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Effect of Guided Inquiry-Based Learning on Senior Secondary II Students' Academic Achievement in Computer Studies in Owerri Education Zone, Imo State

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Abstract
This study investigated the effect of Guided Inquiry Learning on Senior Secondary II students' academic achievement in computer studies in Owerri Education Zone, Imo State. The study adopted a quasi-experimental design with pre-test post-test non-equivalent control group with a population of 9,815 SSII Computer Studies students in 78 public secondary schools in Owerri Education Zone I. The sample of the study comprise of 180 SSII Computer Studies students drawn from four Secondary Schools in Owerri education zone I, Imo State (100 students from two schools in the urban and 80 students from two schools in the rural). Three research questions and three hypotheses were formulated and tested at 0.05 significant levels. Data were collected using Computer Studies Achievement Test (CSAT) of 41 items. The instrument was subjected to face and content validation by three experts. The reliability of CSAT instrument was carried out using Kudder Richardson ($K\text{-}R_{20}$) formula to determine the internal consistency which yielded an index of 0.70. The data collected during the pre-test and post-test administration was statistically analyzed using Analysis of Covariance (ANCOVA) for the null hypotheses while mean and standard deviation were used to answer the research questions. The study revealed that guided inquiry based method has significant increasing effect on students' academic achievement in Computer Studies, while gender has no significant effect on students' academic achievement in computer studies. The study recommended, among others, that Computer Studies teachers should be encouraged to use guided inquiry-based learning in the teaching of Computer Studies.

Keywords: Computer Studies, Guided Inquiry, Based Learning, Academic Achievement, Gender.

Introduction

In a rapidly changing world, basic education is essential for an individual to be able to access and apply information. The Economic Commission for Africa has indicated that the ability to access and use information is no longer a luxury, but a necessity for development. Unfortunately, many developing countries, especially in Africa, are still low in Information and Communication Technology (ICT) application and use (Aduwa & Iyamu, 2013). Computer science is the study of the theory, design, use and analysis of computer devices. This entails knowing the computer itself, its operation, what it can do, how it can do it and why it's doing it. These form the basis of computer studies curriculum in secondary schools. It is widely accepted that Computer Science competencies are important skills for the twenty-first century, since they allow students to construct and create meaningful artefacts using computers. In particular, skills such as computational thinking, which include problem solving, complex systems design, and evaluation as well as human behaviour understanding, are cornerstones of Computer Science education (Adigun, Onihunwa, Irunokhai, Sada & Adesina, 2015). The ability to use computers effectively has become an essential part of everyone's education. Skills such as book keeping, clerical and administrative work, stocktaking, and so forth, now constitute a set of computerized practices that form the core IT skills package, Spread Sheets, Word Processors and Database.

Because of the usefulness of Computer/ICT, the methods of teaching the subject should be of great importance to Computer Studies/ICT educators. Generally, teaching requires that, the teacher creates an environment in which students are active learners. It also requires that the teacher integrates a range of assessment methods into their instruction to enhance students understanding (National Board for Professional Teaching Standards, 2009). Unfortunately, Science teachers in sub-Saharan Africa use the traditional method of teaching in their lessons where concepts are taught by giving a set of rules to students to be followed without the students knowing how those concepts came about (Akyeampong, Lussier, Pryor, & Westbrook, 2013). According to Annan, Adarkwah et al (2019), educators are beginning to recognize that there are better ways to learn other than through the traditional methods. The traditional methods of teaching according to experts are passive rather than active. Students are made to act as spectators rather than partakers in the learning process. Also, the traditional method of teaching does not enhance critical thinking and collaborative problem-solving since *chew and pour* is

the order of the day. Students should be exposed to various strategies of problem solving. One of such strategies is to create conducive learning environment where students can learn through inquiry by which students are placed at the Centre of the learning process (Wonkyi & Adu, 2016).

Inquiry teaching method is a term used in science teaching that refers to a way of questioning, seeking knowledge, information or finding out about phenomena, it involves investigating data and arriving at a conclusion (Sola & Ojo, 2015). In inquiry situation students learn not only concept but also self-direction, responsibility and social communication. It also permits students to assimilate and accommodate information. It is the way people learn when they are left alone.

