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Unizik Journal of Educational Research and Policy Studies VOL.9;
https://unijerps.org
2021 Impact Factor: 5.641; 2020 Impact Factor: 5.355.
July-December, 2021
Indexing and Impact Factor URL: http://sjifactor.com/passport.php?id=21363

EFFECT OF GENDER ON BASIC SCIENCE STUDENTS ACADEMIC ACHIEVEMENT IN SECONDARY SCHOOLS

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ABSTRACT
The study examined the effect of gender on social studies students' academic achievement in secondary school. The study adopted a quasi-experimental design of pre-test and post-test non-equivalent control design. Four research questions and four hypotheses were formulated to guide the study. Three research questions and three hypotheses were formulated to guide the study. Population of the study comprised of all the JSS 2 students in Enugu Education Zone of Enugu State, Nigeria. Two intact classes of seventy-two (72) JSS 2 students (30 males and 42 females) were randomly selected from public secondary schools for the study State Nigeria. The selected classes were randomly assigned to experimental and control groups. A 25-item Basic Science Achievement Test (BSAT) was designed by the researchers and used for data collection. The instrument was subjected to face and content validity by experts in Basic Science and Measurement and Evaluation. Kuder-Richardson reliability formula 20 (K-R 20) was used to determine the reliability coefficient index of 0.81 for the instrument, which indicates that the instrument was very good to be used for the study. Means, Standard Deviation was used to answer the research questions while Analysis of covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance. Result revealed that gender (male/female) had no significant effect on students' achievement in Basic Science and finally, result showed that there was significant interaction effect of treatment and gender on students' academic performance in Basic Science. Based on the findings of the study, conclusion and some recommendations were made.

Keywords: Academic Achievement, Basic Science, Gender, Secondary School

Introduction

Integrated science, now Basic Science is the first form of science a learner comes across at the secondary school level; hence, Basic Science prepares students at the junior secondary school level for the study of core science subjects (Physics, Chemistry, Biology) at the senior secondary school level. Basic Science is a subject which embraces all science subjects, namely: biology, chemistry, physics and mathematics. Basic Science is a subject that cut across the school curriculum and needed in all branches of science, applied science and social sciences. This implies that for a student to be able to study single science subjects at the senior secondary school level successfully, such students had to be well grounded in Basic Science at the junior secondary level. In view of this, Basic Science is given great emphasis in the junior secondary school curriculum (Okolo, 2018). The objectives of Basic Science teaching in Nigeria secondary schools are as follows:

1. It provides students at the junior secondary school level a sound basis for continuing science education either in single science subjects or further integrated science;
2. It enhances the scientific literacy of the citizenry;
3. It allows students to understand their environment in its totality rather than in fragments;

4. It allows the students to have general view of the world of science;
5. The processes of science serve as unifying factor for the various science subjects. It is necessary for the learner to know these processes through integrated approach of learning science (Federal Ministry of Education, 2004).

Researchers (Opara, (2011); Olarewajin, (1994); & Adewurum, (1982), were all in agreement with the reasons for teaching Basic Science in Nigeria. Basic Science is teaching science in such a way as to present scientific ideas as a unified whole. It is devised and presented in such a way that students gain the concept of the fundamental unity of science, the commonality of approach to problems of scientific nature, and are helped to gain an understanding of the role and function of science in everyday life and the world in which they live (Arbon as citied in Opara, 2011). Arbon added that, the integrating principles are intended to produce a course which is relevant to student's needs and experiences, stresses to fundamental unity of science, lays adequate foundations for subsequent specialist study and adds a cultural dimension to science education (Opara, 2011). The integration of Basic Science minimizes fragmentation of learning and links together basic scientific information. Basic Science teaching also ensure academic teaching experience in science in which the subject matter boundaries between various scientific disciplines (Biology, Chemistry, and Physics) are dissolved in favour of broad ideas that transcend all the Basic sciences (National Open University of Nigeria) (NOUN,2006). This implies that the teaching of Basic Science as a unified course eliminates the repetition of subject matter from the various sciences and does not recognize the traditional subject boundaries when presenting topics or theme.

