
EFFECT OF GUIDED-INQUIRY INSTRUCTIONAL STRATEGY ON ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS IN BIOLOGY IN FEDERAL CAPITAL TERRITORY, ABUJA NIGERIA

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Abstract

This study investigated the Effect of Guided Inquiry Instructional Strategy on Academic Achievement of Secondary School Students in Biology in Federal Capital Territory, Abuja. The study adopted quasi-experimental pretest, posttest and control group research design. The sample of the study was 75 students (40 males and 35 females) in two intact classes from two secondary schools randomly drawn from the six area councils in Abuja. One class randomly formed the experimental group and the other formed the control group. The experiment lasted for six weeks during which the experimental group was taught by the means of Guided Inquiry while the control group was taught using the Conventional Method. Two research questions were raised and two corresponding null hypotheses were formulated and tested at 0.05 level of significance. One instrument was used for data collection; Cell Division Achievement Test (CDAT) which was validated by experts in Biology Education Department of University of Abuja. The instrument has

reliability co-efficient of 0.81 using Kuder-Richardson K-R₂₁. Data collected were analyzed by the use of Means, Standard Deviations and Analysis of Covariance (ANCOVA). The results revealed that: students exposed to Guided Inquiry instructional strategy achieved significantly better than those taught by means of Conventional Method, gender is not a factor to determine achievement gains in cell division by employing GI. Both gender benefitted after experiment. It is recommended that Guided Inquiry strategy can be used to compliment other methods of teaching cell division.

Keywords: Achievement, Guided-Inquiry and Gender.

Introduction

The introduction of science subjects right from primary schools are essential in order to inculcate scientific ideas into the learners at the early stage, even up to higher levels of education. Science is a human activity that had profound influence on our social, economic and cultural lives. Otuka and Uzoечи (2009)

stressed that, there is need for every citizen to be scientifically literate, it is only scientifically literate individuals and societies that can appreciate, understand and properly interpret scientific knowledge and methods as well as apply scientific knowledge to solve their everyday problems. Scientific literacy is getting popularized daily due to global growth and development in the field of science and technology.

Biology is one of the requirements for studying science and the science related courses in the tertiary institutions. It is the study of plants and animals which partly provides scientific literacy required for national growth and development. Biology is such a broad field, covering the minute working of chemical inside our cells, to broad scale concept of ecosystem and global climate change. According to Laurie (2008), it is the bedrock of medicine such as genetics cloning, kidney transplant, production of test-tube babies (IVF), genetic counseling, and disease diagnosis. In agriculture, Biology is used in hybridization to produce high yielding varieties of individual species and resistant species. Biology also covers all the life processes such as movement, respiration, nutrition, irritability, growth, excretion and reproduction. The life processes are characteristics of all living things either plant or animal regardless of races and geographical distributions. According to Federal Republic of Nigeria in the National Policy on Education, NPE (2004) learning of Biology will provide the students with suitable laboratory and field skills in Biology, meaningful and relevant knowledge

in Biology, scientific knowledge that is applicable, in health, agriculture, personal and community daily life matters and development of functional scientific attitudes.

However, research findings have shown that a number of topics in Biology such as genetics, ecology, mitosis and meiosis (cell division) and evolution pose a lot of difficulties for Biology students in some cases even the Biology teachers (Etobru, 2017 & Autumn 2010). This was supported by Wakesa,(2010) and Ozcan, (2003) who reported that, in Biology, cell division is one of the topics ranked near the top of the ladder of difficulty by learners and teachers, some of the stages can only be imagined. This study focuses on the topic 'Cell Division' which is seen difficult for some Biology teachers and students to learn.

