



Gender Difference in the Effectiveness of Constructivist Method of Teaching Biology on Academic Performance of Senior Secondary School Students in Maiduguri Metropolis, Borno State Nigeria

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Abstract

This study determined gender difference in the effectiveness of constructivist method of teaching Biology on academic performance of senior secondary school students in Maiduguri Metropolis, Borno State. The study adopted the pre-test post-test quasi experimental design. A Sample of 190 (97 male and 93 female) were selected from senior secondary schools in Maiduguri Metropolis through stratified random sampling technique. Biology Performance Test (BPT) serves as a research instrument. The study was validated to obtained reliability index of 0.78 using Kuder Richardson (KR-20) formula. Data was analysed using analysis of Covariates (ANCOVA). The findings of the study showed that constructivist method of teaching Biology has no significant effects on students' academic performance based on gender. The study concluded that gender had no significant effect on students' academic performance in Biology. The study therefore, recommended that Biology teachers should use the constructivist method as it was found to be effective in enhancing students' academic performance regardless of gender.

Introduction

Science education is the backbone of any development in any nation. The aim of science education includes inculcating into the learners' creative ability, inquiry and thoughtfulness through the exploration of nature and environment in order to live a self-reliant life in future (Federal Government of Nigeria (FGN), 2013). Biology as a branch of science and a prerequisite subject to many fields of learning contributes immensely to the technological growth of the nation. The importance of Biology to humanity relies on the provisions of the necessary knowledge with which to control or change the environment for the benefit of an individual and community (Miller and Levine, 2002). This indicates that Biology affects all aspects of human life at different degree and permeates all other science and explains the fundamentals of every living organism.

In Nigeria, secondary school Biology curriculum is designed to continue students' investigation into the natural phenomena, to deepen students understanding and interest in biological science and also to encourage students' ability to apply scientific knowledge to everyday life in matters of personal, community, health and agriculture among others (FGN, 2006). Biology has a very higher enrolment of student in the external examination more than Physics and Chemistry (WAEC, 2002). Regardless of the high number of students' enrolment in biology in the senior secondary schools, the poor performance of students in biology has been a source of concern to parents, policy makers and examination bodies (Ogunleye, 2002; Agogo & Naakaa, 2014). In Maiduguri, the analysis of senior secondary certificate examination performance in Biology for the years 2013, 2014 and 2015 indicated that 11%, 2.5% and 1.3% of students out of 34,438, 18,724 and 28,019 candidates who sat for the examination had credits in Biology (WAEC, 2015). Several scholars ((Okebukola, 1998; Agogo & Naakaa, 2013) believed that the causes of mass failure of students in senior secondary school Biology examination includes teacher's methods of teaching, structuring of the curriculum, the concentration of examination questions on few topics, the inability of students to perform enough practical before examination, inadequate curriculum contents, topic difficulty, over loaded time table, teacher related problems, inadequate preparation on the part of the students large classes, lack of innovations in teaching strategies such as lack of media resources.

However, gender plays a vital role in determining performance of students. Available empirical studies such as Nwagbo & Chukelu, (2011); Oludipe, (2012) inferred that there exists no significant



difference in the performance of male and female in Biology. Other studies, (Obiekwe, 2008; Okoro, 2011) indicated that a significant difference exist in the achievement of male and female in Biology.

To this point, teaching as a concept and practice is central to education and any academic setting. There are different types of teaching methods: lecture/expository methods, discussion, demonstration, recitation, lecture/discussion, games and simulations, problems solving, role-play, scaffolding, inquiring learning among others. These methods are grouped by some educators under the umbrella of constructivist approach of teaching which emphasizes that learning should be co-constructed by the interaction of student-teacher and the environment. The major premise of this approach is that learning is more effective when learning is constructed based on the learner's experience with the support of suitable instructional tools.

A good number of researches have been conducted to examine the effect of constructivist methods on students' performance in science. However, only a few studies concentrated on gender difference in the performance of the students when constructivist method employed. In view of this, the researcher considers the need to explore the gender difference in the effect of constructivist method of teaching Biology on academic performance of senior secondary school students. From the foregoing, this study determined gender difference in the effect of constructivist method of teaching Biology on academic performance of senior secondary school students in Maiduguri Metropolis, Borno State, Nigeria

Objective of the Study

The objective of this study was to determine Gender difference in the effectiveness of constructivist method of teaching Biology on academic performance of senior secondary school students in Maiduguri. The specific objectives include:

Hypotheses

The following hypotheses were tested at 0.05 level of significance:

- H01: There is no significant effectiveness of constructivist method on academic performance of experimental group by gender
- H02: There is no significant effectiveness of constructivist method on academic performance of experimental group by gender

