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EFFECT OF GUIDED INQUIRY INSTRUCTIONAL METHOD ON SECONDARY SCHOOL STUDENTS' RETENTION IN BIOLOGY IN PLATEAU STATE, NIGERIA.

By

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### ABSTRACT

*The study was aimed at finding out the Effect of Guided Inquiry Instructional Method on Secondary School Students' Retention in Biology. It was conducted in Pankshin and Barkin Ladi local government areas of Plateau State. The study adopted a quasi-experimental design with one research instrument, the Biology Retention Test (BRT). The BRT was a reshuffled Biology Achievement test with 50 objective questions. The reliability of BAT was 0.74 computed using Spearman rank order correlation. The sample for the study was 358 Seniors secondary two (SS II) students in six randomly selected schools in the study area. The sample was divided into experimental and control group. The experimental group was taught Biology using Guided Inquiry while the control was taught the same biology concepts with conventional method. Data were collected using BRT. The two research questions were answer using mean and standard deviations while the hypotheses were tested at 0.05 level of significance using ANCOVA. The findings showed that students taught Biology using Guided Inquiry retained more than those taught using conventional method. The study recommended among other things that Federal Ministry of education in conjunction with curriculum planners should integrate the Guided Inquiry instructional method into the curriculum as a teaching method to be used in teaching Biology concepts.*

### INTRODUCTION

The importance of Biology as a science subject has been recognized in national development. The knowledge of principles, facts and processes in Biology helps in agriculture to produce a high quality of plants and animal's products in large quantities. Indeed, the knowledge of genetic crops breeding has been put to use in agriculture to produce high yield of crops and livestock, (Iyaoromi, 2012). Adejoh and Ityokyaa (2010) asserted that Biology (genetics) is in search of high yield, disease resistant and early maturing varieties of plants and animals. More crops and food would be available for local consumption and for export to boost foreign exchange earnings. Shihusa and Keraro (2009) stated that biological knowledge has also been applied in

organ transplant such as kidney and control of wide range of diseases.

Despite the importance of Biology to humanity and a core subject among other science subjects in schools, it is disheartening to note that the overall achievement of students remains poor. The annual reports of West Africa School Certificate Examination from 2007 to 2014 stressed the low achievement in Biology. The high failure rates may be traceable to ineffective teaching strategies employed by most Biology teachers.

Retention means recalling pieces of knowledge, processes and skills that were learned earlier in time. The existence of academic institutions is based in large part on the belief that students remember what they learn. It is the ability of the working memory of an

individual to retrieve, stored information from long term memory for processing. Clair (2004) has observed that long term memory retention is a significant goal of education. Steyn (2003) argues that knowledge retention is related to the way the concept is taught to the learners and that the teacher's method of teaching may be responsible to guide students in the process of learning. Knowledge retention should therefore be a focus of every academic institution and it should be evaluated to assure the quality of programme. This has prompted the researcher to investigate the efficacy of Guided Inquiry method on students' retention in Biology. Guided Inquiry process is primarily a pedagogical method, developed during the discovery learning movement of the 1960s as a response to traditional forms of instruction where people were required to memorize information from instructional materials. The philosophy of Guided Inquiry process finds its antecedents in constructivist learning theories, such as the work Piaget, Dewey, Vygotsky and Freire among others and can be considered a constructivist philosophy. Guided Inquiry method starts by posing questions, problems rather than simply presenting established facts or portraying a smooth part to knowledge. The process is often assisted by a facilitator. The determination of its effectiveness in secondary school students' Retention in Biology is a matter that desires an urgent attention. Thus, the need for this study which is centered on finding out the effect of Guided Inquiry method of instruction on secondary school biology students' retention in secondary schools in Plateau State, Nigeria.

Retention is the preservative factor of knowledge, attitude and skills in the mind. Knowledge gained during instruction is useful only when it is stored and retained, retrieved or produced for application in new situation. It is a major of knowledge or skills that students are able to keep or retained in their memory after some time. This retentive memory defers in

individuals as some students are not able to retain knowledge or recall for a long time (short term memory) and others have the capacity to store knowledge that have been retained for some time or for long time (long term memory).

