

LECTURE AND INQUIRY METHODS OF TEACHING IN ACQUISITION OF SCIENCE PROCESS SKILLS AMONG BIOLOGY STUDENTS IN AKWA IBOM STATE, NIGERIA.

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Abstract

The study investigated the effectiveness of lecture and inquiry methods of teaching in acquisition of science process skills among Senior Secondary Biology Students. A sample size of 200 SS2 students, intact classes selected from four schools (50 students per school) in Uyo capital city of Akwa Ibom State was used for the study. The instruments used to gather data for the study were: (i) Instructional Package for Senior Secondary Biology (IPSSB) and (ii) Test of Science Process Skills of Biology (TOSPSB). The data generated were analyzed using t-test statistics. Results obtained showed that: (i) Students taught with inquiry method acquire the process skills of Biology significantly higher than those taught with lecture method; (ii) Male Biology students taught with inquiry method acquire the process skills of Biology significantly higher than their male counterparts who are taught with lecture method; (iii) Female Biology students taught with inquiry method acquire the process skills of Biology significantly higher than their female counterparts who are exposed to lecture method. Based on the findings, it is recommended that: (i) Necessary science equipments should be made available in schools to facilitate the acquisition of science process skills; (ii) Educational sector should be improved through the training of teachers in use of science process skills to enhance teaching and learning in our schools.

Introduction

The persistent poor performance of students in biology in the public examinations could be attributed to a number of factors which have been identified as contributing to non acquisition of skills by secondary schools students (WAEC 2004). One of such factors is the teacher variable that is, the teacher's method of teaching (Okoli 2006). According to Ajewole (1990) the lecturing method involves teacher-students interaction through chalk and talk which the teachers provide all the necessary facts on science concept in question to the students. The teacher teaches facts and gives opinions about the subject matter being discussed. He poses problems and goes further to solve problems for the students.

According to Essien (2009) who posited that most science curricula attach much importance to student's acquisition of skills, despite the relevance of process skills, students' performance in science examinations are still low. Harlen (1984) describe science process skills as abilities which can be developed by experience and which are used in carrying out mental operations and physical actions.

Awodi (1994) observed that teachers cannot teach effectively without employing the processes of science neither can students learn science effectively without acquiring such processes as well. Studies by Okebukola and Ogunniyi (1984), Nwosu (1990) and Okoli (1998) asserted that when one acquires the science process skills of observing, measuring, questioning, designing experiments, interpreting data etc., such a person becomes specially equipped with the tools required for scientific inquiry or problem solving as well as ability to use these skill in the laboratory for a variety of investigations.

Biology teachers should be creative, resourceful, and enthusiastic in their chosen profession by adopting measures that ensures that their students acquire the right scientific knowledge, skills and attitude while the same time inculcating scientific literacy in these students (Okoli, 2006). Although the National Policy on Education recommends the inquiry methods for teaching biology, observations shows that in Nigeria, the lecture methods is by far employed by biology teachers in the classrooms.

As important as the issues is, educational researchers seems to be uninterested in it. This study is therefore set to investigate the relative effects of the lecture and inquiry methods of teaching on acquisition of science process skills among biology students in Uyo capital city of Akwa Ibom State.

Research Questions

This study specifically addressed the following research questions:

- (i) What difference exists in the acquisition of science process skills among senior secondary biology students taught by lecture methods and those taught by inquiry methods?
- (ii) What difference exists in the acquisition of science process skills among senior secondary biology male students taught by lecture methods and those taught by inquiry methods?
- (iii) What difference exists in the acquisition of science process skills among senior secondary biology female students taught by lecture method and those taught by inquiry method?

Research Hypothesis

Based on the research questions posed, the following null hypothesis were formulated and tested to guide the study:

- (i) Students who are taught by the lecture method do not differ significantly from those who are taught by inquiry method in the acquisition of science process skills measured in terms of their performance in senior secondary biology:
- (ii) Male students who are taught by the lecture method do not differ significantly from those who are taught by inquiry method in the acquisition of science process skills measured in term of their performance in senior secondary biology:
- (iii) Female students who are taught by the lecture method do not differ significantly from those who are taught by inquiry method in the

acquisition of science process skills measure in terms of their performance in senior secondary biology.