Cell from the Latin word 'cella' meaning small room, is the basic structural, functional and biological unit of all known living organism, cell undergoes processes for growth and replication of progeny. These processes are known as Cell division which is fundamentals to life. The dynamic and the chromosomal orientation during the process of the cell division are pertinent to the understanding of the topic. It was envisaged that the traditional method might not be the best approach to support the deep understanding of cell division hence a better approach be sort. The WAEC Chief Examiners' yearly reports (2013, 2014, 2015, 2016, and 2017) have drawn attention to the facts that students' performances are not consistent over the years. WAEC Chief

Examiners' general comment reported in 2019 that students' performance in biology is not encouraging. This could have been one of the reasons why there is low achievement in Biology SSCE Examinations over the years. Despite the positive roles played by science and technology in general, the teaching and learning of science has suffered setback. Bichi, (2017) asserted this to the fact that; there is persistent low level of students' achievement of sciences at the various levels of examinations. Ebele and Orji (2006), Olurukoba (2007), Gambari (2014) attested to this claim as their reports show that, students' achievements in core science subjects in which Biology is inclusive at the secondary school level are not encouraging.

Some researchers such as Olurukoba (2007) revealed that, Poor teaching methods, abstract nature of science concepts lack of qualified teachers, poor infrastructure and inadequate laboratory facilities, teacher-centered instruction and non-availability and utilization of instructional materials were identified which could be the reason for low achievement in Biology. However, research evidences posited that some science teaching strategies have been identified which have being applied in the teaching and learning in various courses and subjects with promising results. These include; cooperative learning, computer assisted instruction, computer- supported cooperative learning, computer simulation others may include; Guided Discovery (GD) and Guided inquiry (GI) etc. Poor teaching strategies adopted by teachers at senior secondary school level in Nigeria have been identified as one of

the major factors contributing to poor achievement of students. However, there is need to acknowledge that for different topics in Biology, the teaching strategies may differ depending on the complexity and structure of the topics. The most enjoyable aspect of teaching and learning can occur when varieties of teaching strategies are used. Effective teaching is important in order to help students progress from one level to another in a more sociable interactive environment and to get the strategy right in order to get students to be independent learners (Muijus & Reynolds, 2011).

Conventional or traditional teaching method is the usual method of teaching Biology in secondary schools in Nigeria. Conventional teaching involves the use of text books and lecture teaching methods. King'Aruru (2014) stated that in conventional method, there is very little interaction between the teacher and the students or among the students themselves in the classrooms it is mostly teacher dependent and exam orientated. The emphasis is mainly to remember and reproduce facts, principles and theories while guided inquiry is innovative and activity instructional technique. Guided-Inquiry is an act of seeking for information or the search for truth or examination of principles, methods and strategies concerning an issue or concept. It is an act of seeking for information or the search for truth or examination of principles, methods and strategies concerning an issue or concept (Kathleen, 2013 & Deboer, 2004). Engaging in inquiry can also help students to develop a wide range of skills, such as psychomotor and

academic or intellectual skills. Hence, this study employed guided inquiry in teaching and learning of cell division among secondary school students.

Gender is a division into which an organism is placed according to its' reproductive functions or organs. In this context gender is based on students' status of male and female. Findings from researchers such as; Oscar, Luis and Lopez (2018); Abdullahi (2014); Yusuf and Afolabi (2013), stipulates that, there is a general imbalance that exists in gender and in technology base teaching strategies use, access, career and curiosity among students. Abdullahi (2014) stressed that, when there are gender related differences in science, the method of

teaching could be the cause. Abdullahi opined that an appreciable way of obtaining optimal achievement is to engage the strategies that are gender bias free. Agu and Akpan (2015); Uzoechi (2015) reported in their studies that, male students performed better than the female students while Ibe (2013) is of the contrary view. Sumbabi and Anaduaka (2018); Akhideno (2019) reported that gender have no influence on students' achievements. To this end, this study aimed at finding out the Effect of Guided Inquiry on Achievement in Cell Division amongst male and female Secondary Schools Students in FCT, Abuja.

