EFFECTS OF GUIDED INQUIRY TEACHING METHOD ON SECONDARY SCHOOL STUDENTS’ ACHIEVEMENTS IN BIOLOGY

by

Onwuachu, Winifred Chidimma

Department of Biology

Nwafor Orizu College of Education, Nsugbe- Anambra State.

and

Chukwurah Kanayo


Abstract

The study examined the effects of Guided Inquiry method on the academic achievements of secondary school students in Nnewi education zone of Anambra State. Two research questions and two null hypotheses were generated to guide the study. The design of the study was quasi experimental, specifically the pre-test, post-test, non-equivalent control group design. The population comprised all senior secondary II biology students of the 2009/2010 academic session in Government owned secondary schools in Nnewi Education zone numbering 5140. The sample for the study was one hundred and sixty three (163) SS II students drawn through purposive random sampling technique. Data were collected using Biology Achievement Test (BAT) that contained 40 test items used for the pre-test and post-test. The instrument was validated and its reliability established using Cronbach alpha, value of 0.92. Research questions were answered using means and standard deviation, while t-test and analysis of covariance were used in testing the hypotheses. The findings among others indicated that students taught with guided inquiry approach performed better in achievement test in biology than those taught the same topic with the expository approach. Again, there was no significant difference in the academic achievements of the students based on gender some recommendations such as, that teacher should encouraged to integrate guided inquiry teaching method in their classroom were made as a way forward.

Introduction

Science is a great enterprise which nations depend on, in order to advance technologically. Science therefore is receiving much emphasis in education because of its significance and relevance to life and society. Biology as a branch of science and the prerequisite subject for many fields of learning contributes immensely to the technological growth of the nation. Biology serves as a building bridge among subjects like chemistry, physics and other disciplines, therefore requiring its students became well grounded. The study of Biology in senior secondary school can equip students who useful concepts principles and theories that will enable them face the challenges before and after graduation. Despite its importance in the society available statistics from the
West Africa Examination Council (WAEC 1999, 2003, 2004, 2006, 2007 and 2008), on senior secondary school students' achievement in biology revealed that although biology had the highest enrolment relative to other science subjects; it recorded very poor achievement at senior school certificate examination.

One of the leading causes of students’ poor achievements in biology as reported by Okoroafor (2007), has to do with the instructional methods used by teachers. Bausal (2006), argued that instructional methods mostly used by teachers are inadequate to bring about desired achievement in students. Egbuonu (2008), also found that Biology teachers mostly used the lecture method that centers on the teacher text book, the chalk and the chalkboard. Under this scene, the teacher is seen as a disseminator of knowledge, the knower of the answer and a lecturer who heavily relies an textbook as the only available instructional material; conveys facts and procedures of students and hardly encourages students to engage in practical and creative learning activities. The expository methods (lecture method) of teaching have been largely criticized for stifling interest and creativity in students. The expository methods of teaching Biology might be responsible for a situation where students have not been able to manifest at the end of schooling, desirable biology and competencies for useful living. There is therefore a need to use innovative teaching methods to see if there will be improvements in students’ achievements in Biology. One of such methods is the guided inquiry method.

Guided inquiry is a student – centered method of teaching whereby students participate actively, question assumptions and provide their viewpoints on any area of subject matter: Bybee (2002), stated that this strategy emphasizes higher-level thinking skills and collecting, analyzing and synthesizing information and data from multiple sources and viewpoints. In guided inquiry method, teachers guide students to learn content as well as discipline-specific reasoning skills and practices by engaging in questioning, experiential learning, project work, discovery learning problem – solving and investigations. A teacher using the guided inquiry method gives minimal lectures to introduce ideas and to provide overviews but uses more of questioning and interactive class activities to stimulate and to share ideas (Johnston, Markle and Haley Oliphant, 2007). The teacher’s role in guided inquiry is that of a facilitator, coach, mentor and motivator, rather than dispenser of all the right knowledge (Adedoyin, 1990; Benefield, 2007).