Significance of the Study

The study is significant for the following reasons:

- (i) It will point out the most appropriate and fruitful method of teaching;
- (ii) It will encourage the training of teachers in the use of the most effective methods of teaching;
- (iii) It will reveal the positive correlation between acquisition of science process skills and students performance in science skills oriented subjects;
- (iv) It will reveal the positive correlation between acquisition of science process based learning;
- (v) It will encourage the students to participate actively in process based learning;
- (vi) It will point to the beneficial effects of in-service training of teachers in process based learning;
- (vii) It will provide information for the school counselor for effective guidance counseling service.

Method

Research Design

The design of the study was quasi-experimental, specifically the pre-test post test – non – equivalent control group design. This design was used because intact classes were used as it was not possible to randomly assign students to experimental and control conditions.

Population of the Study

The population of the study comprised all the senior secondary two (SS2) biology students in Uyo capital city of Akwa Ibom State.

Sample and Sampling Technique

For the intact classes of 50 students per class were randomly sampled from four selected senior secondary school in Uyo capital city of Akwa Ibom State.

Instruments for Data Collection

Two instruments were used for data collection, namely:

- (i) Instructional Package For Senior Secondary Biology (IPSSB)
- (ii) Test of Science Process Skills of Biology (TOSPSB)

The IPSSB

The learning materials in the IPSSB are drawn from the first term scheme of work for SS2. The topics taught were: (i) the cell and its environment, (ii) Some properties and function of cells and (iii) types of systems in organisms. The topics have not been taught in the selected classes before.

The TOSPSB

The TOSPSB consisted of two sections A and B, section A demanded the personal data of the respondents while section B demanded ten procedural steps from students in order to give answers to accompanying quizzes.

The TOSPSB seven process skills of biology namely: observing, measuring, classifying, predicting, communicating, interpreting data and experimenting.

Validity of IPSSB and TOSPSB

The IPSSB and TOSPSB were face-validated by the expert of biology education. The expert was made to acquaint with the research problems, objectives of the research and the hypothesis. The expert then critically, inspected the IPSSB and TOSPSB to determine their suitability or otherwise. Their criticisms suggestions and recommendations were effected in the instruments.

Reliability of TOSPSB

The test- retest method was used in estimating the reliability of TOSPSB. This was achieved by administering the test twice - to a constant class of 50 students which were of the same level, and population area, as the study sample, but not a portion of it. There was a time lapse between the two administrations. The two sets of scores were correlated to obtain the reliability coefficient.

Difficulty and Discrimination of TOSPSB

The average difficulty and discrimination indices of TOSPSB were 0.57 and 0.62 respectively.

Treatment

The four intact classes of students (sample) were pre-tested and then randomly assigned to experimental control groups in equal ratio; i.e. two classes of students (100 students) were assigned to experimental groups; while the other two classes(100 students) were assigned to control groups. The students in the experimental group were taught the topics using inquiry methods while those in the control groups were taught using the lecture method. The two groups of students (experimental and control) were taught by the researcher (Investigator) to ensure that there was uniformity in the use of the respective teaching methods. The teaching lasted for two weeks. The two groups of students were pre-tested.

Scoring the TOSPSB

Marking scheme was prepared. Scoring was done under six headings weighted as follows:

-	Observing -	-	-	40%
-	Classifying -	-	-	80%
-	Experimenting -	-	-	16%
-	Communication -	-	-	8%
-	Interpretation data -	-	-	8%
-	Short answer to questions -	-	-	20%
Total		-	-	100 %

Method of Data Analysis

The data obtained was analyzed using an independent t-test statistics.

Results

Table 1: t-test Analysis of Significant Difference in Acquisition of Process Skills of Science Among Biology Students Exposed to Lecture and Inquiry Teaching Method

Variable	N	\bar{x}	SD	t	DF	Decision at $P < 0.05$
Students exposed to lecture method	100	48%	2.5	30.77	1.98	*Significant
Students exposed to inquiry method	100	60%	3.5	(1.96)		

* Significant at $P = 0.05$

t – Value in bracket is the critical value

The analysis in table 1 shows that the calculated t- value, 30.77, is greater than the critical value, 1.96 at 0.05 level of significance. Therefore, the null hypothesis of no significant difference in acquisition of process skills of science among biology students exposed to lecture and inquiry methods is rejected. The results shows that students taught with inquiry method acquire the process skills of science significantly higher than those taught with lecture method.