Cheval and Hart (2013) classify inquiry teaching method into three classes, namely: structured inquiry, guided inquiry and open inquiry. All these types of inquiry can be useful to students to learn science when taught appropriately. Structured inquiry is the most teacher-centred of the three types of inquiry. This type of inquiry is commonly seen in science classrooms in the form of laboratory exercises. The teacher provides fairly structured procedures for the inquiry activity, and students carry out the investigations. Structured inquiry could be described as the most traditional approach to inquiry (Cheval & Hart, 2013). The open inquiry on the other hand is a type of inquiry which requires the least amount of teacher intervention and is student centred. Students, in this case, often work in groups and plan all phases of their investigations, while guided inquiry falls in the middle of the inquiry instructional spectrum. This type of inquiry is commonly used when students are asked to make tools or develop a process that results in a desired outcome. The teacher provides the problem and materials and the students carry out the experiment using their own scientific process or procedure.

The inquiry-based teaching approach is supported on knowledge about the learning process that has emerged from research (Bransford, Brown, & Cocking, 2015). In inquiry-based science education, children become engaged in many of the activities and thinking processes that scientists use to produce new knowledge. Science educators encourage teachers to replace traditional teacher-centred instructional practices, such as emphasis on textbooks, lectures, and scientific facts, with inquiry-oriented approaches that (a) engage student interest in science, (b)

provide opportunities for students to use appropriate laboratory techniques to collect evidence, (c) require students to solve problems using logic and evidence, (d) encourage students to conduct further study to develop more elaborate explanations, and (e) emphasize the importance of writing scientific explanations on the basis of evidence (Secker, 2016). Sandoval and Reiser (2014) pointed out in order to build the inquiry-based classroom environment must construct a community of practice like the scientists work. In authentic inquiry-based activities, the students take action as scientists did, experiencing the process of knowing and the justification of knowledge. Alignment of teaching methods with students' needs and preferred learning influence students' academic attainments (Zeeb, 2014). Effective instructional strategy leads to improvement in students' performance whereas poor teaching strategy leads to poor performance and frustration on the part of the students. Adewale and Effiong (2015) report vividly that poor performances of students are a direct result of techniques employed by teachers. Therefore, effective instructional strategy not only improves students' performance, but motivates the learners. It is in view of the importance of instructional strategy in improving students' performance that researchers continue to seek for appropriate strategies that will ensure effective teaching and learning (Adewale & Effiong, 2015).

Academic achievement is the outcome of education, that is, the extent which a student, teacher or institution has achieved their educational goals. Academic achievement is commonly measured by examination or continuous assessment but there is no general agreement on how it is best tested, but it intends to measure systematic education and training towards a conventionally accepted pattern of skills or knowledge. According to Adediwura and Tayo (2017), academic achievement is designated by test and examination scores or marks assigned by the subject teachers. It could also be said to be any expression used to represent students' scholastic standing. Several subjects may be combined into an achievement series for measuring general academic proficiency either in point score or achievement age. What this means is that academic achievement is measured in relation to what is attained at the end of a term, since it is the accomplishment of medium or long term objective of education. What is important is that the test should be a standardised test to meet national norm. For a test to be standardised, it must be valid for over a period of time.

Gender is a specially constructed phenomenon that is brought about as society ascribes different roles, duties, behaviours, and mannerisms to the two sexes, (Mangvwat, 2016). It is a social connotation that has sound psychological background, and it is used to refer to specific cultural patterns of behaviour that are attributed to human sexes. Gender relates to cultural attributes of both males and females (Akpochafo, 2019). Gender according to Lahey (2013) is a psychological experience of being a male or female. It has to do with personality and central components of self-concept. Unlike sex, which is concerned with, only the distinction between male and female based on biological characteristics, gender encompasses other personality attributes as roles, orientation and identity based on individual's conceptualization of self. For instance, Singh (2016) opines that gender refers to a socio-cultural construct that connotes the differentiated roles and responsibilities of men and women in a particular society. This definition implies that gender determines the role, which one plays in relation to general political, cultural, social and economic system of the society. According to Betiku (2015), gender refers to all the characteristics of male and female, which a particular society has determined and assigned each sex. Also, Onyeukwu (2014) sees gender as the dichotomy of roles culturally imposed on the sexes.

Joel and Aride (2016) once described gender stereotype in school as "hidden curriculum" which send out messages to girls to conform to role expectation. In most societies, gender has roles based on the women folk, preventing their participating in, and benefiting from development efforts (UNESCO, 2000). This has created a big psychological alienation or depression in the minds of the female students. As a result, boys dominate science subjects such as Chemistry, Physics, Mathematics and Environmental studies classes while the girls go into reading, languages and Arts.

Statement of the Problem

The benefits of teaching Computer Studies in secondary schools are numerous but the available statistics shows that there is poor performance of students in the subject. This leaves one in doubt of the effectiveness of the teaching methods used in teaching the subject by the Computer Studies teachers, which may have resulted in low learning, regurgitation of facts, with the indication that such instructional method has not been adequate in improving students'

achievement and interest in Computer Studies. Two factors limiting students' achievement are lack of understanding of Computer Science/ICT as a discipline of study and lack of properly trained Computer Studies teachers. In line, most researches carried out in Computer Studies are continually seeking for better teaching techniques that will enhance students' achievement, improve attitude, increase engagement and bridge the gender gap in male and female students' achievement in Computer Studies.

