EFFECTS OF DISCOVERY AND INQUIRY APPROACHES IN TEACHING AND LEARNING OF BIOLOGY ON SECONDARY SCHOOLS STUDENTS' PERFORMANCE IN DELTA STATE, NIGERIA

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ABSTRACT

This study focused on the effects of discovery and inquiry approaches in teaching and learning of biology on students' performance. Four null hypotheses were formulated. The study employed a quasi-experiment design. One research instrument namely Biology Achievement Test (BAT) was used for data collection. The data collected was analysed using analysis of covariance (ANCOVA). The major findings of the study indicated that; discovery method was more effective and superior to the inquiry method in teaching biology; the level of retention was higher in students taught with discovery method than students taught with inquiry method. Based on the findings, it was concluded that the discovery method was superior and more effective than the inquiry method. Therefore science teachers should consistently make use of the discovery approach in teaching biology.

Keywords: Discovery, inquiry, teaching approaches, teaching and learning

INTRODUCTION

The knowledge of biology, chemistry and physics which have been crystallised into concepts, empirical laws and theories form the basis of our material comfort. As we entered the 21st century and expect better health for all, abundant food for all, better knowledge of man, animals and plants and less polluted environments with sulphur (IV) oxide and radio-active substances there is need to effectively teach and learn biology to meet these challenges. Ajaja (2002). Teaching is effective when approach used brings about a desirable change in the behaviour of the learner. If learning strategies and students achievements have to improve, then the students have to be introduced to a more efficient and appropriate teaching approach.

Several research reports indicate that students' achieve poorly in secondary school science subjects especially biology (Azubuike 2005; Nwagbo 2001). A number of factors were identified as militating against students' attainment of the objectives of science instruction. The isolated factors among researchers are the inappropriate and uninspiring teaching approaches adopted by science teachers. These researchers express the view that teachers shy away from activity oriented teaching approaches which are known to be more effective. They rely most on teaching approaches that are easy but most times inadequate and inappropriate. A lot of innovative instructional methods including guided discovery, co-operative learning, inquiry concept mapping have been suggested for teaching science and they have proved effective.

However there are very little research efforts in the use of these methods in teaching biology. A number of teaching strategies have been employed in teaching biology for over two decades. Not much effort seems to have been made towards finding out the effectiveness of the instructional methods used by biology teachers. A lot of innovative instructional methods including guided

discovery, co-operative learning, inquiry programmed instruction, concept mapping have been suggested for teaching but records show that there is a trend of poor performance in secondary school students in biology. This has been an issue of serious concern to the researcher, thereby necessitated this study - the effect of discovery and inquiry approaches in teaching and learning of biology on students' performance in secondary schools in Delta State, Nigeria.

In an attempt to solve the above stated problem, the following hypotheses were formulated to direct the course of this research.

H_o1: There is no significant difference in achievement between female and male biology students taught with discovery and inquiry methods

H_o2: There is no significant difference in retention level between biology students taught with discovery and inquiry methods

H_o3: There is no significant interaction effect between instructional method and sex on achievement

H_o4: There is no significant interaction effect between instructional method and ability on achievement

DISCOVERY AND INQUIRY APPROACHES

The discovery and inquiry approaches of science teaching are the recommended approaches adopted by many nations to revolutionize science teaching and learning. Emphasis has shifted from traditional teaching strategies which revolves hand-on minds-on science activities (Nzewi and Isisioma 1995, Ochi 2004 and Azubuike 2005). Discovery (Heuristic) approach in recent years gained prominence as a fascinating teaching strategy in science education. This is because educators became disenchanted with the concept of the teacher as the transmitter of knowledge.

Discovery is a method which offers learners the opportunity to discover scientific facts, concepts and principles for themselves rather being told. It gives learners the opportunity to discover and learn science from their own participation.

Inquiry approach on the other hand is a teaching strategy which attempts to help learners 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. This research has a number of purposes which are as follows: to compare the relative effectiveness of two methods of teaching biology:- the discovery and inquiry methods on students achievement; to identify which of the teaching methods was more effective in teaching biology; to find out if there is interaction effect between instructional method, sex and ability on achievement.

METHODOLOGY

The study design is quasi-experimental which employed the pre-test, post-test control group. It was quasi-experimental because intact class was used. The population comprises all senior secondary school two (SSII) students in the 284 secondary schools in Central Senatorial District of Delta State, Nigeria.The sample consist of one hundred and fifty (150) senior secondary two (SSII) students from three intact classes (50 in each class respectively) which were randomly selected from amongst the 284 secondary schools in Delta Central Senatorial District of Delta State, three biology graduate teachers of over five years of experience. Samples of schools were drawn in a randomly unbiased manner (probability sampling). The simple random sampling method was used through balloting (withdrawal-replacement procedure). Schools were randomly assigned into experimental and control groups.

A 50-item achievement test instrument BAT (Biology Achievement Test) was developed by the researcher for the study. The test was constructed by using content on the topic Nutrition. Validity was established by a panel of qualified experts in science education, test and measurement and biology teachers in secondary schools. The Biology Achievement Test (BAT) instrument was pilot-tested to establish its reliability using test re-tests. On correlation a reliable co-efficient of 0.75 was obtained using the Pearson Product Moment Correlation.