Objectives of the Study

The aim of the study was to find out the Effects of Guided Inquiry on Achievement, in Cell Division among Secondary School Students in Abuja, Nigeria. The Specific objectives of the study were to;

1. ascertain whether there will be difference in the achievement of Biology students taught using Guided Inquiry and those taught using conventional method.
2. examine gender influence in achievement of secondary school Biology students taught using Guided Inquiry instructional technique.

Research Questions

The following research questions guided the study.

1. What is the mean difference in achievement scores of students taught cell division using Guided Inquiry and those

taught cell division using Conventional Method?

2. What is the mean difference in achievement scores of male and female students taught cell division using Guided-Inquiry?

Statement of the Hypotheses

The following null hypotheses were tested at 0.05 level of significance;

1. There is no significance difference in the mean achievement scores of students

taught cell division using Guided Inquiry and those taught using conventional method.

2. There is no significance difference in the mean achievement

Method

The study adopted quasi experimental pre-test, post-test and a control group research design. The target population for this study was all the senior secondary school (SSS) three students in all the fifty-five (55) co-educational Senior Secondary Schools in FCT Abuja. Multi stage random sampling was used to draw two area councils from the six area councils in FCT. The Two randomly selected schools formed the experimental and control group respectively. The sample was 75 students, (40 males sand 35females) senior secondary school students who offer Biology as a subject .One instrument was used for data collection titled Cell Division Achievement Test (CDAT).The (CDAT) consists of 30 multiple choice objective items adopted from past examinations of the West African Examinations Council (WAEC). Each item of the multiple-choice objective questions had four options (A-D), where students were expected to choose the correct answer. CDAT was validated by experts

in Biology Education Department University of Abuja with reliability of 0.81 using Kuder-Richardson K-R₂₁. The students were expected to respond to the instrument (CDAT) in two sections; The first part (section A) elicits information on the students demographic data; name and gender, while section B elicits information on the pre-test and post -test respectively, which is constructed to test the students' knowledge of the topic taught. Data generated formed the bases of the analysis of the study.

Results

Research Questions were answered using means, standard deviations and null hypotheses were tested at 0.05 level of significance using analysis of covariance (ANCOVA).

Research Question One

What is the mean difference in achievement scores of students taught cell division using Guided Inquiry and those taught cell division using Conventional Method?

H₀₁: There is no significance difference in the mean achievement scores of students taught cell division using Guided Inquiry and those taught using Conventional Method.

Table 1: Means and Standard Deviations of Achievement Scores of Students taught cell division using Guided Inquiry and Conventional Method

Group	Pre test			Post test		
	N	Means	SD	N	Means	SD
Guided Inquiry	40	40.15	12.20	40	66.05	14.20
Conventional Method	35	39.00	9.72	35	47.91	12.21

Table 1 shows pre-test, post-test, Mean and Standard Deviations of Achievement Scores of Students taught Cell Deviation using Guided Inquiry(GI) and Conventional Method (CM). The pre and post- test of students taught cell division by GI were; 40.15 and 66,05, Standard deviation of 12.20 and 14.20, while the pre and

post- tests of CM were; 39.00 and 47.91 and standard deviation of 9.72 and 12.28 respectively. The difference in the gain scores indicated the students who were exposed to GI group had higher means scores than those in CM.

Table 2: Analysis of Covariance (ANCOVA) of Achievement Scores of Students Taught Cell Division Using GI and CM

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8881.327	3	2960.442	29.637	.000	.452
Intercept	7797.225	1	7797.225	78.058	.000	.420
Pre test	7608.523	1	7608.523	76.169	.000	.414
Group	1095.875	2	547.937	5.485	.005	.092
Error	10788.093	108	99.890			
Total	448092.000	112				
Corrected Total	19669.420	111				

Table 2 shows that $F_{(2,108)} = 5.485$, $P = 0.005 < 0.05$ for this study, here the P value is less than 0.05 probability level. Statistical significant difference was observed. Therefore, a null

hypothesis is rejected. This implies that students in experimental group (GI) out- performed their counter- part in control group (CM).