Agboola and Onyemede (2007), stated that the uses of the guided inquiry method presents, students with opportunities to ask questions, seek answers, analyze data, discuss ideas and apply scientific concepts in a variety of context to describe and explain phenomena. Teachers are expected to use guided inquiry method to improve achievement as well as produce Biology students that are sound enough to merge their classroom knowledge with a result oriented life experience. A lot has been done to improve biology teaching in secondary school in Nigeria. In spite of that, students continue to perform poorly in biology. This situation has created that need for more effective teaching method. It then becomes necessary to explore the efficacy of alternative method of redressing this situation. The problem of this study posed as a question is: can Guided Inquiry serve as an improved and more effective instruction strategy that can lead to students achievements in Biology.
Purpose of the Study

The purpose of this study is to determine the effect of guided inquiry on secondary schools achievements in Biology. Specifically, the study intends to ascertain:


Research Questions

The following research questions guided the study,

1. What are the mean achievements scores of biology students taught with guided inquiry method when compare with those taught with expository method (lecture method)
2. What are the mean achievement scores of male and female students taught Biology using guided inquiry method.

Hypotheses

The following null hypotheses (Ho) tested at 0.05 level of significance were formulated for the study.

HO1 There is no statistically significant difference in the mean achievement scores of students taught biology using guided inquiry method and those taught using the lecture method.

HO2 There is no statistically significant difference in the mean achievement scores of male and female students taught Biology using Guided Inquiry (method) strategy.

Research Method

The design of this is quasi-experimental specifically, it used pre-test, post-test, non-equivalent control group design. This design was adopted because intact classes were used as it was not possible to have complete randomization of the subjects. The population of this study consisted of all the senior secondary school II biology students in the state governments owned secondary schools located in Nnewi education zone of Anambra State in the 2009/2010 academic session, totaling 5140.

The sample consists of one hundred and sixty three (163) senior secondary (SS2) biology students; randomly drawn from four (4) out of 49 (forty-nine) Government owned senior secondary schools in the area. Purposive and random sampling techniques were used for this study. Four (4) single-sex schools (2 males and 2 females) were purposively selected. Two schools (a male and a female) assigned to experimental treatment (Guided inquiry method). While another two (a male and female) were assigned to control group (lecture method). All the students in each of the four intact classes were used for study. The experimental sample (N = 80) consisted of 38 boys and 42 girls while the control sample (N = 83) consisted of 43 boys and 40 girls. Biology achievement test (BAT) was
used for data collection. The BAT is a 40-item multiple choice objectives with four options developed by the researchers using WAEC past questions papers and biology text books based on the contents taught in the lesson which were derived from SS 2 biology curriculum. The face validity of the instrument was determined using Cronbach Alpha reliability coefficient. The correlation coefficient was 0.97, and it was accepted to be good for the study. The BAT was administered to both the students in experimental and control groups as pretest, before the treatment commenced and scores were collected. Students in experiment group were taught Biology with guided inquiry method while students in control group were taught with lecture method. Post test scores were collected after four weeks of treatment. The scores obtained from the pre-test and post-test were analysed using mean and standard deviation to answer the research questions while t-test and analysis of covariance (ANCOVA) were used to test the hypotheses for significant difference at 0.05 level.

Results

Results of data analysis were presented in tables accordingly.

Table 1

Mean, standard deviations and mean gain in academic achievements of experimental and control group of biology students.

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N  X  SD</td>
<td>X  SD</td>
<td></td>
</tr>
<tr>
<td>Experimental Group (using Guided Inquiry)</td>
<td>80 34.77 6.90</td>
<td>64.35 9.42</td>
<td>29.58</td>
</tr>
<tr>
<td>Control group using Lecture method</td>
<td>83 35.10 6.56</td>
<td>41.82 7.12</td>
<td>6.72</td>
</tr>
<tr>
<td>Total</td>
<td>163</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Data presented in table 1 shows that the mean pre-test score for 80 students in experimental group was 34.77 while that of the control groups of 83 students was 35.10. The mean post-test scores for the students in experimental group (GM) was 64.35 while that of control group was 41.82. The table also shows that the average mean gain score pre-test, post- test change for the experimental and control group were 29.58 and 6.72 respectively. This implies that the experimental group performed better than the control group in the Biology achievement test.

Table 2

Pre-test and Post-test mean achievements and standard deviation scores of male and female (experimental group) students taught with guided inquiry teaching method.

