include inability to explain/define terms or acronyms, basic programming and use of keywords in defining terms, misinterpretation of computer file, inability to differentiate between data and information, confusion between concepts, and poor knowledge of computer keywords. It was suggested that computer studies teachers/instructors should identify the correct method of teaching which will help the students to understand their weak areas better (Sidmach Tech, 2015).

In secondary schools, (public schools) the trends on students' achievement in computer studies has been quite discouraging as earlier stated. A close study of the way teaching and learning of computer studies are conducted in the senior secondary schools shows that the method of instructions does not stress the real life situation (Sule, 1997). The scholar argued that the methods of teaching used by teachers do not provide the students the opportunities for inductive and deductive reasoning. There is need to adopt a variety of teaching methods by secondary school teachers of computer studies in order to promote positive attitudes of students towards problem solving, enabling them to find out things for themselves and also prepare them for the senior school certificate examinations for better achievement.

Egunjobi (2007) opined that in secondary schools, most computer science teachers usually adopt the lecture method or the 'talk and chalk' method of teaching. Some other factors such as insufficient periods to cover some wide and technical/practical topics, lack of power supply, inadequate provision of enough computer gadget (instructional materials) to illustrate and also demonstrate the topic taught, students poor knowledge, and poor background, among others are in no doubt contribute to the poor performance of students in computer studies in Secondary schools (Adeyemi, 2002; Egunjobi, 2002).

The need to find alternative methods of teaching for improving the achievement of students in computer studies has stimulated a number of pedagogical claims and counter claims (Kahneman 2003; Santrock 2004; Shane 2005; and Hau-xu & Clark 2008). In secondary school, adopting rote learning in teaching computer studies could also be seen as incapable of imparting the relevant skills and knowledge in learners, therefore, it has been criticized by scholars, though effort at improving teaching and learning of computer studies generally has been made through the introduction of new innovations yet their achievements continue to be poor.

Nwafor (2014) defined method of instruction as those things/ activities the teacher does in order to facilitate learning. Method of instruction enhances effective communication, direction, and inculcation of values, skills and ideas to learners and also the systematic order of performing any activity, which stimulates and motivates students to learn. Regular poor achievement is basically related to application of ineffective teaching method employ in teaching students (Adunola, 2011). The method of teaching computer studies is teacher centered; students are not fully involved in teaching learning process. This method did not yield expected results. In the quest to search for a method which makes students more participatory in the teaching and learning process, the introduction of heuristic method of instruction becomes imperative. Therefore, method of instruction that can give students the contentment that one derives from discovering things by oneself is required (Prakash, 2011). According to the scholar, heuristic method of instruction is learning by doing, it opposes the dogmatic techniques of teaching where learners are passive. Perhaps, teaching methods work effectively if and only if they suit learners' needs, since every student interprets and reports to every question in a unique way (Bharadwaj & Pal, 2011).

Heuristic as a noun is a method of solving problems by discovering practical ways of dealing with the problems, learning from past experiences and as an adjective heuristic method of teaching encourages one to learn by finding things for himself (Hornby, 2010). The difference between heuristic and discovery approach is that the former adopts learning from past experiences while the latter is the process of finding something or learning about something that was not known about before that is a thing that is found or learned about for the first time (Hornby, 2010).

In computer science, a heuristic is a method designed to solve a problem more quickly so as to produce a good solution; that ignores whether the solution can be proven to be correct, but trades optimality and accuracy (Wikipedia, 2010). Prakash (2011), is of the view that heuristic means "I find out" and as a method, it is one in

which the students are left to find out things for themselves, in the position of discoverers and instead of being told the facts.

Generally, in the field of sciences, Heuristic method of instruction as proposed by its author Armstrong who is a professor of chemistry in the central Technical College, City of Guilds of London Institute has to do with one which involves placing students as far as possible in the position of discoverers. It is a method which involves finding out instead of being merely told about things.

These statements mean that telling is not teaching. The heuristic method tends to set the learner himself on the track of invention and to direct him into the paths in which the author has made his own discoveries. This method helps students to be observant and an independent problem solver; thoughtful and confident decision markers (Prakash, 2011).

