



## Gender difference among Science Education pre-service teachers' enrolment and achievement in Taraba state, Nigeria.

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### ABSTRACT

*The main purpose of this study was to find out whether gender difference exist in terms of enrolment and academic achievement in the basic science subjects (Biology, Chemistry & Physics) achievement among pre-service teachers in Taraba State, Nigeria. Expost-facto design was used for the study. The study sampled 168 final year pre-service science teachers in science education department of Taraba state university within 2015/2016—2017/2018 academic session. The data used for the study were drawn from final year pre-service teachers (105 males 63 female) existing results from Science education department. Data collected were analyzed using mean, standard deviation and t-test at 0.05 level of significant. Major findings of the study revealed that there was a significant difference in enrolment and achievement with the male pre-service teachers dominating in physics, chemistry and biology. The study recommends that female pre-service teachers should be given adequate motivational environment that is more gender-friendly.*

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### INTRODUCTION

Gender differences in science are prevalent in academia (Holman, Sturt-fox & Hauser 2018). The females tend to study, lecture and research some fields more than the male but are heavily under-represented in most science intensive areas. The reasons for this imbalance are unclear. Explicit bias against women and any gender difference in science performance cannot explain much of the continuity inequalities (Ceci and Williams 2011; Brihon, 2018; Just-man & Mendez 2018). Stockard, Greene, Richmend, Lewis 2018) opined that computer science engineering and physics may be avoided by female because their male dominated cultures are (inadvertently) unattractive to women, they have chilly climate that alienate females (for another subject. There is implicit bias within primary, secondary and tertiary science education (Robnett 2016). Females lack necessary

early exposure to the science topics and have low self-efficacy (Cheryan, Ziegler, Monotoya & Jiang 2017) or differing abilities of fields of study to satisfy personal goals for status or social impact (Yang and Barth 2015).

Furthermore, a deeper understanding of gender factors influencing academic achievement in science in Taraba is needed. If gender imbalance in science is to be redressed, it is also important to understand why we have male dominant and female unrepresented in some science discipline. A fine-grained examination of gender difference in science is a pre-requisite for any deeper investigation. This is why (Ekin and Abay 2013) opined that what has remained the main focus on are at the concerned in the field of science education are the biases and misconceptions about women and science that is to say science is a male enterprise.



In Taraba state and Nigeria as a whole gender bias is still very prevalent (Adamu 2012). Nwagu (2013) reported that women are grossly under presented in science and technology courses both at the secondary and tertiary levels. Certain vocation and profession (medicine, engineering and architecture) have traditionally been regarded for men and others (nursing, catering, typing and arts) for women. Typically, parent call boys to wash cars, cut grass, fix bulbs or climb ladders to fix or remove things. Moreover, they left the work such as washing of dishes, cooking, cleaning for the girls. In short complex and difficult task are located to boys and girls are expected to handle the relatively easy and less demanding task. Consequently, an average Nigeria or Taraba child goes to school with these fixed stereotypes. These stereotypes persist because in terms of assertiveness. However, government policy insists on gap/imbalance between male and female education arose from a lot of cultural practices in society resulting from deeply fixed prejudices, attitudes, custom, behavioral decisions and procedure. And these combine to discriminate against women are long aged problems as opined by some Science educators (Abdullahi 2008; Okeke (2012); & Allele 2013) who stressed that women enrolment in science and technology education in secondary and tertiary institutions have not been encouraging.

Sex-stereotyped careers of the male over female is a culture which has reinforce the nation of women into a misconception that STEM-related courses are more of men's world. Nnchi, 2008 opined that gender differential treatment is extending to classroom lessons while the boys are expected to do better in science and mathematics the girls are expected to do better in-home economics and certain art subject. Thus, intellectual psychology of depression is developed against female potentials. Although a number of studies have been done on issues related to genders as well as the teaching and

learning of science, the focal point has been on gender differences in students' performance, in other core science subjects (biology, chemistry and physics). Pre-service teachers are indeed tomorrow's educational leaders. There has been no research work on gender difference in biology achievement among pre-service teachers in Taraba state. Science is a tool for economic growth and survival for every nation. Biology is a popular subject among secondary or pre-service students due to its nature it addresses the need of majority through its relevance and functionality in content practice and equity is taken at this level. It thus provides sound bases for reducing gender biases and misconception the field of science.

