Effect of Students-Team-Achievement-Division (STAD) and Academic Performance of Students in Biology in Essien Udim Local Government Area

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Abstract
Instructional strategy used by science teacher is critical for effective teaching and learning of Biology. The study examined the effects of Student-Team-Achievement-Division (STAD) instructional strategy on Biology students' academic performance on the concept of ecosystem in Essien Udim Local Government Area. Two research questions were raised and two null hypotheses formulated to guide the study. The study was a quasi-experimental with non-randomized pre-test, post-test design. The population was 1,186 senior secondary two (SS 2) students from six co-educational public Secondary Schools in Essien Udim Local Government Area of Akwa Ibom State. Criterion sampling technique was used to select two schools for the study. An intact class of SS2 was adopted from each school and the sample of 147 SSS II (males= 78; females= 69) was obtained. Researchers' made instrument titled "Biology Academic Performance Test (BAPT) which had twenty (20) questions was used for data collection. The reliability co-efficient for BAPT was determined using test retest. The data was analysed using KR20 and r= 0.83 was obtained. The data obtained from tests were analyzed using mean, standard deviation, and Analysis of Covariance (ANCOVA). The result showed that there was a significant difference in the academic performance of students in the concepts of ecosystem taught using Student-Team-Achievement-Division (STAD). There was no significant influence of gender on the students' performance; and that there were no significant interaction effects of learning strategies (Student-Team-Achievement-Division (STAD) and expository) and gender on Biology students' academic performance on the concepts taught. It is recommended that Biology teachers should employ Student-Team-Achievement-Division (STAD) during instructional delivery to enhance students' academic performance in Biology.

Keywords: Student-Team-Achievement-Division (STAD), expository, academic performance, ecosystem

Introduction

Biology is an important intellectual discipline especially in modern advances in biotechnology, medicine processes. It is indispensable in helping individuals think more clearly about quality of live and values involved in the changing world. The Biology curriculum for secondary schools is designed to prepare students to acquire adequate laboratory and relevant skills and knowledge in Biology, as well as ability to apply the knowledge to everyday life (FRN 2014).

Biology as a science subject in the secondary school is a requirement for further learning of science related courses like medicine, anatomy, pharmacy, botany, cytology, embryology, agricultural science among others. The knowledge of Biology can also be applied in industries like food manufacturing, processing, preservation, crime detection through the use of finger print, population control, and disease control in medical field, development of vaccines and animal/Plant hybridization and improvement. All these could be achieved through quality teaching that would enhance student academic performance. Students' academic performance are affected directly or indirectly by many factors such as teaching strategies used by the teacher, gender, school environment, study habit among others. The poor academic performance of secondary school students in Biology seems to have risen in recent years. This observation is supported by West African Examination Council (WAEC) Chief Examiners Report between 2018-2022, which indicated poor students' performance in Biology student's performance. This problem might have adverse effects on the society as it signals failure in attaining scientific and technological development in the country.

Poor students performance in Biology has been attributed to various reasons such as inadequate teaching facilities, use of inappropriate teaching strategies in the teaching of science, especially Biology, abstract nature of some Biology concepts, students variables like gender and self- concept. Idoko (2010) asserted that monotony kills interest in science teaching, hence the use of variety and innovative teaching strategies in teaching Biology is important.

Instructional strategy according to Udofia (2022) includes all the approaches that a teacher may use to actively engage students in deep learning and construction of knowledge. Meanwhile teaching of Biology in Nigerian secondary schools is dominated by teacher centered lecture and expository methods (Ajewole 2012). The author further maintained that the method has failed to produce science students that are committed to science and who can critically reason and transfer what is learnt to new or similar situations. The consistent poor performance of students in Biology has made Biology educators to emphasize the use of students centered strategies like co-operative, simulation, Student-Team-Achievement-Division (STAD) and laboratory strategies to enhance critical thinking and understanding.

Student-Team-Achievement-Division (STAD) strategy is a type of cooperative learning strategy which if well implemented uses a reinforcement system structure to improve learning. Student-Team-Achievement-Division (STAD) is an innovative instructional strategy that could be employed in the teaching and learning of Biology concepts. It is a collaborative learning strategy in which small groups of students with different levels of ability work together to accomplish a shared goal. Here, students are grouped to four or five member learning teams that are mixed in performance level, gender and ethnicity. Wahyuni (2013), opined that Student-Team-Achievement-Division (STAD) aims at motivating students to master skills presented by teacher. Student must help their team mate to learn the material, encouraging them to do their best if they want their team to earn team rewards and thereby making learning important, valuable and fun. It also uses the form of direct learning and group work, during which the students do exercises prepared in form of work sheets by the teacher and discuss the results with members of the group (Kauchak, 2014). In Student-Team-Achievement-Division

(STAD), the teacher presents a lesson, and the students work together within their teams to make sure that all the members have mastered the lesson. After which all students take individual quizzes on the concept, at which time they do not help one another of any gender to boost academic performance.