Three biology graduate teachers with over five years teaching experience were used for the study. The essence was to ensure uniformity and mastery of the teaching approaches upon which the research was based to enable them apply the techniques accordingly in teaching the stipulated contents. At the end of the training, the instructor for discovery approach was given a copy of a validated lesson plan; instructional materials and pre-activity questions, while the instructor for inquiry was given a copy validated lesson plan, probing questions and instructional materials

The test instruments were administered as a pre-test before treatment commenced. The main treatment for the study was teaching using the inquiry and discovery approaches and it lasted for six (6) weeks. Immediately after the treatment the test instrument was administered again to students as a post test. The data collected were analysed using the analysis of covariance (ANCOVA) at the significance level of 0.05.

RESULTS AND DISCUSSION

Hypothesis 1: There is no significant difference in achievement between female and male biology students taught with discovery and inquiry methods.

Table 1: ANCOVA Test of difference in achievement between Male and female students taught with discovery and inquiry methods

Sources of Variation	Sum of Sq.	Df	Mean Sq	F Ratio	F Critical	Sig
Covariate/pre-test	11.242	1	11.242	.665	3.15	.419
Main Effect/DIS/INQ	3976.429	2	1988.214			
Explain	3976.671	3	1999.456	117.630	4.00	.000
Residual	1707.124	98	16.902			
Total	5694.795	101	2016.358			

Source: Pre-test, Post-test student data. Significant: P>0.05

From the table 1, the calculated value is greater than the table value; therefore the null hypothesis is rejected.

Hypothesis 2: There is no significant difference in retention level between biology students taught with discovery and inquiry methods

Table 2: ANCOVA Test of difference in retention level among students taught with discovery and inquiry methods

Sources of Variation	Sum of Sq	Df	Mean Sq	F Ratio	F Critical	Sig
Covariate/pre-test	12.831	1	12.831	.736	400	.398
Main Effect/Retention	4079.206	11	370.837	21.265	1.95	.000
Explain	4092.037	12	383.668			
Residual	1604.347	92	17.439			
Total	5696.384	104	401.107			

Source: Pre-test, Post-test student data. Significant: P>0.05

Since the calculated value is greater than the table value, the null hypothesis is therefore rejected.

Table 3: Delayed Test Scores

Groups	Frequency	Mean($\bar{x}$)	S.D
Discovery	50	34.2	3.65
Inquiry	50	27.0	3.4
Control	50	22.4	3.4

Source: Delay Test data

Hypothesis 3: There is no significant interaction effect between instructional methods and sex on achievement

Table 4: ANCOVA Test of Interaction Effect between Instructional Methods and Sex on Achievement

Sources of Variation	Sum of Sq	Df	Mean Sq	F Ratio	F Critical	Sig
Covariate/pre-test	4.919	1	4.919	.800	3.92	.756
Interaction (sex and method)	2.452	3	.817	1.187	2.68	.278
Explain	7.371	4	5.736			
Residual	24.995	149	.167			
Total	32.995	153	5.903			

Source: Pre-test, Post-test student data. Significant: P>0.05

The calculated value is less than the table value. The null hypothesis is therefore accepted.

Hypothesis 4: There is no significant interaction effect between instructional methods and ability on achievement

Sources of Variation	Sum of Sq.	Df	Mean Sq.	F Ratio	F Critical	Sig
Covariate/pre-test	10.340	1	10.340	.698	3.92	.405
Interaction (ability/method)	8828.302	6	1471.384	99.338	2.18	.000
Explain	8838.642	7	1481.724			
Residual	2162.538	146	14.812			
Total	11001.178	153	1496.536			

Source: Pre-test, Post-test student data. Significant: P>0.05

From the table the calculated value is greater than the table value; the null hypothesis is therefore rejected.

The findings of the study as presented in Tables 2 and 3 indicate that the level of learning is higher with students taught with discovery method. Bruner (1961) noted that what is crucial

in learning are storage of knowledge and retrieval. Egbule (2000) stated that the greater the students involvement the greater the learning and level of retention. Stressing the value of retention, Abdullahi (1982) pointed out that since students find out information for themselves through discovery, retention of knowledge is better facilitated.

Another major finding of this study is that there is non significant interaction effect between instructional method of teaching and sex on achievement. This implies that a combination of instructional method and sex do not have any effect on the achievement of students. As pointed out by Dada (2000), a teacher is free to choose his/her method once he/she believes in the efficacy of the method in achieving the aims and objectives. Speaking in line, Oxford (2001) commented that with careful planning any teacher could integrate skills using appropriate methods that will enable him/her achieve his objectives irrespective of sex

Also there is a significant interaction effect between instructional method and ability on achievement in biology. This implies that a combination of right instructional method and ability will enhance students' performance in biology. This finding is in line with the findings of Ochonogor and Ajaja (2005). They pointed out that teaching task based on a good instructional method and ability keeps the students intellectually alert and keen to participate in an instructional class thus enhancing performance.

CONCLUSION

This study highlights the effects of discovery and inquiry approaches on performance of students in biology in secondary schools. The findings indicate that the discovery method is more effective and superior to the inquiry method in improving students' performance in biology. It can be concluded that the best method for teaching/learning biology is the discovery method; since

students taught with discovery method apart from achieving high score also retained more content materials than students taught with inquiry method. Secondly, since there was a significant interaction effect between instructional method and ability on achievement, it can be concluded that if the right instructional method is combined with students ability the students will achieve better in biology.

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