One of the goals of Basic Science education is to produce scientists for national development, FME (2004). The problem is that some Basic Science teachers do not even think about the goals, and may even not know what the policy demands from their work (Okolo, 2018). It is important that science teachers be trained and retrained on the goals of teaching science, since teaching and learning without aims is like traveling without knowing the destination. Moreover, having clear aims before teaching enables the teacher to select the content to be learnt by the learners, and to determine the methods and materials to be used during teaching in order to achieve the aims. This implies that the gender of the learners, methods and materials will be considered to help in effective delivery so as to help achieve the goals.

Gender sensitivity has been observed in the area of Basic Science as one of the factors that affect the performance of students in Basic Science. Most male students out-performed female students in science related subjects due to the psychological ability of the male students to with stand difficult tasks compared to their female counterparts who go for easy ways of life or less boredom tasks (Bichi, 2002). Aniugwu as cited in Okolo (2018) asserted that gender issues in Basic Science have a source of aversion and that Science related subjects has been male stereotyped since it was regarded as abstract and difficult subject as well as has attributes which boys were attracted to. Ani, Kalu, Iketaku & Obodo (2020) in the study conducted, observed that male students performed better than their female counterparts when taught Basic Science. Fabunmi (2004) in a study discovered that gender composition has a significant relationship with students' academic performance and that gender composition has a significant influence on secondary school students' academic performance. Gender differences in achievement have been examined for some time resulting in a substantial body of literature (Jack and Johannes, 2001). Beside this, inconsistent findings have been discovered on gender differences and academic achievement (Gimba, 2006; Nsofor, 2006; Akinsola, 2007; Okereke 2011; Amosun, 2011; Asuai 2013 and Ugwuanyi, 2016).

In view of the fact that gender of participants may have impact on the students' academic performance, this study will use

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gender as moderator variable. There is therefore the need to find out if gender has effect on students' academic achievements in Basic Science.

The study investigated the effect of gender on the academic achievement of students in Basic Science. Based on the objectives of the study, the following research questions were raised to guide the study:

1. What is the influence of gender on academic achievement of students in Basic Science?
2. What are the mean posttest achievement scores of male and female students exposed to treatment?
3. What are the mean retention scores of male and female students exposed to experimental control?

Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance:

Ho_1: There is no significant difference in the mean scores of male and female students' academic achievement in Basic Science.

Ho_2: There is no significant difference in the mean achievement scores of male and female students exposed to treatment and their counterparts in the control group.

Ho_3: There is no significant difference in the mean retention scores of male and female students exposed to experimental control.

Research Method

The study adopted quasi-experimental design of pretest-posttest and post-posttest non-equivalent control group design. The choice of this design was made as none of the true experimental designs were possible. According to Anikweze (2015), this design is desirable for analyzing gain scores, that is, differences between posttest and pretest scores. This design was used because the researchers were interested in the study of cause and effect and in manipulating the independent variable (gender) in order to observe the effect on the dependent variable (academic achievement). The target population of the study was the entire JSS II students in the 31 public secondary schools in Enugu zone. A sample of 72 students consisted of 42 female and 30 males students participated in the study. Two (2) intact JSS II students were randomly picked from two (2) randomly selected public secondary schools in Enugu Education Zone of Enugu State, Nigeria. The two selected intact classes were randomly assigned to experimental and control groups respectively. Three research questions and three null hypotheses were formulated to guide the study.