Hence, will a change in the focus of the classroom from the traditional teacher-centred approach to a learner-centred approach bring about an improvement in students' achievement in Computer Studies? This is the problem this study addressed.

Purpose of the Study

The purpose of this study is to determine the effect of inquiry based method on students' academic achievement in Computer Studies. Specifically the study sought to:

1. ascertain the mean achievement scores of students taught Computer Studies using guided inquiry based method and those taught with lecture method.
2. determine the mean achievement scores of male and female students taught Computer Studies using guided inquiry based method.
3. find out the interaction effect of gender and method on mean achievement scores of students taught Computer Studies using guided inquiry based method.

Research Questions

The following research questions guided the study:

1. What are the mean achievement scores of students taught Computer Studies using guided inquiry based method and those taught with lecture method?
2. What are the mean achievement scores of male and female students taught Computer Studies using guided inquiry based method?

3. What are the interaction effects of gender and method on mean achievement scores of students taught Computer Studies using guided inquiry based method?

Hypotheses

The following null hypotheses were formulated and was tested at 0.05 level of significance:

HO_1 There is no significant difference between the mean achievement scores of students taught Computer Studies using guided inquiry based method and those taught with lecture method.

HO_2 There is no significant difference between the mean achievement scores of male and female students taught Computer Studies using guided inquiry based method.

HO_3 There is no significant interaction effect of gender and method on mean achievement scores of students taught Computer Studies using guided inquiry based method.

Method

This research adopted a quasi-experimental design with pre-test post-test non-equivalent control group to determine the effect of guided Inquiry-Based Learning on students' academic achievement in Computer Studies.

Three research questions and three null hypotheses guided the study. The population of the study was 9,815 Senior Secondary II Students in the Secondary schools used for the study. One Hundred and Eighty (180) students from four intact classes participated in the study. The students were randomly assigned to experimental and control groups respectively. The students in the experimental group were taught using inquiry method while those in the control group were taught with the conventional lecture method. The instrument used for data collection was 41 items multiple choice Computer Studies Achievement Test (CSAT).

The validity of the instruments was determined by three experts, one in Curriculum Studies and one in Measurement and Evaluation of College of Education Michael Okpara University of Agriculture, Umudike (MOUAU) and one from Computer Science Department, Alvan Ikeku Federal University of Education, Owerri, to check both the content and face validity of the instrument. The internal consistency reliability estimate was determined using K – R 20 formula, which yielded a coefficient of 0.70.

Prior to the commencement of the treatment, all students both in experimental and control groups were subjected to a pre-test in order to obtain the pre-test achievement scores. The scores obtained by the students from the two groups represented their pre-test scores. Thereafter, the actual treatments began in which the experimental groups were taught with inquiry-based method while those in the control groups were taught using conventional lecture method.

After six weeks of treatment, the post-test was administered to the students in their respective groups to obtain the post-test achievement scores. Those scores obtained for the two tests (pre-test and post-test) from the two groups (experimental and control) were compiled for the analysis. Mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used test for the hypotheses at 0.5 level of significance.

Results

The summary of the data analysed and results are presented below:

Research question One

What are the mean achievement scores of students taught Computer Studies using inquiry based learning and those taught with lecture method?

The data for answering research question 1 is presented in Table 4.1

Table 1: Analysis of mean and standard deviation on mean achievement scores of students taught Computer Studies using inquiry-based learning and those taught with lecture method

Group	N	Pre-test		Post-test		Mean Achievement Gain
		Mean	*S*	Mean	*S*	
Inquiry Based learning	90	42.09	4.11	53.70	4.12	11.61
Lecture method	90	40.14	4.12	48.89	4.16	8.75

N = Number of Students, S = Standard Deviation

The data presented in Table 1 showed that the students taught computer studies with Guided Inquiry Based learning (experimental group) had a mean pre-test of 42.09 with a standard deviation of 4.11 with a corresponding mean post-test score and standard deviation of 53.70 and 4.12 respectively. Conversely, the students taught computer studies using the lecture method had pre-test mean scores of 40.14 with standard deviation of 4.12 while the post-test mean scores and standard deviation were 48.89 and 4.16 respectively. More so, from the table, it was observed that students taught with Inquiry Based learning (experimental group) had a mean gain score of 11.61while those taught with lecture method (control group) had a mean gain of 8.75 in computer studies. This indicated that students taught computer studies using the Inquiry Based learning had a higher positive mean achievement gain compared to those taught computer studies using the lecture method. Therefore, in order to ascertain how significant the mean achievement gain is, hypothesis 1 was tested at 0.05 level of significance.

