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Effect of Discussion Method on Achievement and Anxiety Level of Secondary Biology Students in Gashua Educational Zone, Yobe State, Nigeria

Mohammed D. Danladi

Principal Lecturer, Department of Biology, Umar Suleiman College of Education Gashua, Nigeria

Abstract:

The purpose of this study was to compare the Effect of Discussion Method on the Achievement and Anxiety of Secondary Biology Students in Gashua Educational Zone, Yobe State, Nigeria. The study used a population of 532 students (363 boys and 169 girls) and a sample of 71 students (49 boys and 22 girls). A pretest post-test Experimental and Control groups design was used. Simple random sampling was used to select the two (2) schools out of the four (4) co-educational secondary schools in Gashua educational Zone of Yobe State. The selected schools were randomly assigned into experimental and control groups. The experimental group was taught for six (6) weeks using discussion method and control group was taught using lecture method for the same period. The instruments used for data collection were Biology Achievement Test (BAT) and Biology Students Anxiety Questionnaire (BSAQ) with reliability coefficient of 0.80 and 0.70 respectively. Two (2) Null hypotheses were formulated and tested at $P=0.05$ level of significance using t-test statistic. The major findings in the study indicated that; there was significant difference between the mean academic achievement scores of the experimental and control groups in favour of experimental group. There was also significant difference between the anxiety levels of experimental and control groups in favour of experimental group. Based on the findings of the research, a number of recommendations were made, among which were: (i) teachers should adopt discussion method which is learner-centred in their day-to-day classroom instruction and encourage students to actively participate, as this enhances the understanding of instructional content, improves academic achievement and reduces anxiety. (ii) Biology teachers should be trained through workshops and seminars on how to effectively use discussion teaching method to teach in secondary school.

Keywords: Discussion method, achievement and anxiety, secondary biology students

1. Introduction

Science teaching in Nigeria has undergone several transformations and syntheses to get to its present state of basic science (in primary school level), basic science and technology (in junior secondary school level), single science (in senior secondary level) and applied science (in tertiary institutions), all in an attempt to improve the teaching and learning of science. The national policy on education describes the objectives of biology curriculum as fostering adequate laboratory and field skills in biology, relevant and meaningful knowledge to everyday life on matters personal and community health and agriculture, as well as reasonable and functional scientific attitude (FME, 2013; Danladi, 2019). With all these efforts, results still show lower achievement by students in Senior Secondary Certificate Examination (SSCE) (Aliyu, 1982; NTA Network News, 9:00p.m; 14/10/2011). For instance, the West African Examination Council (WAEC) Chief Examiners' Reports revealed with empathy that students performed poorly in some science subjects, biology inclusive (WAEC, 2003; 2005; 2006; 2013; 2014). Recent media report revealed that National Examination Council (NECO) recorded mass failure in its May/June, 2011 results, in which Science subjects such as Mathematics, Chemistry, Physics and Biology recorded less than 30% pass, respectively. Commenting over this, NECO registrar emphasized that; better results would largely depend on good teaching and learning in secondary schools (Weekend File; NTA Network Programme 10:30 p.m. 06/08/2011). Similarly, the Nigeria's Minister of Education in a public address on secondary education, decries mass failure in public examinations such as WAEC and NECO and promised to double effort to arrest the situation (NTA Network News 9 p.m. 14/09/2011).

Recalling their experiences in the course of learning over the years, some secondary school students in the study area revealed having found certain learning situations very tasking to cope with. For instance, some SS II and SS III students interviewed revealed having experienced some difficulties to ask or answer questions during a lesson. For others, no matter the level of preparation towards test or examination, they still experience nervousness or anxiety when writing the test or examination. (Personal interview with some students, 2010). It is against this background that the researcher investigated into the problem of anxiety and academic achievement of Senior Secondary School Students.

The major problems affecting teaching in general and biology teaching in particular could be attributed to the inappropriate usage of some instructional techniques by teachers (NTA Network News, 9:00p.m; 14/10/2011). The use of

lecture method alone by teachers create a lot of tension among students because often little or no room is given to students to express their areas of difficulties either by way of asking questions or contributing to the progress of the lesson. This situation leads to restlessness, frustration and anxiety which impair students learning (Hollandsworth, 1999; Geddes & Grosse, 2007).