Farooq (2013) called “heuristic” “problem -solving”. He goes further to discuss heuristic method of instruction as a way of solving problem which is placed before the learners and are asked to find the solution to the problem through various literacy means; like library, laboratory and internet search. Heuristic method is an innovative approach for effective teaching and learning of computer studies. Blinkston (2000) is of the view that, Heuristic method of instruction is a self-directed and self-invitation developed by the learner. It is a technique that deals with experience which helps in problem-solving, learning and discovery that is attributed by questioning and outlining line of attack and holds its root to the right signal a student got from his immediate environment.

It may be argued that this method is derived from experience with similar problems. The most fundamental heuristic is “trial and error”. Heuristics are rules of thumb, procedures, mental shortcuts, educated guesses or assumption, instructive opinions, and judgments or common sense (Jaszcolt & Katarzyna, (2006).

A specialist in the theory and methods of education and a professional who evaluates and studies behaviour and mental processes has been working on these natural ways of teaching and learning owing to the short comings of the conventional teaching methods (Obodo, 1997). This shows that secondary school computer laboratory or information and communication technology ICT center does not only aim at acquisition of knowledge, but also solve problems and make decisions (Kimpley, 2006). However, the level of interest of the students determine the level of attention, when the teacher raises the attention level to be high, learning becomes easy on the part of the students irrespective of sex. Heuristic method of instruction is not gender bias, it has positive effects on both male and female learning it and has the same motivating factors on learners A question may arise to ascertain whether heuristic method of instruction may have differential effects on male and female students in computer studies, perhaps there are gender inequalities on the achievement of secondary school students in computer. There may be differences in the performance of students in favour of male or female students but let both perform highly.

With the trends in the world of science and technology, the Nigerian schools are further challenged with the task of producing competent manpower in the field of computer. This urges great demand on computer teachers to formulate appropriate methods of instruction that could help candidate to face the emerging challenges in secondary schools (Achor, Agogo & Orokpo, 2011).An argument was raised that Heuristics are merely “rules of thumb” and educated guesses based on common sense (Santrock, 2004). There was an opinion that heuristic method aims at the students own observations to satisfy as many questions as possible to be raised in the teaching and learning situation (Prakash, 2011).

Xu-chug (2008) in his argument, opined while he could not set aside the heuristics as a strong tool for teaching computer studies. He observed that methods of learning which proffer solutions to problems without actually ensuring its workability might be followed with errors. Intervening into these raining controversies and authentic pursuit for the most suitable method of instructional for teaching computer studies, this study is on a mission to provide empirical confirmation on how heuristic method of instruction effects the achievement of secondary school students in computer studies.

### *1.1 Statement of the Problem*

The poor skill exhibited by senior secondary school students in solving computer science problems raise obvious worries about the subject.

The WAEC Chief Examiner’s report (2014) on ICT revealed that there was a decline in the performance of candidates. This is due to the fact that candidates did not take time to understand the technical and keywords used in the question before answering them. Candidates could perform better in the subject when practical and theories are taught with good method. He summarized the candidates’ weakness leading to poor achievement or knowledge of students in computer studies which attributed to their poor performance; un-readiness and poor preparation, poor command of English language, using acronyms and abbreviation in answering questions that require complete answers, error- types observed indicated poor knowledge of content and procedure, candidates from schools that did not have access to computers were at disadvantage and this showed in their work.

The rate at which students fail in science examinations (Computer studies inclusive), pose a lot of

challenges not only to science teaching and learning, but also technological development in Nigeria. The poor achievement of senior secondary school students in computer studies is caused by man power needs, the nature of laboratories in terms of materials and equipment, the use of inappropriate methods in teaching among others. A number of researchers have attributed the problem to poor method of instruction (Eke, 1991; Busari, 1999; and Ali, 2003). It was also observed that many students are not interested in the practical aspects of the subject, (Olotu, 2002).

