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Effect of Guided Inquiry Teaching Strategy on Academic Performance of Secondary School Students in Biology in Ekiti State, Nigeria

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Abstract:

This study investigated the effect of guided inquiry teaching strategy on the academic performance of students in Biology in secondary schools in Ekiti State. In addition, the study examined the influence of gender on the effectiveness of the teaching methods. The study was quasi-experimental research which adopted the pre-test post-test research design. The population for the study comprised 10,712 Senior Secondary School class two students in Ekiti State out of which 80 students were selected using multistage random sampling technique. The instrument used for the study was the Biology Achievement Test (BAT) designed by the researcher. The face and content validity of the instrument was ensured by the experts of Tests and Measurement. The data obtained through the instrument were analyzed using inferential statistics of t-test at 0.05 level of significance. The finding of the study revealed that there were significant difference between the mean pre-test and post-test scores of students taught Biology using guided inquiry and lecture method. Highest scores were recorded when guided inquiry was used in instructional delivery while lecture method has the least mean score in the post-test. Based on the findings of the study, it was recommended, among others, that Biology teachers should deliver their lessons to students using guided inquiry method of teaching.

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Introduction

Biology, as a science subject, is meant to help learners acquire knowledge about biological nature. Learners gain facts, concepts, principles, and processes in Biology, and are equipped with relevant skills and attitudes. The objectives of Biology at the secondary school level, as stipulated in the National Policy of Education (NPE, 2004) include: adequate laboratory and field skills in Biology, meaningful and relevant knowledge, ability to apply scientific knowledge to everyday life, and reasonable and functional scientific attitudes.

Biology is one of the core subjects for science students at senior secondary school level so as to acquire the basic concepts of Biology as a field of Science. However, the performance of students keeps declining in Senior School Certificate Examination (SSCE) in Biology. The performance of students in Ekiti State Senior Secondary Certificate Examination conducted by West African Examinations Council for a period of five consecutive years (2015 – 2019) showed that an average of 49% of the candidates failed (Ekiti State Ministry of Education and Technology, 2020). This unfortunate trend should agitate the minds of Science educators in Nigeria.

Failure of students in Biology has been a source of concern to parents, students, teachers and the society at large. This failure has been attributed to teachers' methodology, non-availability of teaching materials and parental factors. All of these appeared to have been investigated yet the problems seem to have persisted considering the rate of failure of students in Biology in external examinations.

The researcher observed that if students' performance in Biology declines, Nigeria may never attain her goal of scientific development through her indigenous human resources. Hence, Nigeria as a country may have to continue to rely on manpower from other countries. Therefore, there is the need for students to perform well to acquire the required knowledge and skills and application of Biology for both personal and national development.

The question then is what could be responsible for poor performance of students in Biology? The researcher was of the opinion that if the method of teaching is improved, students could perform better. A lot of reasons have been proffered for this downward trend. These include poor teaching methods, lack of qualified teachers, lack of necessary facilities and textbooks, poor communication skills and dearth of the knowledge of certain biological concepts (Adesoji, 2008). The method used in any teaching and learning situation is very important because the way a teacher presents the subject matter to students may make the students to like or dislike the subject.

Guided Inquiry means careful planning, close supervision, on-going assessment and targeted intervention by an instructional team of teachers through the inquiry process that gradually leads students toward independent learning. Guided inquiry approach is a teaching strategy which attempts to help students ask questions and discover answers to their questions. Inquiry methods permits to observe an event, recognise relevant and irrelevant questions, search out data and take complete responsibility for an entire process of obtaining, organising and interpreting data (Amos, 2002). Guided-inquiry requires students to find out things for themselves. This cannot be done where the teaching method is lecture oriented and

study habit inactive. The use of guided inquiry method for teaching Biology in combination with an active study habit will motivate and interest students in a lesson. It focuses students' attention and initiates problem-solving.

According to Mtsem (2011), the conventional method is an oral presentation given to Biology students by the teacher. Teachers are comfortable with this method because they are in control of content and time. This method is good for large class since much work could easily be covered in a short time. Teaching under lecture method is usually reduced to story-telling. The method reduces learners to mere note–takers and passive listeners. Student's perception and assimilation of the subject matter is usually very slow. Therefore, the focus of this study is to consider the effect of guided inquiry teaching strategy on the learning outcomes of secondary school students in Biology.

Purpose of the Study

The purpose of the study was to investigate the effects of guided inquiry teaching strategy on the academic performance of Ekiti state secondary school students in Biology. It also determined the difference in the pre-test and post-test of students exposed to guided inquiry strategy and the conventional group. It further examined the interactive effects of gender on the academic performance of students taught Biology using guided inquiry and conventional strategies.