Retention and recall of learned information is a function of training the mind to do so when such a need arises. The mind acquires the materials of knowledge through sensation and perception. These acquired materials need to be preserved or retained in the mind in the form of images for knowledge to develop. Retention is preservative factor of the mind (Kundu and Tutun, 2002). Whatever, touches consciousness leaves trace or impression and is retained in the mind in form of images. Whenever stimulating situation occurs intended images are revived or reproduced to make memory possible. The amount of original meaning that will be retained at any point in time is a variable of quantity at hand. Retention is the continued capacity to behave in the particular way that one has learnt (Imoko and Anyagh, 2012).

Nworgu and Otum, (2013) studied the Effect of Guided Inquiry with analogy instructional strategy on students acquisition of science process skills at University of Nigeria Nsuka. The study investigated the effects of Guided Inquiry with analogy instructional strategy on students' acquisition of science process skills in biology. The study which adopted a nonequivalent control group quasi experimental design was conducted in four secondary schools in the area, out of these schools, two schools were exposed to the use of guided inquiry with analogy instructional approach while the remaining two used the conventional instructional approach. The participants comprised 160 juniors secondary class three (JSIII) students. The test of science process skills acquisition TOSPSA which was developed by the researchers was used as an instrument for data collection. TOSPSA was subjected to both face and content validation while its reliability was

established using Kuder-Richardson formula  $20(k-R20)$  mean and standard and the analysis of covariance (ANCOVA) were used to test the hypotheses at 5% level of significance. The result of the study revealed that teaching method was statistically significant in enhancing students acquisition of science process skills in favour of the Guided Inquiry with analogy. Based on these findings. It was recommended that science teachers should adopt the guided inquiry with analogy teaching method in science classroom since it would encourage both male and female students to perform well and reduce the gap between the two groups. In this study guided enquiry was used, but the location of my study is different and I have wider coverage.

Ibe (2013) investigated the effects of guided inquiry and expository teaching method on senior secondary school student performance in Biology in Imo State. The study adopted a two-factor pre-test/post-test non-randomized quasi-experimental design. The subjects for the study were eighty-four (84) senior secondary school (SS II) Biology students from one co-educational school. The 84 students were divided into two equal groups of 42 each. The subjects are made of 42 students, 24 are females while eighteen (18) are males. The expository method on the other hand consisted also of forty-two (42) students. Twenty-five (25) of the students are females while seventeen (17) are males. The Kuder-Richardson 20 formula was adopted in determining the reliability coefficient of this instrument (BAT). Thirty senior secondary school II Biology students selected from one co-educational school not used for the study gave answer to the items for the reliability of the instrument. The value of 0.78 was obtained. The research questions were answered using Mean and standard deviations while the hypotheses were tested using Analysis of co-variance (ANCOVA). Major finding of the study included: Teaching methods have significant effect on students' performance in Biology. Students taught with guided

inquiry teaching method outperformed students taught with expository teaching method. The female students outperformed the males. The female students have higher interest levels than the males.

In another study in Bursa-Turkey, Ozdilek and Bulunz (2009) examined the effectiveness of a Guided Inquiry method for science teaching on elementary pre-service teachers self-efficacy beliefs. In the study a pretest /posttest one group research design was used. The study sample that consisted of 101 second year pre-service elementary teachers who are registered to a science laboratory course in the 2008 spring semester. At the beginning of the study, the Elementary Science Teaching Efficacy Belief Instrument (STEBI) was completed by the participants. A 14-week science laboratory course was taken by the learner that was designed to use a Guided Inquiry teaching method with heavy reliance on the use of science process skill. At the end of the course the STEBI was again completed by the pre-service teachers. The data were analyzed using paired sample t-test with the SPSS 16.00 program at the 0.01 significance level. Focus group interviews were also conducted with 10 groups of participants after they completed the course. Qualitative and quantitative findings indicated that levels of participants efficacy expectations and outcome expectations on post-test scores were higher than the pretests scores. The reliability coefficient was 0.78. This showed the effectiveness of a Guided Inquiry method to increase the sense of self efficacy beliefs of pre-service teachers in science teaching. This study is related to my work but however, the location for my study is different.