More so, from the researcher's observation during her youth service days; qualified teachers are employed to teach computer studies, teachers are exposed to workshops, industrial training and seminars. Computer studies teachers are provided with incentives, government/non-governmental organizations made provisions for textbooks, information and communication technology (ICT) centers and computer laboratories are provided and used in teaching computer studies yet students' achievement continue to dwindle; the expectation required of the students are not achieved. On this established view, the researcher sought to determine the effect of Heuristic method of instruction on the achievement of secondary school students in computer studies.

### 1.2 Purpose of the Study

The major purpose of the study is to determine the effect of heuristic method of instruction on the achievement of Secondary School Students in Computer Studies. Specifically; the study sought to determine the effects of:

1. heuristic method of instruction on students' mean achievement scores in computer studies.
2. heuristic method on the mean achievement of male and female students in computer studies.
3. interaction between gender and method of instruction on students' mean achievement in computer studies.

### 1.3 Scope of the Study

The study was de-limited to the effects of heuristic method of instruction on the achievement of senior secondary school students in computer studies. It was restricted to Senior Secondary School (SS II) students in government/public schools. The study was conducted in Ebonyi North Education zone, Abakaliki where the achievements of students in computer studies are not encouraging and also where information and communication technology centers /computer laboratory can easily be assessed. In terms of content scope, the following topics were taught which is under Basic Concept of Computer Hardware: (1) Central processing unit (2) Memory unit (3) Units of storage (4) Standard simple logic gates

### 1.4 Research Questions

The following research questions guided the Study:

1. What is the effect of Heuristic method of instruction on students' mean achievement scores in computer studies?
2. What is the effect of Heuristic method of instruction on the mean achievement scores of male and female students in computer studies?
3. What is the interaction effect of gender and method of instruction on students' mean achievement scores in computer studies?

### 1.5 Hypotheses:

The following null hypotheses were tested at an alpha level of 0.05

- Ho<sub>1</sub>: There is no significant effect in the mean achievement scores of students taught computer studies using heuristic method of instruction and those taught with the conventional approach.
- Ho<sub>2</sub>: There is no significant effect in the mean achievement scores of male and female students in senior secondary school taught computer studies using the heuristic method of instruction.
- Ho<sub>3</sub>: There is no significant interaction effect of gender and method of instruction on the mean achievement scores of students' in computer studies.

### 1.6 Methodology

This study adopted a quasi-experimental design; pre-test post-test non-equivalent control group design with one experimental group (Heuristic method) and a control group (conventional method 'chalk and talk'). The design is illustrated thus:

$$\frac{Y^b \quad xY^a}{Y^{b\sim} \quad xY^a}$$

Where

$Y^b$	=	measurement taken before treatment
$Y^a$	=	measurement taken after treatment
$x$	=	treatment for experimental group (Heuristic method)
$\sim x$	=	treatment for control group (conventional method)

This study was conducted within the Ebonyi North Education Zone Abakaliki of Ebonyi State. The experimental group comprised 99 male and female students while the control group comprised of 101 male and female students, making a total of 200 students was used for the study.

Six secondary schools out of the seventy-six secondary schools in Ebonyi North Education Zone Abakaliki, Ebonyi State were used for the study. The criteria used for the selection of the six schools was that the school must have information and communication technology center / computer laboratory, the school must offer computer studies as a subject and also the school must have a qualified computer studies teacher. The six secondary schools (2 boys' schools, 2 girls' schools and 2 co-educational) were drawn from the Education Zone through simple random sampling. Out of the six schools, three schools (one male, one female and one coeducational) were assigned as the treatment group while the remaining three schools as the control group through the toss of a coin. That means six schools (3 for treatment group and the other 3 for control group) were used for the study. In each school, all the intact classes of SSII were used for the study.

The instrument, Computer Studies Achievement Test (CSAT), structured by the researcher was used for the study. The CSAT consist of thirty (30) multiple choice questions with four options A-D for each of the items. The items were drawn using tables of specification from the contents that was covered during the experiment, which includes: central processing unit, memory unit, units of storage (memory unit 2) and standard single logic gates. The topics were the content specified in the computer studies curriculum of the Ministry of Education for senior secondary 1-3 in computer studies.

The instrument was subjected to both face and content validation procedure.