Hypotheses One

There is no significant difference between the mean achievement scores of students taught Computer Studies using inquiry-based learning and those taught with lecture method.

Table 2: Analysis of Covariance (ANCOVA) of significant difference between the mean achievement scores of students taught Computer Studies using inquiry based learning and those taught with lecture method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	342.812[a]	4	85.703	3.308	.009
Intercept	7356.101	1	7356.101	283.899	.000
PRETEST	67.512	1	67.512	2.6055	.000
METHOD	1442.121	1	1442.121	55.66	.001
Error	4612.203	178	25.911		
Total	441280.080	180			
Corrected Total	6318.932	179			

The data presented in Table 2 shows a p-value of .001 which is less than the alpha value of .05. This indicates that there was a statistical significant difference between the mean achievement scores of students taught Computer Studies using inquiry based learning and those taught with lecture method. Therefore, the hypothesis of no significant difference between the mean achievement scores of students taught Computer Studies using inquiry based learning and those taught with lecture method was rejected.

Research Question Two

What are the mean achievement scores of male and female students taught Computer Studies using inquiry based learning?

Table 3: Analysis of mean and standard deviation on mean achievement scores of male and female students taught Computer Studies using inquiry based learning

Group	N	Pre-test		Post-test		
		Mean	*S*	Mean	*S*	Mean Gain
Male	43	43.10	4.33	50.11	4.15	7.01
Female	47	42.54	4.15	48.99	4.09	6.45

N = Number of Students, S = Standard Deviation

The result in Table 3 indicated that male and female students taught Computer Studies using inquiry based learning had pre-test mean achievement scores of 43.10 and 42.54 with the respective standard deviation of 4.33 and 4.15. More so, a post-test mean achievement scores of 50.11 and 48.99 with standard deviation of 4.15 and 4.09 respectively. This statistical data presented in the table showed that the male students taught computer studies using the inquiry based learning performed better than their female counterparts with a mean achievement gain score of 7.01 as against the female of 6.45 resulting in the mean gain interest of 0.56. Meanwhile, to ascertain how significant the mean difference was, hypothesis two was tested at 0.05 level of significance.

Hypothesis Two

HO_2 There is no significant difference between the mean achievement scores of male and female students taught Computer Studies using inquiry based learning

Table 4: Analysis of Covariance (ANCOVA) of significant difference between the mean achievement scores of male and female students taught computer studies using inquiry based learning

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	421.741[a]	4	105.435	2.541	.009
Intercept	7610.531	1	7610.531	183.39	.000
PRETEST	45.770	1	45.770	1.103	.000
GENDER	18.637	2	9.319	0.225	.011
Error	3610.212	87	41.497		

Total	437145.052	90
Corrected Total	5009.312	89

a. R Squared = .066 (Adjusted R Squared = .047)

The data presented in Table 4 shows a p-value of .011 which is greater than the alpha value of .05. This indicates that there was no significant difference between the mean achievement scores of male and female students taught computer studies using inquiry based learning. Therefore, the hypothesis of significant difference between mean achievement scores of male and female students taught computer studies using inquiry based learning was not rejected.

Research Question Three

What are the interaction effects of gender and method on mean achievement scores of students taught Computer Studies using inquiry based learning and those taught with lecture method?

Table 5: Interaction effects of gender and method on mean achievement scores of students taught Computer Studies using inquiry based learning and those taught with lecture method

			Pre test		**Post-test**		
Group	**Gender**	N	$\overline{X}$	SD	$\overline{X}$	SD	Mean Gain
Inquiry Based Learning	**Male**	43	43.10	4.33	50.11	4.15	7.01
	Female	47	42.54	4.15	48.99	4.09	6.45
	Differences		**0.56**	**0.18**	**1.12**	**0.06**	**0.56**
Lecture Method	**Male**	44	40.83	4.01	44.63	4.08	5.80
	Female	46	38.89	4.09	43.30	4.12	4.41
	Differences		**1.94**	**-0.88**	**1.33**	**-0.04**	**1.39**

The results presented in Table 5 revealed that the mean gain achievement scores of 7.01 and 6.45 obtained by male and female students respectively when taught computer studies using inquiry based learning were higher than the mean gain achievement scores of 5.8 and 4.41 obtained by male and female students respectively when taught with lecture method. The table further disclosed that male and female students in the inquiry based learning group had pre-test mean scores of 43.10 and 42.54 respectively while male and female students in lecture method group had pre-test mean scores of 40.83 and 38.89 respectively. The male and female students in inquiry based learning group obtained post-test mean scores of 50.11 and 48.99 respectively while male and female students in lecture method group had post-test mean scores of 44.63 and 43.30 respectively.