Expository is derived from the concept of exposition which means to give direct explanation. In the concept of learning, expository strategy is that which most Biology teachers use to explain facts, ideas and other important information to students. Expository teaching strategy is basically a direct instruction, where a teacher stands in front of the room lecturing and students are taking notes and being told what they need to know. Martin (2013), opined that, in expository strategy, the teacher is the source and owner of the knowledge. According to Romiszowski, (2014) expository learning strategy takes place through several stages which are: presentation of information, test of mastery and restatement, providing opportunities of application in form of examples and problem, opportunity to apply new information in real life situations and problem. The disadvantage of this strategy is that, it is teacher-centered, therefore, the teacher is the primary source and main information giver, thereby making students inactive and loss focus.

Students personal variables like gender has been on the front burner of research especially now that gender equality is emphasized. Gender is a construct that is used for being a male or female. According to Udofia and Ekong (2022) the current knowledge demand society and complexity to global challenges call for both male and female students to be given equal opportunities for participation in the classroom. For instance Nzewi (2015) maintained that female students learn more once the classroom environment is friendly. However poor student academic performance and the gender issue are still debatable. Hence the need to carry out this study.

Statement of the Problem

Despite the numerous applications of Biology to all areas of human endeavors, most students perform poorly in Biology at external examinations certificate conducted by WAEC and NECO in Nigerian secondary schools. The poor academic performance of Biology students in external examinations has post a serious threat to scientific and technological development. The observed reasons for poor academic performance include; poor teaching method, inadequate laboratory facilities, abstract nature of some Biology concepts.

Several studies have been carried out to proffer solutions to the problems. Despite all these, students' academic performance in Biology in external examinations has remained low especially in Biology. Although researchers have advocated the use of innovative and student centered teaching strategies such as guided discovery, computer simulations, and co-operative teaching strategies among others in teaching of Biology, study has not been done on the effect of Student-Team-Achievement-Division (STAD) on Biology students' academic performance on the concept of ecosystem in secondary schools in Essien Udim Local Government Area,

Akwa Ibom State.. Hence the study sought to determine the effect of STAD on the students' academic performance in Biology.

Purpose of the Study

The aim of this study was to determine the effect of Student-Team-Achievement-Division (STAD) in Senior Secondary School Students academic Performance in Biology in Essien Udim Local Government Area. Specifically, the study sought to

1. Determine the difference in the academic performance mean scores of Biology students taught ecosystem using Student-Team-Achievement-Division (STAD) and those taught using expository teaching strategy.
2. Determine the difference between the academic performance mean scores of male and female Biology students taught ecosystem using Student-Team-Achievement-Division (STAD) and those taught using expository teaching strategy.

Research Questions

The following research questions guided the study;

1. What is the difference in the academic performance mean scores of Biology students taught ecosystem using Student-Team-Achievement-Division (STAD) and those taught using expository teaching strategy?
2. What is the difference between the academic performance mean scores of male and female Biology students taught ecosystem using Student-Team-Achievement-Division (STAD) and those taught using expository teaching strategy?

Research Hypotheses

The following null hypotheses were raised for the study:

H_{01}: There is no significant difference between the academic performances mean scores of Biology students taught ecosystem using Student-Team-Achievement-Division (STAD) and those taught using expository teaching strategy.

H_{02}: There is no significant difference between the academic performance mean scores of male and female biology students taught ecosystem using Student-Team-Achievement-Division (STAD) and those taught using expository teaching strategy.