The items were trial tested on thirty students in a school different from those used for the study. The instrument CSAT was assessed for reliability using the Kuder-Richardson's (K-R 20) procedure. A reliability index of 0.98 was obtained which is an indication that the instrument was reliable.

### *1.7 Experimental Procedure*

Two instructional approaches were used for the study. The Heuristic instructional method was used in teaching the treatment group, while the conventional approach was used in teaching the control group. The researcher used the computer studies teachers in the school for the study and also trained them on how best to use the method. At the onset of the experiment, pre-test was administered to the intact classes for both the treatment and control groups. The various computer studies teachers act as the research assistants. The experiment was carried out during the normal school hours using the normal school time table. At the end of the experiment which lasted for eight weeks, the researcher administered the post-test on the subjects in the two groups. The items of pre-test and post-test were the same for both groups. The data/scores of students were collected from the pre-test and post-test. These were kept separately for the two groups and were used to answer the research questions and testing the hypotheses. Research questions were answered descriptively using mean and standard deviation while the hypotheses were tested at 0.05 confidence level using the analysis of covariance (ANCOVA).

### *1.8 Control of Extraneous Variables*

The following procedures were adopted by the researcher to ensure that extraneous variables which may introduce bias into the study are properly controlled.

- a) **Teacher Variable:** The researcher co-ordinate the computer science teachers by organizing pre-treatment training based on the contents to be taught so as to minimize errors coming from the teacher variable. Separate pre-experimental training was organized for teachers in the two groups (treatment and control groups). The researcher trained the teachers to ensure that they do not deviate from the agreed instruction.
- b) **Subject Interaction:** The researcher will not select treatment and control group from the same school. This is to ensure that students in the two groups do not mix up at all and also reduce the errors that might arise from the exchange of ideas or even interactions among research subjects from the treatment and control groups. Further, the researcher tried to eliminate the possibility of a John Henry Effect (a spirit of competition arose in students when they realized that they are being used for experiment that requires comparison at the end).
- c) **Intergroup Variable:** The study made use of an intact class, as such; it implies that attaining initial equivalence is not possible for the two groups. The researcher employed a statistical approach i.e. Analysis of Co-variance (ANCOVA) in analyzing data and to control the errors that may arise from comparing effects of treatment on two unequal groups and also ensure that only the effects of the treatments formed the basis for inference.
- d) **Instructional Situation Variable:** To ensure that instructional situation is the same for all the schools, the researcher prepared instructional guides/manuals for the teachers in each group. The teaching was conducted in all SSII classes in various schools that were used for the study.
- e) **Testing Effect:** The same test was administered for the pre-test and post-test. To ensure that students do



not recall/cram answers, the items were re-arranged in the post-test so that the numbers do not correspond with the one of the pre-test.

## 2. Results

### 2.1 Research Question 1:

What is the effect of heuristic method of instruction on students' mean achievement scores in computer studies?

To answer this research question, mean score and standard deviation of students taught computer studies with heuristic and conventional methods are computed and presented in table 1.

Table 1: Mean score and standard deviation of students' achievement for the two groups in computer studies.

Groups	N	Mean	Standard deviation
Treatment group (taught computer studies using heuristic method of instruction)	99	69.30	16.951
Control group (taught computer studies with conventional approach)	101	60.00	18.494

The summary of result presented in table 1 show clearly that the Heuristic method of instruction in computer studies yielded a higher mean achievement score than the conventional approach. Students taught with heuristic approach have mean score of 69.30 with a standard deviation of 16.951 while students taught the same with conventional approach have mean score of 60.00 with a standard deviation of 18.494. The result indicates that students taught with heuristic method of instruction performed better than those taught with conventional method. This shows that heuristic method of instruction has positive effect on students' achievement in computer studies.

### 2.2 Research Question 2:

What is the effect of Heuristic method of instruction on the mean achievement scores of male and female students in computer studies?

To answer the research question, the researcher uses the treatment group only (male and female students in the treatment group were separated and used), mean scores and standard deviations of male and female students taught computer science studies with heuristic method of instruction are computed below in table 2.