Table 2: t-test Analysis of Significant Difference in Acquisition of Process Skills of Science Among Male Biology Students Exposed to Lecture and Inquiry Method of Teaching.

Variable	N	\bar{x}	SD	t	DF	Decision at $P < 0.05$
Male students exposed to lecture	50	51.0%	2.0	24.50	1.98	*Significant
Male students exposed to inquiry method	50	64.0%	3.2	(1.98)		

*Significant at 0.05

t – Value in bracket is the critical value

The analysis in Table 2 shows that the calculated t-value, 24.50 is greater than the critical t-value, 1.98 at 0.05 level of significance. Therefore the null hypothesis of no significant difference in acquisition of process skill of science among biology students exposed to lecture and inquiry teaching methods is rejected. The table 2 shows that male biology students who are exposed to inquiry methods acquire the process skills of science significantly better than their counterparts who are exposed to lecture methods.

Table 3: t-test of Analysis of Significant Difference in Acquisition of Process Skills of Science Among Female Biology Students Exposed to Lecture and Inquiry Method of Teaching.

Variable	N	\bar{x}	SD	t	DF	Decision at P = 0.05
Female students exposed to lecture method	50	48%	3.2	10.96 (1.96)	9.8	*Significant
Female students exposed to inquiry method	50	56%	4%			

*S = Significant at P = 0.05

t-value in bracket is the critical value

The analysis in Table 3 shows that the calculated t-value, 10.96 is greater than the critical value, 1.96, at 0.05 level of significance. Therefore, the null hypothesis of no significant difference in acquisition of process skills of science among female biology students exposed to lecture and inquiry teaching methods is rejected. The table 3 shows that female biology students who are exposed to inquiry methods acquire the process skills of science significantly better than their counterparts who are exposed to lecture methods.

Discussion of Findings

The results of the study are discussed here to show their relevance to teaching and learning of senior secondary school biology. According to Awodi (1984) who reported that teachers cannot teach effectively without employing the process of science, neither can students learn science effectively without acquiring such processes as well. However, the findings in table 1 revealed that students taught with inquiry methods acquire the process skills of biology significantly higher than those taught with lecture method. This finding is in agreement with the findings of Nwagbo (2001) who found that the guided inquiry method of teaching biology enhanced achievement better than the expository method among biology students at the senior secondary school level.

From the findings in table 2, it can be posited that teaching students using the inquiry method enable them to acquire not only scientific knowledge but also science process skills. This implies that biology teachers should use the inquiry method that exposes students to hands-on-mind-on scientific activities, ⁶

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rather than the lecture method that encourage only note memorization of scientific facts (Okoli, 2006).

Furthermore, the findings in table 3 showed that female biology students exposed to inquiry method acquire the process skills of science significantly higher than their female counterparts who are exposed to lecture method. This information also agrees with Nwosu (1990) and Okoli (1998) who stated that the foundation for science process skills is laid in the secondary schools hence the need to investigate its acquisition process.

Their findings further stated that the higher the scientific literacy levels of the students, the better their science process skills acquisition in biology for the two teaching methods.

Conclusion

The findings of this study generally indicated that inquiry method of teaching is more effective than the lecture methods in enabling biology students to acquire the process skills of science.

Recommendations

Based on the finding of the study, the following recommendations are made:

- (i) Necessary science equipment should be made available in schools to facilitate the acquisition of science process skills;
- (ii) Teachers should be given training on the relative efficiency of the different teaching methods in terms of improving student performance in science;
- (iii) Teaching methods used by the teachers should be properly monitored, through regular checking of lessons note, to ensure that the methods used is quite effective;
- (iv) Biology teachers should be enthusiastic, creative and resourceful in their chosen profession by adopting measures that ensures that their students acquire the right science process skills.

Implications of Findings

Implications that arise from the findings of the study include:

- (i) Training of science teachers in process based method of teaching is fundamental to student success at examinations;
- (ii) Achieving the objectives of senior secondary biology and hence advancing technologically is largely dependent on teaching strategy;
- (iii) The degree of acquisition of science process skills of biology is positively related to inquiry methods of teaching biology, hence lecture methods does not promote the acquisition of science process skill.

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