Methodology

The study was quasi-experimental and it adopted a pretest - posttest non randomized control group. The population of the study comprised of all the 1,186 senior secondary two (SS2) students from all the 6 co-educational public secondary schools in Essien Udim Local Government Area. Criterion sampling technique was used to select two schools for the study. An intact class of SS2 was adopted from each of the selected schools and the sample size of 147 SSS II students was obtained. The selected schools were randomly assigned to experimental and control groups. The experimental group was taught using Student-Team-Achievement-Division (STAD) and the control group was taught using expository teaching strategy

The researchers developed an instrument tittle: Biology Performance Test on Ecosystem was used. The BPTE consisted of twenty (20) multiple choice (A-D) test items each. The instrument had 2 sections (A and B). Section A contained items on the demographic variables of the students and Section B contained items on the concept of Ecosystem.The instrument was face validated by one secondary school Biology teacher who partakes in WAEC Biology marking and also has eight years of teaching experience and two experts from the Department of Science Education, University of Uyo, The validating were required to check for the appropriateness of the items in terms of the language used, content coverage and class level. All comments and suggestions made appropriately guided the researcher and was used to produce the final form of the instrument. The study took five weeks with one week for training and administration of pretest and three weeks of intensive teaching and one week of post-test administration. One validated researcher-developed lesson package based on three different topics on ecosystem was used to teach the experimental and control groups. The research assistants in the experimental group were made to understand:

(a) The steps in Students Team Achievement Division,
(b) Activities of the teacher and students during teaching-learning process
(c) Process of administration of Biology Performance Test (BPT). After the training, the teachers in both experimental and control groups exposed the students to pretest followed by teaching which lasted for three weeks and a post-test in the fourth week.

Research Question 1: What is the difference in the academic performance mean scores of Biology students taught ecosystem using Student-Team-Achievement-Division (STAD) and those taught using expository teaching strategy?

Table 1: Mean ($\bar{X}$) and Standard Deviation of Students' pre-test and post-test scores classified by treatment groups

		Pretest		Posttest		
Groups	N	Mean	SD	Mean	SD	Mean Gain Score
STAD	83	12.49	2.83	39.52	5.66	27.03
Expository Strategy	64	12.56	2.84	15.53	3.70	2.97

Table 1, shows the pre-test and post-test mean scores and standard deviation of scores of the two groups of students taught using Student-Team-Achievement-Division (STAD) and expository strategy. The post-test and pre-test mean scores of 39.52 and 12.49 respectively, for those in Student-Team-Achievement-Division (STAD) yielded the best mean gain score of 27.03. This is followed by the post-test - pre-test mean gain scores of 15.53 and 12.56 for those in expository strategy group. The post-test standard deviation scores of 5.66 and 3.70 for students in Student-Team-Achievement-Division (STAD) and expository strategy groups respectively indicated that, though students taught using Student-Team-Achievement-Division (STAD) had the highest performance mean scores and the widest scattering of raw scores about

the group mean, those taught using expository method had their raw scores closest to the group mean. Expectedly the two groups had post-test mean scores that are higher than their pre-test mean scores. To know whether the observed differences in the mean scores of the two groups were statistically significant, the testing of hypothesis one is displayed in Table 2.

Research Question 2: What is the difference between the academic performance mean scores of male and female Biology students taught ecosystem using Student-Team-Achievement-Division (STAD) and those taught using expository teaching strategy?

Table 2: Mean and Standard Deviation of Students' pre-test and post-test scores classified by treatment groups and gender

Treatment Groups	Gender		Pre-test		Post-test		Mean Gain
		N	Mean	SD	Mean	SD	Score
STAD	Male	45	12.51	2.79	38.22	5.95	25.71
	Female	38	12.47	2.93	41.05	4.95	28.58
Expository Strategy	Male	33	12.63	3.00	15.00	3.57	2.37
	Female	31	12.50	2.71	16.06	3.83	3.56

The post-test, pre-test mean scores difference by gender displayed in Table 2 shows that the female students in Student-Team-Achievement-Division (STAD) group had the best mean gain score (28.58), followed by their male counterparts in the same group (25.71). Those in expository strategy group had the least mean gain scores of 2.37 for the male and is 3.56 for the female. As is evident from the results displayed, the female's students performed better than their male counterparts. Whether the observed better performance of the males was statistically significant is assessed by the results for testing of hypothesis two displayed in Table 3

Null Hypothesis 1: There is no significant difference between the academic performance mean scores of Biology students taught ecosystem using Student-Team-Achievement-Division (STAD) and those taught using expository teaching.