The instrument used for data collection was a 25-item Basic Science Achievement Test" (BSAT) designed by the researchers. Face and content validity of the instruments were carried out through test blue print by two experts in Basic Science and Measurement and Evaluation units of Alex Ekwueme Federal University Ndufu Alike Ikwo (AE-FUNAI), Ebonyi State, Nigeria. Trial testing of the instrument was carried out using Kuder-Richarderson Formula 20 (K-R 20) to determine the reliability coefficient index of 0.81 for the instrument. The researchers were introduced as the new Basic Science teachers in order to prevent students from thinking that they are being used for experiment. In order not to disrupt the school schedules, the school normal class time tables were used. The researchers used lesson notes with infused instructional modes and normal lesson notes in teaching the students in experimental and controlled group respectively the content areas for six weeks. Pre-test was administered by the researchers on the two groups before teaching to determine the equivalence and ability level of the students' knowledge in the two groups. Post-test was administered on the two groups at the end of the six (6) weeks of teaching. The BSAT was reshuffled and administered 2 weeks later after the post-test as post-posttest to determine the students; retention. The data were collected and analyzed using mean and standard deviation to answer the research questions while ANCOVA was used to test the null hypotheses at 0.05 level of significance.

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Presentation of Results

Research Question 1: What is the influence of gender on academic achievement of students in secondary school Basic Science?

Table 1: Mean and Standard Deviation Scores of Students in BSAT for Experimental and Control Groups Before and After Treatment Achievement

Gender	Pre-Test			Post-Test			Mean Gain	Mean Gain Diff
	N	Mean	SD	N	Mean	SD		
Male	30	14.65	6.62	30	44.23	11.35	29.58	15.40
Female	42	11.28	5.77	42	25.46	9.83	14.18	
Total	72	12.97	12.39	72	34.85	21.18	21.88	

Data on Table 1 revealed that at pre-test, the achievement mean scores for males and females were 14.65 and 11.28 2 respectively. Similarly the standard deviations were 6.62 for the males and 5.77 for the females. After post-test, it was observed that for the males, mean achievement score was 44.23 with a standard deviation of 11.35 while for the females, the mean achievement scores and standard deviations were 25.46 and 9.83 respectively. This implies that males achieved higher than females. As a result of this observed difference in mean achievement scores, hypothesis 1 was tested at 0.05 level to determine if the observed difference was significant.

Research Question 2: What are the mean posttest achievement scores of male and female students exposed to treatment?

Table 2: Mean Scores and Standard Deviation of male and female Students Achievement exposed to Treatment

Gender	Type of Test	N	Mean	SD	Mean Diff
Male	Treatment	12	21.74	5.27	2.17
Female	Treatment	18	19.57	3.79	

Data in Table 2 shows the mean scores and standard deviation of male and female students exposed to treatment. The difference in the post-test mean scores between male and female students was mean difference of 2.17 in favour of the male students. This implies that the male students retained what they had learned more their female counterparts.

Research Question 2: What are the mean retention scores of male and female students exposed to experimental control?

Table 3: Mean Retention and Standard Deviation of male and female Students Achievement exposed to Experimental Control

Gender	Type of Test	N	Mean	SD	Mean Diff
Male	Retention	10	25.61	7.11	8.15

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Female	Retention	20	17.46	4.46

Data in Table 3 show the mean retention score and standard deviation of male and female students exposed to experimental control group. The difference in the post-test mean retention scores between male and female students was mean difference of 8.15 in favour of the male students. This implies that the male students retained what they had learned more than female students.

Hypotheses

Ho_1: There is no significant difference in the mean scores of male and female students' academic achievement in Basic Science.

Table 4: Analysis of Covariance (ANCOVA) Result for Male and Female Students' Achievement Scores

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	645.023[a]	2	204/770	4.688	.005
Intercept	15874.648	1	15784.648	235.567	.000
Pretest	64.769	1	64.769	0.213	.304
Gender	16.872	1	16.872	9.439	.000
Error	10329.734	70	62.864		
Total	234370.000	72			

S = Significant at P< 0.05; df = 1, 70

The data presented on Table 4 shows that gender is not significant on students' achievement in Basic Science. This is revealed by the calculated F (1, 70) = 9.439, P = .000). This indicates that gender have no significant influence on the achievement of students. The null hypothesis of no significant difference was therefore rejected because the exact P =.000 was less than the level of significance of 0.05. The researchers therefore, conclude that that there was a significant difference in the mean score of students' achievement in Basic Science.

Ho_2: There is no significant difference in the mean achievement scores of male and female students exposed to treatment and their counterparts in the control group.