O'Hair and McIntyre (1996) observed that many students especially at secondary school level develop some form of fear, apprehension and nervousness whenever they are faced with test or examination situation. This situation is referred to as anxiety, and this invariably lead to students' low academic achievement. (Menucha, 2006; Wikipedia, 2010). The anxiety in schools has a negative effect on students' achievement in the classroom especially in test or examination situation or both. Anxiety has an influence on the degree of achievement (Frandsen, 1961; 1981). Odeunmi (1988) and Menucha (2006) also asserted that; many reasons have been attributed to the possible causes of students' poor achievement in science subjects such as biology; one of which is anxiety. This disturbing situation needs to be investigated so as to come up with possible solution(s).

The type of teaching methods used which are teacher-centred (example lecture method) as observed by Bonet (2007) are capable of causing high anxiety in students because the students are given little or no opportunity to contribute or ask questions. Similarly, despite several reform attempts to make a shift from the teacher-centred methods to student-centred methods, the teaching and learning of science is still characterized by the ineffective chalk and talk method (Bakinde, 2000). In this study, discussion and lecture methods were used to determine their effects on biology students' achievement in secondary schools. The researcher also observed poor achievements by students in biology in two secondary schools (for three (3) consecutive years) in the study area (WAEC, 2007; 2008; 2009). This is shown in Tables 1.0 and 1.1 respectively.

Year	Number registered	Number passed (A-E)	Number Failed (F)	Percentage Passed (A-E)	Percentage Failed (F)
2007	215	09	206	4.2	95.8
2008	380	05	375	1.3	98.7
2009	240	02	238	0.8	99.2
Total	835	16	819	1.92	98.08

Table 1: Government Science and Technical College Gashua, Biology Result Statistics (WAEC) 2007 – 2009.
Source: Yobe State Ministry of Education (2010)

Year	Number registered	Number passed (A-E)	Number Failed (F)	Percentage Passed (A-E)	Percentage Failed
2007	460	72	388	15.7	84.3
2008	500	150	350	30	70
2009	500	300	200	60	40
Total	1460	520	940	35.62	64.38

Table 2: Government Day Secondary School Gashua, Biology Result Statistics (WAEC) 2007 – 2009
Source: Yobe State Ministry of Education (2010)

2. Theoretical Framework

This study was based on the constructivists' theory, which is one of the theories of learning science. This theory emphasizes active participation of learner(s) in the process of finding out information through organizing and reconstructing knowledge (Piaget, 1947; Ausubel, 1978; Oyedokun, 1998; Azdina, Azura, Razali & Hassan, 2003; Bichi, 2006). Learning according to constructivism, places more emphasis on the student (learner) rather than the teacher. Teachers are seen as facilitators or coaches who assist students to construct their conceptualizations and find solutions to problems. The learner interacts with objects and events, and thereby gains an understanding of the feature held by such objects or events (Ausubel, Novak, & Haneisian, 1978; Hund & Teagust, 1989; Bichi, 2006). Learning in science is an active, interactive process of interaction between the learner's mental schemes, his learning environment and the teacher (Driver, 1986). Learning primarily entails an active involvement of the learner in the process of learning (Driver & Bell, 1986). Learning should focus on the experience and active involvement of learners in a dialogical process (Vygotski, 1979; 1998). Bruner (1966; 1996) believes that teaching should address the learners' involvement towards learning in a way that instruction can be readily grasped by the learner. Driver (1978) believes that learning is an active, constructive process in which the learner is an active constructor of information.

Discussion also portrays the principle of learner-centred form of learning where the learner is actively involved in the process of learning in which the teacher serves as a guide or moderator (Bonet, 2007; Atadoga & Onalapo, 2008). This research was therefore based on the framework of constructivism.

3. Statement of the Problem

Several reports and studies showed that there is persistent failure in the Senior Secondary School Students' academic achievement in biology which may be as a result of poor teaching methods such as lecture (teacher-centred)

which is concerned with giving factual information (WAEC Chief Examiner's Reports, 2003; 2005; 2006; WAEC(YBMOE),2007; 2008; 2009). The findings of Hassan and Okatahi (1990), Syncamore, (1999) and Okatahi (2006) showed that teaching methods which are teacher-centred leads to anxiety while learner-centred methods have been found to reduce test-anxiety.

3.1. Research Questions

The study seeks to answer the following questions:

- What is the difference between the academic achievements of students exposed to Discussion method and those exposed to lecture method?
- What is the effect of Discussion method on the anxiety exhibited by Senior Secondary Biology students exposed to the method?

3.2. Null Hypotheses

- H_{01} : There is no significant difference between the mean academic scores of subjects exposed to discussion method and those taught using lecture method
- H_{02} : There is no significant difference between the anxiety level of subjects exposed to discussion method and those taught using lecture method.