Table 2: Mean score and standard deviation of males and females students taught computer studies using heuristic method of instruction.

Gender	N	Mean	Standard deviation
Male students	49	72.55	19.467
Female students	50	66.12	13.511

In table 2 above, the male students taught computer studies with heuristic method had mean score of 72.55, with standard deviation of 19.467 while the female students taught same with heuristic method had mean score of 66.12 with standard deviation of 13.511. This shows that male students taught computer with heuristic method of instruction performed better than their female counterparts.

### 2.3 Research Question 3:

What is the interaction effect of gender and method of instruction on students' mean achievement scores in computer studies?

To answer the research question, mean scores of male and female students taught computer studies using heuristic method of instruction were compared with the mean scores of male and female students taught same using conventional lecture method to determine their interaction.

Table 3: Summary of interaction effect of gender and method of instruction on students' mean achievement scores in computer studies.

Methods	Gender	
	Male	Female
1 Heuristic method	72.55	66.12
2 Conventional method	62.19	57.49

As shown in table 3, the heuristic method is superior to the conventional method at the two levels of gender. The heuristic method of instruction in computer studies yielded a mean score of 72.55 for males and 66.12 for females while the conventional approach could yield only a mean of 62.19 for males and 57.49 for females. This is an indication that at the treatment level, the mean achievement scores for both males and females are higher than those of the control group.

### 2.4 Hypotheses

**H<sub>01</sub>:** There is no significant difference in the mean achievement scores of students taught computer studies

using the heuristic method of instruction and those taught the same using conventional method of instruction.

**H<sub>03</sub>:** The interaction effect of gender and method of instruction on the mean achievement scores of students in computer studies will not be significant.

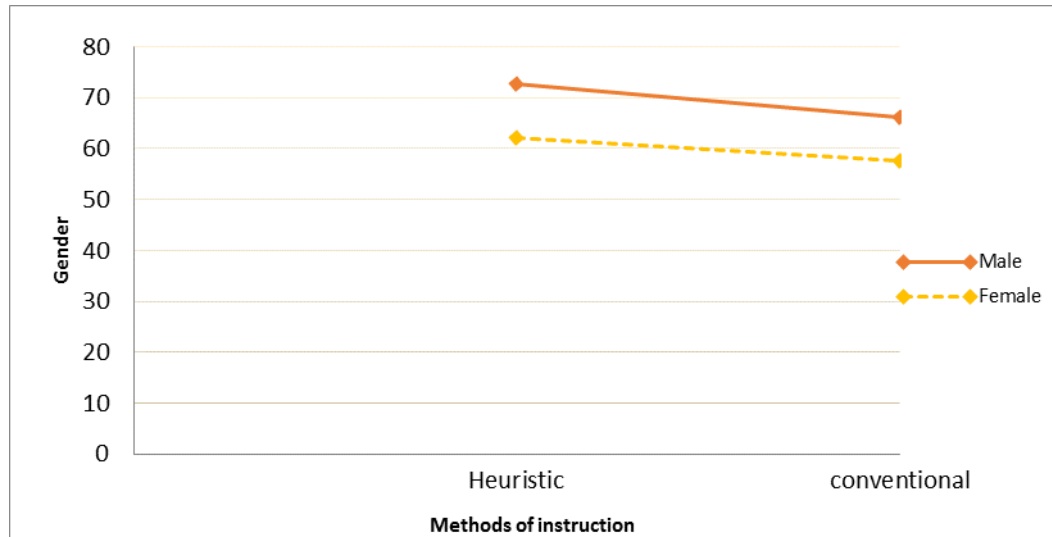
These two hypotheses (H1 and H3) were tested using Analysis of Co-Variance (ANCOVA). Summary of the analysis for hypotheses H1 and H3 are shown in table 4.

Table 4: Analysis of Co-variance for students' overall computer studies achievement scores by method of instruction and by gender.