Researches on gender difference on academic performance in science seem to have so far been inconclusive as finding of Ajayi, and Osoko (2013) indicates that gender can influence students' achievement in science subjects while Maikano and Shaibu (2016) reveal that gender factor has no impact and played no significant role in performance in science, technology and mathematics. However, the study raised the concerned and worries that female performance and achievement in science technology and mathematic is not encouraging. Moreover, Nwagbo and Chukelu (2011) in their studies on the effects of biology practical activities on students' process skill acquisition reveal that there was no significant difference in the mean score of male and female taught biology using the practical approach and that interactive between strategy and gender. Ajayi and Osoko (2013) in their study on the effects of practical assisted instructional strategy on student achievement in biology established that there was no significant difference in the mean, biology achievement scores of male and female students when exposed to the activity-based strategy. Maikano, Bichi and Shaibu (2016) also examined gender related differences in academic achievement of



male and female senior secondary students taught ecology using the outdoor instructional strategies. They discovered that there was no disparity in academic achievement of male and female students exposed to indoor and outdoor laboratory instructional strategies implying that both teaching methods are gender friendly. This study seeks to investigate gender difference in biology or science subject area achievement among pre-service teachers in Taraba state.

Taraba is such a complex, multi-cultural and multi religious society where diverse beliefs, customs, norms and values exist to guide the life and daily endeavors of her citizens (UNESCO 2010). The issue of gender difference and gender stereotyping exist in Taraba culture its consequences have permeated almost every aspect of the nation's social, economic political and educational system especially in the area of science and technology (Ajayi & Osoko, 2013). A number of science educators have to this effect, expressed serious concern over the low participation of female in science courses as well as low number of women who holds professional degrees in science or technology discipline. Science Education (Biology, Chemistry & Physics) pre-service teachers in tertiary institutions continues to decrease the dwindling interest in the basic science subjects and low academic achievement. Therefore, the finding of this study will contribute valuable information to the body of knowledge related to gender, science enrolment and achievement most especially among Taraba University pre-service teachers. The main purpose of this study therefore is to find out whether gender differences exist in enrolment and achievement among Science education pre-service teachers in Taraba State, Nigeria.

### Research Questions

The following research questions were raised to guide the study.

1. What is the mean enrolment of male and female pre-service teachers in physics, chemistry and biology?
2. What is the difference in mean academic performance scores of male and female pre-service teachers for science (physics, chemistry and biology)?

### Hypotheses

To also guide the study, the two null hypotheses were tested at 0.05 significant level.

**Ho1:** There is no significance difference between the enrolment pattern of male and female pre-service teachers in physics, chemistry and biology.

**Ho2:** There is no significance difference in mean academic performance scores of male and female pre-service teachers in physics, chemistry and biology.

### METHODOLOGY

The study used Ex-post facto research design. This research design is used for the study since the research has no control of the independent variables. This design is adopted because the independent variables Students' enrolment and achievement were not manipulated.

The area of study is Jalingo Education Zone, Taraba State, Nigeria. The reason for selection is because the lone University presently offering Science Education courses and having the Faculty of Education is in Taraba State University Jalingo, Nigeria.

The study samples were 168 pre-service science education (biology chemistry and physics) final year students result in the department of science education, Taraba state university, Jalingo, Nigeria within 2015/2016-2017/2018 academic sessions. The instrument for data collection were three years' records of students' enrolment and results for 2015/2016-2017/2018 academic session from Science Education Department. The data collected were analyzed using descriptive and inferential statistics. The research questions were analyzed using



descriptive statistics such as mean and standard deviation while the hypotheses were tested using t-test at 0.05 level of significance.