Table 3: Summary of Analysis of Covariance (ANCOVA) of the students' post-test scores classified by treatment groups with pretest scores as covariate

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision at .05 alpha level
Corrected Model	20803.582[a]	2	10401.791	429.851	.000	S
Intercept	4870.851	1	4870.851	201.287	.000	S
Covariate(Pretest)	12.065	1	12.065	.499	.481	NS
Treatment	20800.574	1	20800.574	859.578	.000	S
Error	3484.595	144	24.199			
Total	148554.000	147				
Corrected Total	24288.177	146				

S= Significant at .05 alpha level, NS= Not significant at .05 alpha level

In Table 2, the calculated F-ratio for the effect of learning strategies at df 1, 146 is 859.58, while its corresponding calculated level of significance is .000 alpha level. The level of significance .000 is less than .05 in which the decision is based, indicating that there was a significant difference in the academic performance of Biology students taught ecosystem using Student-Team-Achievement-Division (STAD). With this observation, null hypothesis 1 was rejected.

Null Hypothesis 2: There is no significant difference between the academic performance mean scores of male and female Biology students taught ecosystem using Student-Team-Achievement-Division (STAD) and those taught using expository teaching strategy.

Table 4: Summary of Analysis of Covariance (ANCOVA) of students' post-test scores classified by treatment groups and gender with pre-test scores as covariate

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision at .05 alpha level
Corrected Model	20987.590[a]	4	5246.897	225.735	.000	S
Intercept	4874.476	1	4874.476	209.713	.000	S
Covariate (Pretest)	12.960	1	12.960	.558	.456	NS
Treatment	20943.309	1	20943.309	901.037	.000	S
Gender	137.658	1	137.658	5.922	.316	NS
Treatment* Gender	27.853	1	27.853	1.198	.276	NS
Error	3300.587	142	23.244			
Total	148554.000	147				
Corrected Total	24288.177	146				

S= Significant at .05 alpha level, NS= Not significant at .05 alpha level

In Table 4, the calculated F-ratio for the main effect of gender at df 1, 146 was 5.92 while its significant level is .316. This significant level is greater than .05 alpha in which the decision is based, indicating that the influence of gender on the students' academic performances was not statistically significant. With this observation, null hypothesis 2 was retained.

Discussion of Findings

The findings with regards to the effects of Student-Team-Achievement-Division (STAD) and expository teaching strategies on Biology students' academic performance on the concept of ecosystem showed that there was a significant difference in the academic

achievement of students taught using STAD performing significantly better than those taught using expository strategy. The students taught using expository learning strategy had very low academic performance scores.

This result could be attributed to the fact that Student-Team-Achievement-Division (STAD) is a student-centered strategy and students engage in a group discussion about the concept taught. This group discussion enhanced interaction and promote independent thinking and construction of knowledge which helped them perform outstandingly on the concept. Whereas students exposed to expository learning strategy were memorizing the facts given by the teacher leading to poor performance because this method does not permit critical thinking in learning. In other word, the relative better enhancing effect of STAD compared with expository strategy could also be attributed to the activity approach which kept the learners adequately engaged during the teaching-learning process as against the didactic teacher-centred approach of the expository method.

The result of this finding is in line with the findings of Mohammad (2017), Ebeneser (2017), Adesoji and Ibrahim (2009) and Joel (2018) who in their different findings on the effect of STAD and expository learning strategies on students' academic performance reported that there is a significant effect of STAD on Students' academic performance. This means that students taught using STAD learning strategy achieved academically better than their counterparts taught using expository teaching strategy.

On research question two and hypotheses two, the influence of gender on students' performance, it was observed that its influence was not statistically significant given the instructional strategies used. This observation indicated that gender is not a strong determinant of students' academic outcomes. The findings is at variance with Adesoji and Ibrahim (2009) who found significant main effect on gender on students' academic achievement in Chemistry with the female performing better than the male.

With reference to treatment-gender interactions on the students' performance the findings on Table 4 showed no significant interaction effects of teaching methods and gender on Biology students' academic performance on the concept; indicating that the effect of treatment was the same at all levels of gender, and that the influence of gender on treatment was the same at all levels of treatment. This implies that Student-Team-Achievement-Division (STAD) could be used to enhance academic performance in Biology irrespective of Gender.

Conclusion

Based on the findings of the study, it is hereby concluded that of the two learning strategies investigated, Student-Team-Achievement-Division (STAD) learning strategy is the more effective in facilitating students' academic performance in Biology. Also gender had no statistically significant influence on students' academic performance in Biology.

Recommendations

1. Biology teachers should make effective use of Student-Team-Achievement-Division (STAD) strategy in teaching concepts in Biology.

2. The government, in collaboration with professional organizations like STAN, should seek organize regular workshops to train Biology teachers in the use of STAD in the classroom.
3. Curriculum planners should ensure the incorporation of Student-Team-Achievement-Division (STAD) strategy in the Biology curriculum for the teaching and learning of Biology.

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