Source of variation	Sum of squares	Df	Mean square	F	Sig. of F
Covariates	1467.158	1	1467.158	4.855	.29
Pre-test	1467.158	1	1467.158	4.855	
Main effects	6250.694	2	3125.347	10.343	
Method of instruction	4731.475	1	4731.475	15.658	.000
Gender	1748.936	1	1748.936	5.788	.017
2-way interaction	44.604	1	44.604	.148	.701
Method and gender	44.604	1	44.604	.148	.701
Explained	7762.456	4	1940.614	6.422	
Residual	58925.339	195	302.181		
Total	66687.795	199	335.115		

For hypothesis 1, the summary of the results in the above ANCOVA table show for the comparison of method of instruction, the F-value is 15.658 while the significance of F value is (0.000) at an alpha level of 0.05. The decision rule is to reject the null hypothesis if the alpha level (0.05) exceeds the significant value. Since the alpha level (0.05) is greater than the sig of F (0.00), the null hypothesis was rejected. The researcher, therefore, concludes that there is a significant effect in the mean achievement scores of students taught computer science studies using heuristic method of instruction and those taught same using the conventional method.

For hypothesis 3, result in table 4 reveals that for the two-way interaction effects the F value is 0.148 while the significance of F value at alpha level (0.05) is 0.701. Based on the decision rule, the researcher upholds the null hypothesis and concludes that there is no significant interaction effect of gender and method of instruction on students' mean achievement in computer studies. The mean scores are displayed graphically and it is evident that there is no interaction.



**H<sub>02</sub>:** There is no significant difference in the mean achievement scores of male and female students taught computer studies using the heuristic approach.

This hypothesis was also tested using the analysis of co-variance. Summary of result is shown in table 5.

Table 5: Analysis of co-variance of mean achievement scores of male and female students taught computer studies using Heuristic method of instruction.

Source of variation	Sum of squares	Df	Mean square	F	Sig. of F
Covariates	1248.180	1	1248.180	4.661	
Pre-test	1248.180	1	1248.180	4.661	
Main effects	1200.610	1	1200.610	4.483	
Gender	1200.610	1	1200.610	4.483	0.037
Explained	2448.790	2	1224.395	4.572	
Residual	25710.119	96	267.814		
<b>Total</b>	<b>28158.909</b>	<b>98</b>	<b>287.336</b>		

For hypothesis 2, table 5 above reveals that the alpha level (0.05) is greater than the significant of F (0.037). Since the alpha value is greater than the F significant value, the null hypothesis is rejected. The researcher, therefore, rejects the null hypothesis and concludes that there is a significant difference between the achievement score of male and female students taught computer studies using the heuristic method of instruction.

### 2.5 Summary of Results

Results presented in this chapter revealed the followings:

1. Heuristic method of instruction fostered higher achievement in computer studies than the conventional lecture method. Heuristic method is therefore superior to conventional method in facilitating higher achievement in computer studies amongst secondary school students.
2. The difference in the means achievement scores of male and female students taught computer studies using the heuristic method is statistically significant.
3. There is no significant interaction effect of gender and method of instruction on students' means achievement scores in computer studies.

### 3. Discussion

#### The Effects of Heuristic method of instruction on secondary school students' mean achievement in computer studies.

The results obtained from this study show that the students taught computer studies using heuristic method of instruction (treatment group) performed better than the students taught same using the conventional lecture method (control group). Thus, the effect heuristic method has on learning determines the success of the experimental group.

The result is in line with the finding of Fassasi, (2015); Abonyi and Umeh, (2014) which showed that there is significant difference in the achievement of the experimental and control groups when exposed to heuristic method of instruction. The results of the study also confirm the findings of Harbor, (2001) who explained that low achievement of secondary school students could be attributed to non-utilization of appropriate method of instruction by teachers.

The higher achievement on the experimental group i.e. those taught with heuristic method of instruction also shows that heuristic method is very effective for teaching computer studies. The method if adopted will enable students to be active participants and learn by doing things for themselves, think for themselves and do not merely listen for information.

The finding of this study also corroborated with the reports of Ngozi, (2003), which showed that new strategies in teaching and learning facilitates greater emphasis, attracts attention of the learners, motivates the student and develop deep understanding of the important ideas.