## RESULTS

**Table 1:** Distributions of sample by gender, subject year and percentages enrolment.

Academic year	Gender	Physics	Chemistry	Biology	Total
2015/2016	Males	6(86%)	4(36%)	17(81%)	27
	Female	1(14%)	7(64%)	4(19%)	12
	Total	7(100%)	11(100%)	21(100%)	
2016/2017	Males	8(100%)	18(67%)	14(47%)	40
	Female	0	9(33%)	16(53%)	21
	Total	8(100%)	27(100%)	30(100%)	
2017/2018	Males	5(83%)	13(68%)	20(47%)	38
	Female	1(17%)	6(32%)	23(53%)	30
	Total	6(100%)	19(100%)	43(100%)	
Grand Total		21	57	90	168

**Table 2:** Mean enrolment of male and female pre-service teacher in physics, chemistry and Biology

Academic Year	Gender	Physics Mean	SD	Chemistry Mean	SD	Biology Mean	SD
2015/2016-2017/2018	Males	6.33	1.53	11.67	7.10	17	3.0
	Female	0.67	0.58	7.33	1.53	14.33	9.61
Mean Difference		5.66		4.34		2.67	

Table 1 reveals the distribution of sample by gender, subject year and percentages enrolment. The result reveals that in 2015/2016 academic session, the male pre-service physics teachers were 6(86%) chemistry 4(36%) biology 17(81%) with a total of 27. While female pre-service teachers on physics that same year were 1(14%) chemistry 7(64%) biology 4(19%) making a total of 12. The total numbers of pre-service teachers in 2015 in physics were 7(100%) chemistry 11(100%) biology 21(100%) respectively. In 2016/2017 the male pre-service teachers in physics were 8(100%) chemistry 18(67%) biology 14(47%) with a total of 40 respectively the female pre-service teacher was physics 0 chemistry 9(33%) biology 16(53%) with a total of 21 respectively. In 2016/2017 male pre-service teacher were physics 8(100) chemistry 18(67%) biology 14(47%) with a total number of 40 respectively. The female was physics 0 chemistry 9(33%)

*Answering Research Question 1:* What is the mean enrolment of male and female pre-service teachers in physics, chemistry and biology? The answer to research question one is presented in Tables 1 and 2.

biology 16(53%) with a total number of 21. The total number of students with physics were 8(100%) chemistry 27(100%) and biology 30(100%). In 2017/2018, male pre-service teachers in physics were 5(83%) chemistry 13(68%) biology 20(47%) with the total number of 38. The female was physics 1(17%) chemistry 6(32%) biology 23(53%) with total number of 30 in all the total the total number of pre-service male and female for 2017/2018 were physics 6(100%) chemistry 19(100%) biology 43(100%). Table 1 therefore reveals that the total number of male and female pre-service teachers for the 2015/2016-2017/2018 school year were physics 21 chemistry 57 and biology 90 which gives the total of 168 as the sample size.

Table 2 reveals the mean of the male pre-service teachers in physics between 2015/2016-2017/2018 (6.33) with standard deviation of (1.53) chemistry (11.67), 7.1003 standard deviation of 3.0

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the table also reveals the mean of female pre-service teachers as physics 0.67 with standard deviation of 0.58 chemistry as 7.33 with standard deviation of 1.53 and biology 14.33 with standard deviation of 9.61 the mean difference between the male and female pre-service teacher within the period revealed the following, Physics 5.66, chemistry 4.34, biology 2.67. In answering research question one, the results from Tables 1 and 2 reveal male

dominant in terms of enrolment for pre-service teachers in physics, chemistry and biology but, was test with  $H_{01}$  in Tables 4, 5, and 6.

*Answering Research question 2:* What is the difference in mean academic performance scores of male and female pre-service teachers for science (physics, chemistry and biology)? The answer to research question two is presented in Table 3.