### ***Objectives of the Study***

The objective of the study is to determine the effect of Guided Inquiry (GI) Instructional Method on secondary school students' retention in Biology. Specifically, the study investigated whether the use of GI for teaching has any effect on students' retention in

biology and if the effect of GI for teaching biology on students' retention is dependent on gender

### Research Questions

The following research questions guided the conduct of this study.

1. What is the mean retention scores of students taught Biology using the Guided Inquiry instructional method and the conventional method?
2. What is the mean retention scores of male and female students taught Biology using Guided Inquiry Instructional method?

### Research Hypotheses

1. There is no significant difference in the mean retention scores of students taught Biology using Guided Inquiry instructional method and those taught using conventional teaching method
2. There is no significant difference in the mean retention scores of male and female students taught Biology using Guided Inquiry instructional method.

## METHOD

A Quasi-experimental research design was used for the study. Specifically, it was a non-randomized pre-test post-test control group design. This was adopted because the researchers were combining one

treatment with control group and the fact that the study involved a computation of two independent means. Quasi-experimental design was used because there was no randomization of subject but intact classes were randomly assigned to groups. The study was termed quasi experimental because it was expected to establish the nature and scope of any cause effect relationship between the use of GI on student retention in biology. The experimental group was taught biology using GI while the control was taught the same biology concepts using conventional method. The independent variable is the use of GI in teaching while the dependent variable is students' retention in biology.

The study was carried out in Pankshin and Barkin Ladin Local Government areas of Plateau State. However, only schools that have been approved by government to teach biology were used. The population of the study was 3491 Senior secondary two (SS II) students in the study area. Out of which 358 students from six schools were used for the study. One research instrument, the biology retention test (BRT) was used to collect data for the study 4 weeks after treatment. The instrument was validated by biology educators and experts in management and evaluation.

## RESULTS

**Research Question 1:** What is the mean retention scores of students taught Biology using Guided Inquiry method and the conventional methods?

**Table 1:** Mean Retention Scores and Standard Deviation of students per Group per Test

Group	N	Pre-Test Mean	SD	Ret – Test Mean	SD
Expr.	195	16.15	4.88	42.34	15.13
Cont.	163	16.79	5.11	24.04	6.31
Mean Diff.	-	0.65	-	18.30	-

From Table 1 the pre-test mean difference between control and experimental group is 0.65. Also,

the mean retention scores of students' taught Biology using Guided Inquiry is 42.34 with the standard deviation

of 15.13 while their counterpart taught with Conventional Method is 24.04 with the standard deviation of 6.31. This showed a mean difference of 18.30 between the retention scores of the two groups in favor of the students taught with Guided Inquiry method. This, implies that the students that were taught Biology concepts with

guided inquiry method retained higher compared to their counterpart taught with the Conventional method.

**Research Question 2:** What is the mean retention scores of male and female students taught Biology using Guided Inquiry instructional method?

**Table 2:** Mean Retention Scores and Standard Deviation of Male and Female Students' Experimental Group per Test

Gender	N	Pre-Test Mean	SD	Ret – Test Mean	SD
Male	102	16.62	4.44	43.49	16.37
Female	93	15.63	4.49	41.09	13.63
Mean Diff.	-	0.99	-	2.40	

From Table 2 the pre-test mean difference between Male and Female students in experimental group is 0.99. However, the mean retention scores of male students in experimental group is 43.49 with the standard deviation of 16.37 while that of female is 41.09 with the standard deviation of 13.63. This showed a mean difference of 2.40 in the retention means in favor of the male students. This implied that male students that were

taught with guided inquiry method retained higher compared to their female counterpart.

The following null hypotheses were formulated and tested at 0.05 level of probability

**Hypothesis 1:** There is no significant difference in the mean retention scores of students taught Biology using Guided Inquiry and Conventional methods.

**Table 3:** Summary of One-Way Analysis of the Mean Retention Scores of Students' Taught Biology using GI Method and Conventional Teaching methods.

Source	Type III Sum of Squares	df	Mean Square	F	Sig
Corrected Model	29846.518 <sub>a</sub>	2	14923.259	104.395	.000
Intercept	28687.210	1	28687.210	200.879	.000
Pre	111.242	1	111.242	.778	.378
Group	29554.544	1	29554.544	206.747	.000
Error	50747.437	355	142.747		
Total	494714.000	358			
Corrected Total	80593.955	357			

a. R Squared = .370 (adjusted R Squared = .376)

The data in Table 3 showed that  $f(J,355) = 206.74$ , with  $P = 0.000$  which is less than 0.05 alpha (UL) level of probability the hypothesis was rejected. Hence there is a significant difference in the mean retention scores of

students taught Biology using Guided Inquiry and Conventional methods

**Hypothesis 2:** There is no significant difference in retention scores of male and female students taught

Biology using Guided Inquiry method.