Research Hypotheses

Based on the aforementioned purpose of the study, the following hypotheses were generated

1. There is no significant difference in the pre-test mean scores of students exposed to guided inquiry and conventional strategies.
2. There is no significant difference in the post-test mean scores of students exposed to guided inquiry and conventional strategies.
3. There is no significant difference in the pre-test and post-test mean scores of students exposed to guided inquiry strategy.
4. There is no significant difference in the pre-test and post-test mean scores of students exposed to conventional strategy.
5. There is no significant gender difference on the academic performance of students exposed to guided inquiry strategy.
6. There is no significant gender difference on the academic performance of students exposed to conventional strategy.

Methodology

The research design adopted for this study is quasi–experimental pre-test and post-test two group design (one experimental group and one control group).

The pattern of the design is as shown below.

O_1 X_1 O_2: Experimental group (i) (Guided Inquiry)

O_3 X_c O_4: Control group (Conventional method)

Where

O_1, O_3,– Pre-test (Performance before treatment)

O_2, O_4, – Post-test (Performance after treatment)
X_1 – Treatment via Guided Inquiry
X_c – Control group

The targeted population for the study were all the 10,712 Senior Secondary School (S.S.S.) class two students in public secondary schools in Ekiti state. The sample consisted of 80 students drawn from four public secondary schools in Ekiti State. The sample was selected using multistage sampling technique. One Senatorial district was randomly selected from the three senatorial districts in Ekiti State. Two Local Governments were randomly selected from the senatorial district earlier selected. Two public secondary schools were randomly selected from each of the two local governments chosen for the study. Stratified sampling technique was used to select 20 students from each school bearing in mind their sex (i.e. 10 male students, 10 female students).

Random Sampling technique was used to group the schools into different experimental groups and a teacher was purposely selected from each school to handle the experimental group his/her school fell under.

The instrument used for the study was tagged Biology Achievement Test (BAT). Biology Achievement Test (BAT), which was self-designed by the researcher, consisted of sections A and B. Section A consisted of bio-data of the respondents which included the name of the school, identification number, and sex. Section B consisted of 30 objectives items with four options made of seven questions on Knowledge, seven questions on Comprehension, six questions on Application, six questions on Analysis, two questions on Synthesis and two questions on Evaluation. The items were drawn from all the topics (Cell, Reproduction and Respiration) covered by the study. The items were used for both pre-test and post-test of the study. The contents of BAT used for pre-test were reshuffled for the post-test in order to prevent carry-over effect.

The face and content validity was judged by experts of tests and measurement to assess the wordings and ambiguity of the test items as well as their coverage. Fifty items which were originally presented to the experts were reduced to thirty based on their suggestions and recommendations. A reliability co-efficient value of 0.82 gotten was high enough to make the instrument adequate for use. Thus the instrument was considered reliable and suitable for the study.

Experimental Procedure

To carry out the research in the schools, the researcher obtained permission from the authorities of the three schools. Therefore, a day workshop was organized for each of the research assistants on the respective methods used in teaching their students from the selected schools.

The study was carried out in three phases:

Phase I: Pre-treatment Stage

The researcher administered pre-test instrument, the instrument was administered to all groups in order to ascertain the homogeneity of the two groups. The instrument used was Biology Achievement Test (BAT).

Phase II: Treatment Stage

Students in Experimental Group (Guided Inquiry) were exposed to forty minutes of teaching and discussion twice per week for six consecutive weeks. The three topics (Cell, Reproduction, and Respiration) were explained by the teacher. The teacher allowed each of the students to work independently but under the guidance of the teacher. Students in the conventional group were not exposed to any treatment.

Phase III: Post-treatment Stage

At the end of the treatment stage, BAT was re-administered on the students to determine the effects of the treatment on them. The same Biology Achievement Test (BAT) used during the pre-test was re-arranged to avoid test-wiseness and administered to the experimental and control groups

After treatment, the scores in pre-test and post-test in the two groups were collated and subjected to appropriate statistical analysis. The six hypotheses were analyzed by t-test at $\alpha = 0.05$ level of significance.

RESULTS

Hypothesis 1: There is no significant difference in the pre-test mean scores of students exposed to guided inquiry and conventional strategies.

Table 1: t-test analysis for Pre–test Mean Scores of Students in Experimental and Control Groups

Variations	N	Mean	SD	df	t_{cal}	P (Sig)	Rem.
Guided Inquiry	40	10.98	2.84	78	1.007	0.317	Not Significant
Conventional	40	10.38	2.48				

P<0.05

Table 1 shows that the t-cal value of 1.007 is not significant because the P-value (0.320) > 0.05 level of significance, this implies that null hypothesis is not rejected. Hence, there is no significant difference in the pre-test mean scores of students exposed to guided inquiry and conventional strategies.

Hypothesis 2: There is no significant difference in the post-test mean scores of students exposed to guided inquiry and conventional strategies.