**Table 3:** Mean academic performance score of male and female pre-service teachers in physics, chemistry and biology.

Academic Year	Gender	Physics mean score	Chemistry mean score	Biology mean score
2015/2016	Males	2.76	3.15	2.68
	Female	4.51	2.90	1.93
	Mean difference	-1.75	0.25	0.75
2016/2017	Males	2.70	2.94	2.96
	Female	0	2.88	2.63
	Mean difference	2.70	0.06	0.33
2017/2018	Males	2.10	2.61	2.54
	Female	2.46	3.25	4.13
Mean difference		-0.36	-0.64	-1.59

Results in Table 3 revealed that in 2015/2016 academic year, the mean scores academic performances of male pre-service teachers were physics (2.76) chemistry (3.15) biology (2.65), while female were physics (4.51) chemistry (2.90) and biology (1.93). The mean difference between them were physics (-1.75) chemistry (0.25) biology (0.75). In 2016/2017, the mean score of male pre-service teachers were physics (2.70) chemistry (2.94) biology (2.96) while female were physics (0) chemistry (2.86) biology (2.63). The mean difference between male and female pre-service teacher reveal the following physics (2.70) chemistry (0.06) biology (0.33). In

2017/2018, the mean score of male pre-service teacher were physics (2.10) chemistry (2.61) biology (2.54). The mean score of female pre-service teacher within this year were physics (2.46) chemistry (3.25) biology (4.13). The mean difference of male and female pre-service teachers within this year were also reveal as physics (-0.36) chemistry (-0.64) biology (-1.59).

**Hypotheses Testing**

$H_{01}$ : There is no significance difference between the enrolment pattern of male and female pre-service teachers in physics, chemistry and biology. The results of  $H_{01}$  tested is presented in Tables 4, 5 and 6.

**Table 4:** Enrolment pattern of male and female pre-service teachers in physics

Academic Year	Gender	N	Mean	SD	Std.-error	t-value	p-value
2015/2016-2017/2018	Males	19	6.33	1.53	0.882	5.091	0.038
	Female	2	0.67	0.58	0.333		
Mean difference			5.66				

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Table 4 showed that the p-value is 0.038 which is less than alpha level of 0.05 with a mean difference of 5.66 which shows that there is a significance

difference in the enrolment pattern of male and female pre-service teachers in physics. Therefore, the null hypothesis one was rejected.

**Table 5:** Enrolment pattern of male and female pre-service teachers in chemistry.

Academic Year	Gender	N	Mean	SD	Std.-error	t-value	p-value
2015/2016-2017/2018	Male	35	11.57	7.095	4.096	9.739	0.016
	Female	22	7.33	1.528	0.882		
Mean difference			4.34				

Table 5, revealed the significant different in enrolment pattern of male and female pre-service teacher within 2015/2016-2017/2018. Chemistry from this

table p-value showed 0.016 with the mean difference of 4.34 this implies that the calculated p-value is less than the alpha level of 0.05 therefore the null hypothesis 1 earlier stated is rejected.

**Table 6:** Enrolment pattern of male and female pre-service teachers in Biology.

Academic Year	Gender	N	Mean	SD	Std.-error	t-value	p-value
2015/2016-2017/2018	Males	51	17	3.00	1.732	6.1995	0.024
	Female	43	14.33	9.609	5.548		
Mean difference			2.67				

Table 6 revealed the significant of difference of male dominant in enrolment pattern in biology with the p-value of 0.024 less than alpha level of 0.05 with the null hypothesis 1 earlier stated is rejected.

**Ho2:** There is no significance difference in mean academic performance scores of male and female pre-service teachers in physics, chemistry and biology. The results of Ho<sub>2</sub> tested is presented in Tables 7, 8 and 9.

**Table 7:** Mean achievement score of male and female pre-service teachers in physics

Academic Year	Gender	N	Mean	SD	Std.-error	t-value	p-value
2015/2016-2017/2018	Male	19	2.52	0.677	0.273	5.31	0.003
	Female	2	2.32	0.010	0.100		
Mean difference			0.20				

P<0.05

From Table 7, the p-value revealed 0.003 against 0.05 level of significant with a mean difference score of 0.20. This revealed that hypothesis 1 of no significant earlier stated is rejected. The result

therefore shows that there is a significance difference in mean academic performance scores of male and female pre-service teachers in physics.