**Table 4.** Summary of One-Way Analysis of Covariance of Mean Retention Scores of male and female Students' Taught Biology using GI Method of Instruction

Source	Type III Sum of Squares	df	Mean Square	F	Sig
Corrected Model	516.001 <sub>a</sub>	2	258.000	1.128	.326
Intercept	20153.100	1	20153.100	88.137	.000
Pre	234.823	1	234.823	1.027	.312
Group	224.458	1	224.458	.982	.323
Error	43901.979	192	228.656		
Total	394049.000	195			
Corrected Total	44417.979	194			

a. R Squared = .012 (Adjusted R Squared = .001)

The data in Table 4 revealed that  $f_{(1,192)} = 0.982$ , with a P-value of 0.323 is greater than 0.05 level of significance. Hence the hypothesis was not rejected. This means that there was no significance difference in the retention scores of male and female students taught Biology using Guided Inquiry Instructional method.

## DISCUSSION

The findings of the study revealed that the use of Guided Inquiry (GI) method of teaching Biology concepts made students to retain higher compared to their counterpart that where taught with Conventional method. The findings also show that there is higher mean retention in both male and female students in the experimental group. These findings are in the same view with Chingle (2010) that retention serves as a means by which students can remember what they learn and the learner must find out exactly what he has to learn. Thus, he must clearly identify his task and it is essential to spot the sense on the meaning of the material as early as possible. The implication is that, when teachers use the GI method of instruction in the teaching and learning of Biology concepts, it would obviously improve the mean retention scores of students in the subject taught.

Many factors affect retention, with time retention goes on diminishing. Retention and recall are not passive processes, organization of experiences and responses is important in retention. We organize the past responses in a new way and this explains some of the forgetting that takes place. When we recall and reproduce figures seen some time back, we do not just forget one figure, but we reproduce that figure in a new way. We reorganize our responses in a new pattern. The extent to which the reorganization is different from the original pattern will determine the extent of retention.

Retention of what is learnt can be aided through learning by studying at a suitable period of the day, constantly reviewing and avoiding circumstances likely to cause interference. Mnemonic devise is a trick or technique designed to aid memory which consists of organizing material in a way that makes it more readily remembered (Ozdilek and Bulunuz, 2009).

## CONCLUSION

The utilization of the Guided Inquiry instructional teaching method in teaching and learning of Biology concepts has shown significant improvement both in Retention of students with respect to male and

female. In other words, the use of Guided Inquiry instructional method of teaching in teaching Biology concept enhanced Retention irrespective of gender.

Having found that Guided Inquiry instructional teaching method is effective in teaching biology it is recommended that Federal ministry of education in conjunction with Curriculum planners should integrate the guided inquiry instructional method into the curriculum as a teaching method to be used in teaching Biology concepts. This would enable Biology teachers to effectively and efficiently use the method in teaching Biology concepts. Biology teachers should employ Guided Inquiry instructional method of teaching in their classes, which could make the students active participants in the teaching and learning process, so that their Retention level may be improved.

## RECOMMENDATIONS

The recommendations based on the findings of this study were as follows:

1. In-service training should be given to Biology teachers on how to use Guided Inquiry Instructional method, and they should be encouraged to use this method in their various classes.
2. Federal ministry of education in conjunction with Curriculum planners should integrate the guided inquiry instructional method into the curriculum as an emphasis in using while teaching Biology concepts. This would enable Biology teachers to effectively and efficiently use the method in teaching Biology concepts.
3. Biology teachers should employ Guided Inquiry Instructional method of teaching in their classes, which could make the students active participants in the teaching and learning process, and their achievement level may then be improved.
4. Stakeholders such as Biology Teachers' Association and Science Teachers' Association of Nigeria should popularize the use of Guided Inquiry Instructional

method through workshops, conferences, and seminars.

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