Table 2: t-test analysis for Post – test Mean Scores of Students in Experimental and Control Groups

Variations	N	Mean	SD	df	t_{cal}	P (Sig)	Rem.
Guided Inquiry	40	16.78	2.87	78	5.78	0.00*	Significant
Conventional	40	13.25	2.58				

*P<0.05

Table 2 shows that the t-cal value of 5.78 is significant because the P-value (0.000) <0.05 at 0.05 level of significance. This implies that null hypothesis is rejected. Hence, there is significant difference in the post-test mean scores of students exposed to guided inquiry and conventional strategies.

Hypothesis 3: There is no significant difference in the pre-test and post-test mean scores of students exposed to guided inquiry strategy.

Table 3: t-test analysis for pre-test and post-test mean scores of students exposed to guided inquiry strategy

Variations	N	Mean	SD	df	t_{cal}	P (Sig)	Rem.
Pre-test	40	10.98	2.84	78	9.08	0.00*	Significant
Post-test	40	16.78	2.87				

*P<0.05

Table 3 shows that the t-cal value of 9.08 is significant because the P-value (0.000) <0.05 at 0.05 level of significance, this implies that null hypothesis is rejected. Hence, there is significant difference in the pre-test and post-test mean scores of students exposed to guided inquiry strategy. The mean score showed a large difference which indicate that guided inquiry strategy is effective

Hypothesis 4: There is no significant difference in the pre-test and post-test mean scores of students exposed to conventional strategy.

Table 4: t-test analysis for pre-test and post-test mean scores of students exposed to conventional strategy

Variations	N	Mean	SD	df	t_{cal}	P (Sig)	Rem.
Pre-test	40	10.38	2.48	78	5.08	0.00*	Significant
Post-test	40	13.25	2.58				

*P<0.05

Table 4 shows that the t-cal value of 5.08 is significant because the P-value (0.000) <0.05 at 0.05 level of significance, this implies that null hypothesis is rejected. Hence, there is significant difference in the pre-test and post-test mean scores of students exposed to conventional strategy.

Hypothesis 5: There is no significant gender difference on the academic performance of students exposed to guided inquiry strategy.

Table 5: t-test analysis for gender difference on the academic performance of students exposed to guided inquiry strategy

Variations	N	Mean	SD	df	t_{cal}	P (Sig)	Rem.
Male	20	16.55	2.46	38	0.49	0.626	Not Significant
Female	20	17.00	3.28				

P<0.05

Table 5 shows that the t-cal value of 0.49 is not significant because the P-value (0.626) > 0.05 level of significance, this implies that null hypothesis is not rejected. Hence, there is no significant gender difference on the academic performance of students exposed to guided inquiry strategy.

Hypothesis 6: There is no significant gender difference on the academic performance of students exposed to conventional strategy.

Table 6: t-test analysis for gender difference on the academic performance of students exposed to conventional strategy

Variations	N	Mean	SD	df	t_{cal}	P (Sig)	Rem.
Male	20	13.00	2.22	38	0.61	0.547	Not Significant
Female	20	13.50	2.93				

P<0.05

Table 6 shows that the t-cal value of 0.61 is not significant because the P-value (0.547) > 0.05 level of significance, this implies that null hypothesis is not rejected. Hence, there is no significant gender difference on the academic performance of students exposed to conventional strategy.

Discussion

The findings revealed that a significant difference exist in the post-test scores of students between the groups. There was a significant difference between guided inquiry and conventional group. These results aligned with that of Ugwuadu (2014) who observed that guided inquiry method of instruction proved more effective than lecture method in enhancing students' academic achievement in Biology. The reason for this may not be farfetched for example Akem (2007) observed that lecture method involves the teacher giving out all the facts expected of the students, with little care on whether or not the students are actively participating and contributing to the success of the lesson. The findings of the study revealed that guided inquiry teaching strategy is an effective strategy of teaching Biology when compared to conventional method.

Furthermore, result showed a significant (very large) difference in the pre-test and post-test scores of students in Biology among the groups especially in guided inquiry group. This result agrees with Ango & Silas (2006) submission that using guided inquiry group makes students' knowledge increases and enhances assimilation of facts. Hence, there is tendency for students to perform better through guided inquiry strategy.

The findings from hypotheses on gender difference among the groups showed no significant difference. This means that gender has nothing to do with students' response to the use of any of the instructional methods i.e. conventional and guided inquiry methods. This outcome contradicted the report of Fennema & Sherman (2000) that there is a significant difference between male and female students' achievement in Biology.

Conclusion

It can be concluded from the findings of this study that conventional method has impact on the students' academic performance in Biology; but Guided Inquiry is more effective. The use of Guided inquiry helped the students to achieve maximally in Biology during teaching. There is no gender disparity in the student responses to the both strategies of teaching Biology.

Recommendations

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

- The use of Guided Inquiry strategy should be encouraged to teach Biology in the secondary schools.

- Biology teachers should be given adequate orientation through workshops and seminars to update their knowledge in the use of Guided Inquiry method in teaching.
- Biology textbooks should incorporate Guided Inquiry strategy of teaching and learning.
- Time allocated to teachers should be managed well in order to accommodate the use of Guided inquiry to teach Biology.

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