Method

The study was based on Bruner (1966) constructivist theory of learning and teaching that states that learning is a social and active process in which the learners construct new knowledge for him or herself and each learner constructs meaning as he or she learns based on past and current knowledge. The study used the pre-test post-test quasi experimental design. Stratified random sampling technique was used in selecting 190 (97 male and 93 female) students from the three schools. The instrument for this study is a researcher made instrument named Biology Performance Test (BPT). The instrument called Biology Performance Test (BPT) consist of Section A contained demographic data of the respondents while section B contained thirty multiple choice items which were drawn from the scope of biology SS11 syllabus. The instrument was validated to obtained reliability coefficient of 0.78 using Kuder Richardson formula (KR-20). The data were collected by Pre-test and Post-test scores. The statistical tool used for data analysis were Means, Standard Deviation and Covariance (ANCOVA). Analysis of covariance according to Bear (1993) is a statistical tool that can be used to adjust for initial difference of a sample when analyzing post test scores. Steven (1996) recommended the use of covariates to reduce error variance and increase the chances of detecting a significance difference between groups. The use of well choosing covariates can help to reduce the confounding influence of group difference (Pallant, 2001). In this study, ANCOVA was used to: determined academic performance of students in Biology in experimental and control groups, and to compare performance of male and female students in the experimental group only.



Results

Ho: The effectiveness of constructivist method of teaching Biology based on academic performance of senior secondary school students does not significantly vary with gender.

The result of ANCOVA in Table 2 indicate that there was no significant difference between experimental and control groups in pre-test on student's academic performance in female senior secondary school as $0.77 > 0.05$ level of significance. This means that the two groups started at the same level. Also from table 1 indicates that there was significant effect in female senior secondary school as the post mean of experimental 21.59 was higher than control mean 13.29. The difference was in favour of experimental group. Therefore, there was effect of constructivist method of teaching Biology on academic performance of female senior secondary school.

The results of ANCOVA in Table 3 shows that there was no significance difference on students' academic performance in Biology between experimental and control groups in mixed school as $0.65 > 0.05$ level of significance. Also table 1 indicates that there was significance effect of constructivist method of teaching in mixed secondary school as the post mean of experimental 19.66 was higher than control mean 4.46. This implied that there was significance difference on students' academic performance in mixed school. The difference in post-test mean was in favour of the experimental group. Therefore, there was significant effect of constructivist method of teaching Biology on academic performance of mixed senior secondary school.

Results of ANCOVA in Table 4 shows that there was no significant difference on students' academic performance between experimental and control groups on pretest mean ($0.278 > 0.05$) in male school. However, table 2 indicates that there was significant effect of constructivist method on academic performance in male school as the post mean of experimental is 20.03 was higher than control mean 18.14. The difference in post-test mean was in favour of the experimental group. Therefore, there was significant effect of constructivist method of teaching Biology on academic performance of male senior secondary school.

The result of analysis in Table 5 shows that there was no significant difference in the performance of students based on gender $F = 0.306$, $P = 0.583$, with a small effect size of 0.05 (Cohen, 1988). Since the calculated value of $P = (0.683; > 0.05)$ level of significance, then the null hypothesis that says effectiveness of constructivist method of teaching Biology does not significantly vary with gender is accepted. Thus, gender has no significant effect on students' academic performance in Biology. However, the probability value associated with the calculated value $F (0.033)$ for the interaction effect of method and gender is (0.857) with a medium effect size of (0.005) according to Cohen (1988) is not significant. The study found that. Gender does not affect students' academic performance when taught Biology using constructivist method.



Table 1: Means and Standard Deviation for Pre-test and Post-test Scores of the Experimental and Control Groups in the three Senior Secondary Schools

Gender	School Type	Group	N	PRE-TEST		POST -TEST	
				Mean	SD	Mean	SD
Male	Male	Experimental	31	6.00	2.77	20.03	4.42
		Control	35	4.94	1.86	18.14	4.09
		Total	66	5.44	2.37	19.03	4.32
	Mixed	Experimental	17	4.53	1.51	19.47	4.00
		Control	14	4.71	1.44	13.14	1.96
		Total	31	4.61	1.45	16.61	4.52
	Total	Experimental	48	5.48	2.48	19.83	4.24
		Control	49	4.88	1.74	16.71	4.26
		Total	97	5.18	2.15	18.26	4.50
Female	Female	Experimental	29	5.55	2.23	21.59	4.79
		Control	32	4.48	1.72	13.29	2.41
		Total	61	4.98	2.04	17.22	5.59
	Mixed	Experimental	18	4.56	2.04	19.83	5.05
		Control	14	4.21	1.42	13.79	2.80
		Total	32	4.41	1.78	17.19	5.15
	Total	Experimental	47	5.17	2.19	20.91	4.91
		Control	46	4.39	1.63	13.43	2.51
		Total	93	4.79	1.96	17.21	5.41
Total	Mixed	Experimental	35	4.54	1.77	19.66	4.51
		Control	28	4.46	1.43	13.46	2.39
		Total	63	4.51	1.62	16.90	4.82
	Total	Experimental	95	5.33	2.34	20.67	4.59
		Control	95	4.64	1.69	15.13	3.88
		Total	190	4.98	2.06	17.45	4.99

The Analysis in Table 1 shows the means and standard deviation of the three senior secondary schools based on group and gender.