Research Question Two

What is the mean difference in achievement scores of male and female students taught cell division using Guided-Inquiry?

H₀₂: There is no significance difference in the mean achievement scores of male and female students taught cell division using Guided inquiry.

Table 3: Means and Standard Deviations of Achievement Scores of Male and Female Students Taught Cell Division Using Guided Inquiry

Gender	Pre test			Post test		
	N	Mean	SD	N	Mean	SD
male	21	41.43	14.25	21	66.24	16.09
Female	19	38.74	10.89	19	65.84	12.20

Table 3 shows pre- test, post -test, Means and Standard Deviations of achievement Scores of male and female students taught cell division using Guided Inquiry, This shows that the male

students with the mean scores of 66.24 had higher achievement scores than the female students with 65.84 taught cell division using GI. GI was in favour of male students.

Table 4: Analysis of Covariance (ANCOVA) of Achievement scores of Male and Female Students Taught Cell Division Using Guided Inquiry

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4481.688	2	2240.844	24.503	.000	.570
Intercept	3074.823	1	3074.823	33.622	.000	.476
Pretest	4480.124	1	4480.124	48.989	.000	.570
Gender	38.709	1	38.709	.423	.519	.011
Error	3383.712	37	91.452			
Total	182369.500	40				
Corrected Total	7865.400	39				

Table 4 shows that $F_{(1, 37)} = .423$, $P = .519 > 0.05$, here, the calculated P value is higher than 0.05 probability level. Therefore, a null hypothesis is retained. The statistical difference in the mean achievements scores of male and female students observed is insignificant, this implies that gender is not a major factor to determine achievement gains in cell division using GI. Both gender benefitted after experiment.

Discussion of Findings

This study revealed that guided inquiry instructional strategies enhanced students' achievement in cell division among Biology students. This implies that students in experimental group performed better than those in the control group. This is in agreement with Bamidele (2016), Adegoke (2010) and Obeka (2010) who carried out investigations on students' achievement using Guided Inquiry, and demonstration method and found out that, Guided Inquiry performed better than other methods. Akhideno (2019); Oluwasegun (2019); Uzoechi (2015) also agreed with this study and reported independently that students exposed to experimental groups performed better than those exposed to control groups. Owusu (2010) is on the contrary and reported that, students exposed to conventional method outperformed those in experimental group in a study carried out on cell unit in Biology. However, this study affirms that when students are actively involved in learning, achievement can be enhanced.

This study also revealed that gender is not a major determinant in achievement. Males and females students improved in achievement after

exposure to experiment. This is not in agreement with Agu and Akpavan (2015), Ezeugo and Agwagah (2000), Uzoechi (2015) who reported independently that the male students performed significantly better than their female counterparts in their studies. Ibe (2013) had a different opinion whose study shows that, female students outperformed the male students. These claims are closely supported by Abdullahi (2014); Yusuf and Afolabi (2013), who stipulated that, a general imbalance exists in gender and in technology base teaching strategies and in science related subjects. However, this study is in agreement with studies carried out by Danmole and Adeoye (2004); Sumbabi and Anaduaka (2018); Oluwasegun (2019) who found that there is no significance difference between male and female students in their performances; in biology, mathematics and physics respectively. This study has shown that, gender is not a determinant factor in achievement if students are provided with similar enabling learning environment. Therefore, single and co-educational schools can employ Guided Inquiry Instructional Strategy in teaching and learning of cell division.

Recommendations

The following recommendations have been made based on the findings of this study;

1. Biology teachers should be encouraged to employ Guided Inquiry in preference to conventional method for class room instruction in both single and co-educational schools despite the pressure on the curriculum content, time table, extra curricula activities and the coverage of syllabus before terminal examination such as WASSCE and NECO.
2. In the procurement of instructional materials for effective teaching and learning to teach cell division to compliment other methods., consideration should be given to innovative and activity base instructional strategies such as guided inquiry

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