**Table 8:** Mean achievement score of male and female pre-service teachers in chemistry

Academic year	Gender	N	Mean	SD	Std.-error	t-value	p-value
2015/2016-2017/2018	Male	35	2.90	0.702	0.293	10.9845	0.0001
	Female	22	3.01	0.946	0.354		
Mean difference			-0.11				



Table 8, revealed that the significant difference of mean score of academic achievement of male pre-service teacher higher than that of female with the calculated p-value of 0.001 less than the alpha level of 0.05 with mean difference of

-0.11. This rejected hypothesis 2 earlier stated. The result therefore shows that there is a significance difference in mean academic performance scores of male and female pre-service teachers in chemistry.

**Table 9:** Mean achievement score of male and female pre-service teachers in biology

Academic Year	Gender	N	Mean	SD	Std.-error	t-value	p-value
2015/2016- 2017/2018	Male	51	2.73	0.825	0.206		
	Female	43	2.90	2.895	0.649	11.50	0.0002
Mean difference			-0.17				

From Table 9, the significant difference of male and female achievement score is seen as (2.73) female (2.90) with the p-value of 0.0002 and mean difference of -0.17, it revealed the higher achievement of male than the female, with this there is a significant difference which caused hypothesis 2 earlier stated to be rejected.

**DISCUSSION OF FINDINGS**

Tables 4, 5 and 6 revealed the male dominant pre-service teachers' enrolment pattern in physics, chemistry and biology with the significant level of p-value 0.038 and mean difference of 5.66, in physics chemistry p-value of 0.016, mean difference of 4.34, biology p-value of 0.024 mean differences of 2.67. This is in support of the finding of the work of Adamu (2012) and Afay & Okoro (2013) which showed male dominant in science. But disagreed with the finding of the work of Babajide (2010) which showed female dominant in science.

The result in Tables 7, 8 and 9 revealed that the male pre-service teacher achieved more than the female academically. This is showed in the mean difference within 2015/2016-2017/2018 physics (-0.20) with p-value of 0.003, chemistry (0.11) with the p-value of 0.001, biology (0.17) with the p-value of 0.002 respectively while the p-values were physics (0.003) chemistry (0.0001) and biology (0.0002). This shows level of

significant since the calculated p-value is less than alpha level of 0.05. This implies that null hypothesis 2 which was earlier stated of no significant is rejected. The finding of this study contradicted with the work of Adamu (2012). Afay & Okoro (2013) Nneji (2011) and Amosum (2011) which showed no significant difference between male and female achievement in science agreed.

This study also revealed in Table 8 that the mean score of academic achievement of female pre-service teacher in chemistry was (3.01) higher than that of the male (2.90). This implies that there was a selective academic achievement of female in chemistry even though the mean difference is -0.11 and the p-value 0.0001 less than the alpha level of 0.05. This is in agreement with the work of Babajide (2010) which indicates higher achievement of female student in science and disagreed with Adamu (2012) and Agbaje & Alake (2014) whose pre-service teacher in physics, chemistry and biology. This implies that in Taraba State, science seems to be gender bias in which male dominant is revealed. The reason may be due to the cultural practices, customs, beliefs and negative attitudes of the female folks towards science. This is supported by the work of Adamu (2012) and Nwagu (2013) which reported women are grossly under-presented in Science.

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## CONCLUSION

The study concludes that the gender difference exists academic achievement among pre-service teachers in biology or science related areas are significant in Taraba state. It is seen that the male both in enrolment and achievement dominated the female. This implies that the gender gap exists in science in Taraba state, Nigeria.

## RECOMMENDATIONS

Based on the finding of the study, the following points are recommended:

1. Female pre-service teachers should be encouraged to see science as day today activities in their everyday life and also given adequate motivational environment that is more gender-friendly.
2. Parents, teachers, the university authorities and policy makers are expected to work together in order to promote more female pre-service science teachers 'enrolment and academic achievement in science and science education-related subjects in Taraba state.

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