Table 2: Results of Analysis of Covariance (ANCOVA) on the Effectiveness of Constructivist Method of Teaching Biology on Academic Performance of Female Senior Secondary School

Source	SS	Df	MS	F	Sig	PES
Corrected Mode Intercept	1050.476 ^a	2	525.238	37.137	0.000	0.562
	2532.152	1	2532.152	179.035	0.000	0.755
Pretest	1.192	1	1.192	.084	0.773	0.001
Group Error	999.419	1	992.419	70.169	0.000	0.547
	820.311	58	14.143			
Total	19997.000	61				
Corrected Total	1870.787	60				

a. R. Square = .562 (Adjusted R. Squared = .546)

**Table 3: Results of Analysis of Covariance on the Effectiveness of Constructivist Method of Teaching Biology on Academic Performance of Mixed Senior Secondary School**

Source	SS	Df	MS	F	Sig	PES
Model	18607.124	5	3721.425	256.993	0.000	0.957
Pretest	2.930	1	2.930	.202	0.655	0.003
Group	592.976	1	592.976	40.950	0.000	0.414
Gender	4.425	1	4.425	.306	0.583	0.005
Group* Gender	.477	1	.477	.033	0.857	0.001
Error	839.876	58	14.481	.033		
Total	19447.000	63				

R Squared = .957 (Adjusted R Squared = .953)

Table 4: Results of Analysis of Covariance on the Effectiveness of Constructivist Method of Teaching Biology on Academic Performance of Male Senior Secondary School

Source	SS	Df	MS	F	Sig	PES
Corrected model	80.300	2	40.150	2.227	.166	.066
Intercept	4130.555	1	4130.535	229.143	.000	.784
Pretest	21.614	1	21.614	1.199	.278	.019
Group	72.375	1	72.375	4.015	.049	.060
Error	1135.639	63	18.026			
Total	25118.000	66				
Corrected Total	1215.939	65				

R Square = .66 (Adjusted R Square = .036)

Table 5: Analysis of Covariance (ANCOVA) on the Effectiveness of Constructivist Method of Teaching Biology on Academic Performance based on Gender

Sources	SS	DF	MS	F	Sig	PES
Model	18607.124	5	3721.425	256.993	.000	.957
Pretest	2,930	1	2.930	.202	.655	.003
Group	592.976	1	592.976	40.950	.000	.414
Gender	4.425	1	4.425	.306	.583	.005
Group*Gende	.477	1	.477	.033	.857	.001
r						
Error	839.876	58	14.481			
Total	19447.000	63				

R Squared = .957 (Adjusted R Squared = .953)

Discussion

This study determined the determined Gender difference in the effectiveness of constructivist method of teaching Biology on academic performance of senior secondary school students in Maiduguri Metropolis, Borno State. The study was consistent with the constructivism theory propounded by Bruner (1966) which emphasized on active participation and personal involvement of students in the learning process. The study investigated whether gender difference have significant effect on academic performance of senior secondary school students in Maiduguri Metropolis, Borno State. Quasi experimental design and Analysis of Covariance were used for the study. The study proved that there was no gender difference on students' academic performance when taught using constructivist method. The study further confirmed that constructivist method is effective across schools (male, female and mixed). The method is more effective in female school.

The study collaborates with the findings collaborate with the findings by Oludipe (2012), Dania (2014) who agreed that constructivist method of teaching Biology is effective irrespective of gender



provided that the right motivation and material necessary for the study are available. This study revealed that constructivist method of teaching was effective on students In Biology in respect to academic performance. However, gender had no significant effect on students' academic performance in Biology.

Specifically, the null hypothesis was tested, the finding revealed that there was no significant gender difference on academic performance. However, the probability value associated with the calculated value F (0.033) for the interaction effect of method and gender was 0.875 with a medium effect size of 0.005 according to Cohen (1988) is not significant. Therefore, the null hypothesis that says constructivist method of teaching Biology does not significantly vary with gender was accepted.

Conclusion

The study confirmed that gender had no significant effect on students' academic performance in Biology. However, school types had significant effect on students' academic performance in Biology. Based on the results of the study, it shows that Gender has no significant effects on students' academic performance in Biology based on constructivist method. The limitation of this study it did not considered other science subjects; chemistry, physics and mathematics to see the gender effects of constructivist method in them.

Recommendations

The study recommends the state government should organize seminar, conference and workshop to train teachers on how gender difference have effect on students' academic performance in Biology. This study should be replicated for other science subjects; chemistry, physics and mathematics to see the effects of constructivist method. Related study should be conducted at the primary school level with a view to improving their academic performance.

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