Table 5: Analysis of Covariance (ANCOVA) Result for Male and Female Students exposed to Treatment

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	162.142[a]	2	86.121	1.643	.002
Intercept	1782.566	1	1782.566	44.768	.000
Posttest	88.658	1	88.6658	1.784	.256
Gender	90.312	1	90.312	1.896	.002
Error	2091.241	70	46.761		
Total	115083.247	72			
Corrected Total	2146.400	71			

Table 5 however shows summary of ACOVA test of male and female students' academic achievement in Basic Science. The result revealed that the observed difference between the mean scores of male and female students was significant at 0.05 alpha levels. This was as a result that P<0.05 was rejected since F = 1.896 at P =.002 which is less than 0.05. Thus, the null hypothesis two was rejected and we upheld that there was a significant statistical difference in the mean scores of students exposed to treatment.

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Ho_3: There is no significant difference in the mean retention scores of male and female students exposed to experimental control.

Table 6: Analysis of Covariance (ANCOVA) Result for Male and Female Students' Retention Exposed to Treatment

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	752.121[a]	2	76.121	1.643	.001
Intercept	182.546	1	1682.496	43.77	.000
Posttest	84.653	1	68.645	1.864	.276
Gender	91.312	1	10.313	1.696	.000
Error	2291.143	70	56.682		
Total	135083.244	72			
Corrected Total	2245.401	71			

Table 6 shows summary of ACOVA test of retention of male and female students' academic achievement in Basic Science. The result revealed that the observed difference between the mean scores of male and female students was significant at 0.05 alpha levels. This was as a result that P<0.05 was rejected since F = 1.696 at P =.000 which is less than 0.05. Thus, the null hypothesis two was rejected and we upheld that there was a significant statistical difference in the mean retention scores of students exposed to treatment.

Discussion of Findings

Based on the findings of the above results, students exposed to treatment had higher performance compared to their counterparts. However, hypothesis testing revealed that this difference in the mean achievement scores of male and female students exposed to treatment is significant. This finding is in agreement with Asuai (2013) who found that there was a significant difference in the achievement of students who were exposed to experimental treatment. The study also agrees with the assertions that gender difference may exist but a good method should be capable of neutralizing the difference (Akinsola (2007). Hence, in the pre-test there existed some gender difference between the sexes in both the experimental and control groups. The difference that existed within the experimental groups reduced drastically after treatment.

The findings of the study revealed in Table 2 that the mean difference was in favour of the male students while the null hypothesis 2 tested revealed that the observed difference between the mean scores of male and female students is significant at 0.05 alpha level. Hence, the findings revealed that there was a significant difference in academic achievement gained by both male and female students in the experimental group. This study therefore asserts that students' academic achievement is not a function of gender. This was in agreement with the study conducted by Ani, Kalu, Iketaku & Obodo, (2020) whose findings revealed that the mean achievement scores of students who received geometry instruction using analogical teaching approach did differed significantly.

Table 3 showed that male students had higher mean retention scores that their female counterparts. The male difference was in favour of the male students. Hypothesis three tested, revealed that there was significant difference in academic achievement of male and female students' retention when exposed to treatment. This finding is in agreement with Ugwuanyi (2016) whose findings revealed that students who were taught algebra using algebraic fraction game retained more of the concepts taught than those taught with conventional approach.

Conclusion

Based on the results and discussions of the findings of the study, the researchers concluded that students' academic achievements in secondary school Basic Science are not influenced by gender. The study has shown that gender had no significant effect on students'

achievement in Basic Science. It can therefore be concluded that gender of students whether male or female, does not seem to have any influence on the effectiveness of any of the treatment employed in the study. This is an indication that if both treatments are used effectively for male and female they are likely to produce the same result.

Recommendations

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

1. Students should be given equal opportunity and the same level of encouragement irrespective of their level and gender.
2. Teachers should show and factored equal treatment of male and female in Basic Science instructional curriculum and school policy formulation. There should be no differentiation in the way male and female are taught.
3. Scholarship opportunities should be made available by the government and other institutions to enhance the scientific literacy of the Nigerian citizens.

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