<table>
<thead>
<tr>
<th>Group</th>
<th>No of Students</th>
<th>Pre-test Mean</th>
<th>Post-test Mean</th>
<th>Standard Deviation</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>38</td>
<td>34.56</td>
<td>66.60</td>
<td>9.62</td>
<td>32</td>
</tr>
<tr>
<td>Female</td>
<td>42</td>
<td>34.10</td>
<td>64.85</td>
<td>9.58</td>
<td>30.25</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The table indicates that male students in experimental group slightly differed from female counterpart after treatment in the mean biology achievement score by 1.75.
Table 3:
Mean score, standard deviation, correlational coefficient (r) and t-test of the pre-test scores of experimental and control group.

<table>
<thead>
<tr>
<th>statistical Test</th>
<th>$\bar{X}$</th>
<th>SD</th>
<th>df</th>
<th>R</th>
<th>Standard Error</th>
<th>t-calc</th>
<th>t-Critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>34.77</td>
<td>6.90</td>
<td></td>
<td></td>
<td></td>
<td>2.28</td>
<td>1.960</td>
</tr>
<tr>
<td>Group</td>
<td>79</td>
<td>0.05</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>35.10</td>
<td>6.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3, illustrated that there was very high relationship between the pretest scores of the experimental and control groups. It is observed that both the experimental and control groups are at the same level background of the topic. This is so because there was no significant difference in the performance of the two groups in the pretest ($t_{\text{cal}} = 2.28 < t_{\text{crit}} = 1.96$).

Table 4:
Analysis of Covariance of the experimental control Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>Sum of squares</th>
<th>Mean of Squares</th>
<th>t – cal</th>
<th>t-Critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between group</td>
<td>1</td>
<td>20526.33</td>
<td>20526.33</td>
<td>72.1</td>
<td>3.91</td>
</tr>
<tr>
<td>Within group</td>
<td>161</td>
<td>44599.66</td>
<td>282.27</td>
<td>11.27</td>
<td>10.36</td>
</tr>
<tr>
<td>Total</td>
<td>162</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Effects of guided inquiry teaching method on secondary school student’s…

Table 4, indicates that there is a significant difference due to treatment between experimental and control groups as shown by the calculated value of $t = 72.7$ which is greater than the $t$ critical value 3.91 at 0.05 significant level therefore the null hypothesis is rejected.

**Table 5:**

Mean scores, standard deviation and t-test responses of male and female student taught with guided inquiry method.

<table>
<thead>
<tr>
<th>Test</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>df</th>
<th>t-cal</th>
<th>t-Critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>38</td>
<td>51.48</td>
<td>9.62</td>
<td></td>
<td></td>
<td>1.57</td>
</tr>
<tr>
<td>Female</td>
<td>42</td>
<td>50.63</td>
<td>9.58</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5 shows that the male students obtained higher mean achievement scores with guided inquiry method (mean 51.48; SD 9.62) than their female counter parts (mean = 50.63; SD 9.58). However, this difference is not significant ($t = 1.57$, $df = 78$; $P > 0.05$). Hence, it is concluded that there is no significant effect of gender on students’ achievement taught with guided inquiry method. Thus Null Hypothesis 2 is not rejected.

**Discussion**

Students in the experimental group taught selected biology topics using guided inquiry method performed better than those in control group, taught, using lecture method. This implied that using guided inquiry as instructional method has more positive effect in enhancing and facilitating student’s achievements in biology than the lecture method. The results of this study were in line with the views of previous researchers like (Chung and Son, 2000; Mander, 2002) who indicate of that active participation of the students using guided inquiry gave rise to more meaningful and effective learning.

In the case of gender, the findings of this study revealed that male students has a higher means score than their female counter part in Biology achievement scores, although the difference was not significant. This results agrees with the findings of (Onwioduokit & Akinbolola, 2005) who found no significant difference in the achievements scores of male and female in science subjects.
Conclusion

Teaching strategy from reviews has the potential to make or mar students’ achievements. Guided Inquiry Method is found to improve students’ achievements in biology than lecture method. It also helped to bridge gaps between male and female student’s achievements.

Recommendations

On the basis of findings from this study, it is recommended that:

1. Biology teachers should be encouraged to explore the application of Guided Inquiry in their classroom instruction.
2. Teacher training institutions (Universities and College of Education) should integrate Guided Inquiry among instructional strategies being inculcated into the students.
3. Seminars and workshops should be organized for serving teachers to keep abreast with principles and implementation process of Guided Inquiry Method of teaching.
4. More teachers should be recruited to reduce class size as large class size in school system may hinder effective implementation of the Guided Inquiry as an instructional strategy.

References


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