#### The Effect of Heuristic method of instruction on the mean achievement scores of male and female secondary school students in computer studies

The summary of the result show that heuristic method of instruction does not discriminate across gender, although the achievement of male students is higher than those of their female counterparts, the test of significant shows that the difference in their achievement scores is not statistically significant.

The finding of this study is in line with the studies conducted by Fassasi, (2015); Abonyi and Umeh, (2014) although their studies centred on achievement in mathematics, it revealed that heuristic method of instruction is not gender biased. Their results showed a significant difference in the mean achievement scores of male and female students taught mathematics using heuristic method of instruction. Substantial evidence that active learning strategies are not gender biased was opined by Fayombo, Babalola and Olaleye, (2012).

From the finding of this study, it was also observed that male students and female students could do well in science when they are exposed to similar learning conditions. There is a significant difference in the academic mean achievements of male and female students after treatment indicated that gender is not a significant factor in academic achievement in science subjects Nsofor, (2001). Adigun et al, (2015) obtained no significant difference in students' academic achievement and retention in computer studies. This implies that there are no longer



distinguishing skills based on cognitive, affective and psychomotor in the achievement of students in respect of gender. It is therefore necessary that computer studies teachers should consider the adoption of heuristic method which will improve the academic achievement of our male and female students at the secondary school level. This is evident by the gain in the mean scores of both sexes.

#### **The Interaction effect of gender and method of instruction on secondary school students' mean achievement scores in computer studies.**

The summary of result shown in table 6 showed that the mean scores of male and female students in the treatment group is higher than those in the control group. This reveals that at the levels of gender, the heuristic method of instruction is superior to the conventional lecture method in enhancing the achievement of senior secondary school students in computer studies.

The result of the study showed that there is no interaction between gender and method of instruction on students' achievement in computer science. The findings is also in line with that of Fayombo, Babalola and Olaleye, (2012); Abonyi and Umeh, (2014) and Fassasi, (2015). These studies reveal no interaction between gender and method of instruction on students mean achievement scores. The treatment interaction as explained by Abonyi, (1999) implies generally that different learners with different characteristics may profit more using from one type of method of instruction and another and that therefore it may be possible to find the best match of learners' characteristics and method of instruction in other to enhance learning outcomes or whichever dependent variable that is involved. Hence, there is no need for separation on method of instruction for male and female since the heuristic method could be adopted successfully for the two groups (gender).

#### **4. Conclusion**

Based on the findings of this study, it was noted that students' achievement in computer studies depends on the method of instruction used by the teachers. The result of the study obtained indicates that heuristic method of instruction is very significant and suitable in enhancing students' achievement in computer studies. From the results, the following conclusions were drawn:

- i. Heuristic method of instruction promoted higher achievement in computer studies than the conventional method. This shows that heuristic method of instruction is therefore superior to the conventional method in facilitating better achievement among secondary school students in computer studies.
- ii. The difference in the mean achievement scores of male and female students taught computer studies using the heuristic method is significant.
- iii. There is no significant interaction between gender and method of instruction on students' mean achievement in computer studies.

#### **5. Recommendations**

Based on the findings of this research work, the following recommendations were made:

1. Heuristic method of instruction should be adopted by computer studies teachers in order to motivate or facilitate students, stimulate and sustain their interests in the subject with the objective of enhancing their achievements. This will also enable all students irrespective of their background to understand computer science studies not only as a subject but apply it to solve daily problems.
2. Teachers with the help of the school administrators should be exposed to workshops, conferences, seminars on the effective use of heuristic method of instruction in all secondary schools both in Junior and senior secondary schools.
3. Nigerian curriculum developers and textbook authors should be encouraged by the government to review their books in line with heuristic method so that the books or curriculum materials will be students' friendly.
4. Federal, states and local governments should encourage and also sponsor in-service trainings, workshops, and computer literacy programmes for both students and teachers and encourage teachers to adopt heuristic method of teaching as part of their teaching methods.
5. Federal and state government as well as local government, community leaders and non-governmental organizations should help to equip all schools with the necessary facilities (ICT centers and computer laboratory) for the application of heuristic method of instruction.

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