Therefore, the data in table 5 indicated that both male and female students taught computer studies using inquiry based learning were superior to their counterparts taught with lecture method in their mean achievement scores in computer studies. The table further indicated that though, the male students performed better when exposed to inquiry based learning but this cannot be attributed to their gender but the method used in teaching computer studies. Hence, it is deduced that there is no interaction effect of gender and methods in the mean achievement scores of students in computer studies.

Hypothesis Three

HO_3 There is no significant interaction effect of gender and method on mean achievement scores of students taught Computer Studies using inquiry based learning.

Table 6: Analysis of Covariance (ANCOVA) of significant interaction effect of gender and methods on the mean achievement scores of students taught Computer Studies using inquiry based learning.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	5423.400[a]	4	1355.85	8.902	.000
Intercept	6720.011	1	6720.011	44.121	.000
Pre-test	107.091	1	107.091	0.703	.198
GENDER * METHOD	22.932	2	11.466	.0753	.09
Error	13251.500	87	152.310		
Total	52195.000	90			
Corrected Total	5842.100	89			

The data presented in Table 6 shows a p-value of .09 which is greater than the alpha value of .05. This indicates that there was no significant interaction effect of gender and methods on the mean achievement scores of students taught computer studies using inquiry-based learning. Therefore, the null hypothesis that there is no significant interaction effect of gender and methods on the mean achievement scores students taught computer studies using inquiry based learning was not rejected.

Discussion

The findings of the study revealed that students taught computer studies using inquiry based learning had higher mean achievement (gain) scores than those taught using the lecture method.

More so, the corresponding hypothesis indicated that there was a significant difference in the mean achievement scores of students taught computer studies using inquiry based learning. The findings is in line with Ali Abdi (2014) who affirmed that students who were instructed through inquiry-based learning achieved higher score than those who were instructed through the traditional method. Similarly, the finding is in consonance with Agboghoroma (2014) who asserted that students taught with Guided Inquiry Method performed significantly better and participated more in Social Studies lessons than those taught with the Traditional Lecture Method.

The findings of the study revealed that Male students taught computer studies using the inquiry based learning performed better than their female counterparts. However, the mean difference was not significant. These findings agree with the findings of Ibrahim, Hamza, Bello and Adamu (2018) who resolved that inquiry method of instruction was gender-sensitive and that it enhances retention. More so, the findings corroborate with that of Adigun, Onihunwa, Irunkhai, Sada and Adesina (2015) who averred that even though the male students had slightly better performance compared to the female students, it was not significant

The findings of the study revealed that there was no interaction effect of gender and methods on the mean achievement scores of students in computer studies using inquiry based learning in conformity with the findings of Akpan (2017) whose findings showed that there was significant difference between the mean achievement scores of experimental group and control group and there was no significant difference between the mean interaction effect of male and female students in the experimental group. Similarly, the findings corroborate with Joel and Aride (2016) which revealed that students taught Social studies using inquiry learning had no interaction effect between gender and method. More so, Onyeukwu (2014) agreed that there was significant difference between academic performance of male and female students, taught accounting using guided inquiry teaching strategy

Conclusion

Based on the findings, the study concluded that students taught computer studies using inquiry based learning had higher mean achievement (gain) scores than those taught using the lecture method. More so, the corresponding hypothesis indicated that there was a significant difference in the mean achievement scores of students taught computer studies using inquiry based learning. By implication it means that using guided inquiry strategy in teaching computer studies will improve students' academic achievement.

The findings of the study revealed that Male students taught computer studies using the inquiry based learning performed better than their female counterparts. But however, the mean difference was not significant.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. The Federal and State Ministries of Education, Universal Basic Education Boards, Institutions and Colleges that train teachers should incorporate the use of guided inquiry teaching method as an essential part of the teacher-training programme since it has been found to be effective in improving the students' achievement in computer studies.
2. Female role models, such as women who are adept in computer studies will help reduce or eliminate the gender gap in students' academic achievement in computer studies. Also adopting a gender-neutral language and using textbooks and other teaching materials that challenge the prevalence of gender stereotype.
3. Ministries of Education and other agencies in charge of posting of teachers should balance the quality of teachers posted to the rural and urban areas, by ensuring that teachers who are jackleg in their subject area are not only posted to the rural areas.

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