4. Methodology

The research design is a pretest post-test Quasi - experimental - control group design was used in which subjects were randomly assigned into experimental and control groups. This was in order to determine any possible treatment effect. This study comprised of two (2) groups, one experimental (E) and one control (C) groups. Experimental group (E) received treatment involving Discussion method only and Control group (C) were taught using Lecture method only.

The pretest was used to find out the equivalence of the two (2) groups in their anxiety level and academic achievement, while the post-test was used to determine their academic achievement and anxiety after exposure to treatment. The design is illustrated in fig. 1.0:

Figure 1: Research Design Illustration (Experimental-Control Group Design).

Where:

- E = Experimental Group
 C = Control Group
 O₁ = Pretest
 O₂ = Post-test
 X_o = Lecture Method
 X₁ = Treatment Group (Discussion Method)
 P = Achievement Test (BAT)
 A = Anxiety Test (BAQ)

4.1. Population for the Study

The target population for the study comprised all SS II students of the 4 Public Co-educational Senior Secondary Schools in Gashua Educational Zone. The total number of students is 532 (363 boys and 169 girls), as shown in Table 3.1;

S/N	Name of Schools	Boys	Girls	Total
1.	ADSS Nguru	140	088	228
2.	GSS Yusufari	086	038	124
3.	GSS Machina	112	034	146
4.	GSS Gwiokura	021	009	030
	Grand Total	363	169	528

Table 3: Population for the Study
 Sample and Sampling Technique

Since only four (4) secondary schools are in the study population, and in order to ensure relative similarities in the variables of interest, the students in the four (4) schools were given the pretest. The scores obtained were subjected to analysis of variance (ANOVA) in which the f-value calculated was 31.56. This was higher than the f-value critical of 2.76 at $P \leq 0.05$ level of significance. This showed that there was significant difference. Based on the analysis of the pre-test scores, the classes in the two (2) schools which were found to have equivalent means were selected as the sample for the study through Shaffer's Test and Duncan's Multiple Range Test. A total of 71 students (49 boys and 22 girls) served as the sample for the study. The number is viable for the study based on central limit theory (Tuckman, 1975) recommendation

that minimum of 30 study samples is viable for experimental study (Tuckman, 1975; Fraenkel & Wallen, 2000). The schools and number of students in each of them is presented in Table 4:

S/N	Name of Schools Groups	Boys	Girls	Total
1.	GSS Yusufari Experimental	28	13	41
2.	GSS Gwiokura Control	21	09	30
	Grand Total	49	22	71

Table 4: Sample for the Study

4.2. Instrumentation

Two (2) instruments were used for data collection. These are:

- Biology Achievement Test (BAT)
- Biology Students' Anxiety Questionnaire (BSAQ)

The BSAT was developed by the researcher from West African Examination Council (WAEC) past questions for the years 2007, 2008, 2009 and 2010. This consisted of 20 multiple choice items in order to test the students' knowledge on the biology topic taught (Genetics). The questions picked also covered the topics taught. The Biology Students' Anxiety Questionnaire (BSAQ) was adapted from that developed by Hamilton (Hamilton, 2006 in JRank, 2010). The anxiety questionnaire also followed the theoretical literature that; the nature of science instruction strongly affects attitude of students to learning science (Anameze, 1998). The questionnaire therefore consisted of statements suggesting how subjects felt about test or examination in biology before and after treatment, and how the treatment had affected their attitude to learning and achievement in biology. The BSAQ require students to use a four point Likert scale to report how they felt before taking an examination. The four (4) response options are; Strongly Agree (SA) with score of 4 indicating high test anxiety, Agree (A) with score of 3, Disagree (DA) with score of 2 and strongly disagree (SD) with score of 1 indicating low test anxiety.

4.3. Administration of Treatment to Experimental Group

The administration of treatment was done by the researcher himself so as to remove any form of biasness. The main treatment involved teaching using discussion method. The presentation of the discussion method to Experimental group (E) was in line with the model adapted from Socratic discussion model (1983; 2000) which has three (3) stages of activities, thus:

Stage I: The lesson package (lesson note) on the topic of discussion was provided by the researcher and gave each member of the group to study and also come up with question(s) related to the instructional contents.

Stage II: The questions were vetted by the teacher in preparation for the discussion process. The questions also determine the course of the discussion.

Stage III: Presentation of the lesson which involves clarifying the aims of the lesson to the student and how each student is expected to ask or answer question(s) or make contribution(s).

4.4. The Control Group

The control group (C) was exposed to the same instructional contents using lecture method. The researcher fed the facts of the contents to the students using lecture method. After the lecture period which lasted for six (6) weeks, BAT and BSAQ were given to the control (C) group as post- test. The post-test was given to determine the effect of the lecture on academic achievement and anxiety level. The scores drawn were used to answer the research questions and tested the hypotheses formulated.

4.4.1. Procedure for Data Collection

The Pretest consisted of 20 multiple choice questions (BSAQ) on genetics concept which was administered to the students in their classrooms under the supervision of the researcher for duration of 40 minutes. The scripts/questionnaires were collected and marked. The BSAQ also consisted of 20 items which the students attempted. The scripts were also collected and marked. After six (6) weeks period of instruction by the researcher, both BAT and BSAT items were administered to the two (2) groups as post-test which lasted for 40 minutes each.

4.4.2. Procedure for Data Analysis

The post-test means scores for the experimental and control groups were analysed using t-test statistic. The t-test was used because the groups were two (2), that is, experimental and control groups. Also t-test was used to find out the difference between the mean scores in respect of achievement and anxiety of the experimental and control groups exposed to discussion and lecture methods respectively. All the null hypotheses of this research study were decided at the significant level of $P \leq 0.05$.

4.5. Answering Research Questions

4.5.1. Research Question 1

What is the difference between the academic achievements of senior secondary school biology students exposed to discussion method when compared to those exposed to lecture method?

Variables	N	X	SD	M/D
Experimental	41	11.07	9.11	0.78
Control	30	10.29	7.21	

Table 3.1: Mean and Standard Deviation of Students in Experimental and Control Groups

The Table 4.1 presented data on the mean and standard deviation of academic achievement of students in the experimental and control groups. From the result, students taught genetics concept using discussion method has a mean score of 11.07 and those taught using lecture method has a mean score of 10.29. The difference in mean score on academic achievement between the two (2) groups is 0.78. The experimental group achieved higher than the control group.

4.5.2. Research Question 2

What is the effect of discussion method on the anxiety level exhibited by senior secondary school biology students?

Variables	N	X	SD	M/D
Experimental	41	11.07	9.11	0.78
Control	30	10.29	7.21	

Table 3.2: Means and Standard Deviations of Anxiety of Experimental and Control Groups

The Table 3.2 presented data on the mean and standard deviation of anxiety levels of experimental groups. From the result, experimental group had a mean of 11.07 and control group had a mean of 10.29 when they were taught using discussion and lecture methods respectively. The difference in mean score on anxiety level between experimental and control group is 0.78. This showed that the anxiety level of experimental group was lower than that of control group when they were taught using discussion and lecture methods respectively.

5. Data Analysis and Hypotheses Testing

To test the difference in means of pretest and post-test of the experimental and control groups in academic achievement and anxiety, t-test was used. The results were presented in the tables below:

- H_{01} : There is no significant difference between the mean academic scores of students taught genetics concept using discussion method and those taught with lecture method.

The post-test means scores of the academic achievement and anxiety levels of experimental and control groups were analysed using t-test statistic.

The results of the t-test analyses are presented in Table 4.1:

Variables	N	X	SD	t-cal.	t-crit.	DF	P	Remark
Experimental	41	11.07	9.11	6.96	1.98	69	0.00	Sig.
Control	30	10.29	7.21					

*Table 4.1: t-test Analysis of Post-test Mean Scores for Achievement of Experimental and Control Groups
Significant $P \leq 0.05$*

From the result in Table 4.1, t-value (calculated) is 6.96 and is greater than t-value (critical) which is 1.98 at $P \leq 0.05$ with $df = 69$. This means that there is significant difference between the post-test scores of the experimental and control groups in favour of the experimental group. Therefore, the hypothesis is rejected. This implies that the experimental group taught using discussion method achieved significantly higher than the control group taught the same concept using lecture method.

- H_{02} : There is no significant difference between the anxiety level of Experimental and Control Groups taught genetics concept using discussion method.

The post-test mean scores of the anxiety of experimental and control groups taught using discussion and lecture methods, respectively, was analysed using t-test statistic. The results of the t-test analysis are presented in Table 4.2:

Variables	N	X	SD	t-cal.	t-crit.	DF	P	Remark
Experimental	41	12.39	5.32	2.01	2.08	69	0.06	Not sig.
Control	30	12.25	5.19					

Table 4.2: t-test Analysis of Post-test Mean Scores for Anxiety of Experimental and Control Groups

From the result in Table 4.2, t-value (calculated) is 2.01 and less than t-value (critical) which is 2.08 at $P \leq 0.05$ with $df = 39$. This showed that there is significance difference between the post-test mean scores of Experimental and Control Groups in favour of experimental group when they were taught using discussion and lecture methods, respectively. Therefore the null hypothesis 2 is rejected.

Discussion of the Results

Null Hypothesis One

The analysis in Table 4.1 showed that the experimental group taught using discussion method achieved higher than the control group taught the same concept using lecture method. This significant difference in achievement in favour of the experimental group suggested a greater effectiveness of the discussion method over the lecture method. The finding is similar to that of Blankmeyer, Tennial and Garezynsky (2011) on empirical study of active teaching techniques in which they examined four (4) teaching techniques (Lecture, demonstration, Discussion and Instructional and Students). The result showed discussion method to be the second highest students' achievement, while lecture had the lowest students' achievement. The work of Ugwuandu and Nzewi (2012) on dialogic, peer and guided discussion on students' achievement showed that guided discussion enhanced students' achievement in biology. While the result is contrary to the research work of Atadoga and Lapkini (2012) on the effect of discussion and eclectic instructional methods on the academic performance of senior secondary physics students in Kogi State, in which the eclectic method achieved higher than discussion method. Capraviis, Barman and Magee (2001) also reported that discussion method produced higher achievement and comprehension over the lecture method. Further research works proved discussion method to not only produce favourable student achievement outcomes, but also foster greater participation and self-confidence (Perkins & Soris, 2001; Yoder & Hochevar, 2005).

Null Hypothesis Two

The analysis in Table 4.2 showed that there was significance difference between the anxiety level of experimental and control groups in favour of experimental groups when the former was taught using discussion method, and the latter taught using lecture method. The explanation for this is that discussion method proved superiority over the lecture method. This agrees with the findings of Kirkland (1996) in Hassan and Okatahi (2006) that training programmes such as teaching methods which are student-centred, e.g. discussion method enables students to get better equipped to face evaluative situations which could have helped in reducing test-anxiety irrespective of gender

6. Conclusion

The findings of the study showed that Discussion method which is a form of learner-centred method have significant effects on students' academic achievement over the lecture method in biology. It also showed significant difference between the anxiety level of experimental and control groups in favour of the experimental group, when the former was taught using discussion method and the latter using lecture method. This indicated that discussion method is superior over lecture method in terms of improving achievement and reducing anxiety.

Therefore, it is imperative from the findings of this study that teachers should focus on teaching using learner-centred methods such as discussion rather than teacher-centred methods. This is because discussion method was found to appeal more on the academic achievement of students and reduces anxiety level, while lecture method lead to low academic achievement and high anxiety.

7. Recommendations

Based on the findings in this study, the following recommendations are made:

- Teachers should adopt discussion method which is learner-centred in their day-to-day classroom instruction and encourage students to actively participate in the discussion process, as this will play a major role in their understanding of the instructional content, improve their academic achievement and reduce anxiety level.
- Teachers trainers should endeavour to adopt and also imbibe in their students the culture of adopting discussion method, so as to implement same when they are out teaching in secondary schools. This will further enhance the academic achievement of students.
- At the local education authority level, efforts should be geared towards organizing workshops/seminars on teaching methodology to emphasize the use of learner-centred methods such as discussion for teaching of science subjects including biology at secondary school level. This is to compliment the efforts of the Millennium Development Goals (MDGs) for re-training of science teachers.

8. Contribution to Knowledge

Discussion is something that is used every day to resolve many issues outside the classroom, but from the result of this research finding the researcher discovered that discussion method has enhanced the teaching-learning process in the classroom and thus enhanced the academic achievement of students in science over the traditional lecture method on genetics concept in biology. This research study also established that discussion method can be used to reduce anxiety level of biology students on genetics concept.

This research work is unique in that the researcher could not lay hands on works reviewed in which discussion and lecture methods were used on academic achievement and anxiety using genetics concept in biology. Therefore, this study has added to the existing body of knowledge supporting the merits of teacher-centred teaching strategies.

Suggestions for Further Studies

- Similar studies could be conducted in teacher training institutions such as Colleges of Education and Faculties of Education in Universities. It could also be extended to polytechnics and other higher institutions of learning in Nigeria for widening the scope of generalization.
- The result obtained in this research was for genetics concepts in biology. The methods can therefore be tried in other science disciplines such as chemistry, physics and mathematics in senior secondary schools.

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