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Gender Influence on Students' Enrolment and Academic Performance in Chemistry: An Assessment of Science and Technical Schools in Sokoto State, Nigeria

Faruku Aliyu
Lecturer, Department of Science Education, Sokoto State University, Nigeria
Ibrahim, Nasiru Tambuwal
Senior Lecturer, Department of Science Education, Sokoto State University, Nigeria

Abstract:
Scientific, Technological and Medical courses in Nigeria are dominated by male gender, an imbalance rooted from secondary science education where Biology, Chemistry and Physics are considered by laymen as male subjects. It was in view of this that this research aimed to determine percentage of female students' enrolment in secondary school science and whether students' gender has any influence on their academic performance in chemistry in particular. Two research questions were asked to determine the percentage of female students' enrolment and the difference in the academic performance between male and female students in Sokoto State science and technical secondary schools' chemistry. Population of the study comprised all senior secondary three (SS III) students in science secondary schools under Sokoto state Ministry of science and Technology numbering 1,719 from which a sample of 90 students were purposively selected for the co-relational design. Two instruments, Students' Enrolment Evaluation Form (SEEF) and Students' Academic Performance Test in Chemistry (SAPTC) were used to obtain data for the study. The results obtained revealed that only 13% of the students who offered chemistry at science and technical secondary schools are female and that there is no significant difference between the academic performance of male and female students in chemistry. The research concludes that gender affects students' enrolment and has no influence on students' academic performance in chemistry. The paper suggested for further research to be conducted in other aspects of chemistry and different locations and finally recommends for the establishment of more female science and technical schools, to encourage more female students to study science at secondary school education level which would increase the number at tertiary level.

Keywords: *Science education, imbalance, co-relational, percentage*

Introduction

Traditionally, gender is considered as a state of being male or female. According to Umoh (2003) gender is a psychological term used in describing behaviours and attributes expected of individuals on the basis of being born as either male or female. In a society, the issue of gender differences is a very important, but few studies tackled these issues except for some graduate theses that discussed the topic from an academic perspective at the school level (Faisal and Zaza, 2011).

Chemistry is the study of the nature and properties of all forms of matter as well as substance that make up our environment and the various changes which these substances undergo under different conditions (Edeh & Vikoo, 2013). Nearly all forms of human endeavors involve the application of chemistry (Osei, 2011). Therefore, role of chemistry cannot be over emphasized. Chemistry has long been a traditional part of academic curriculum in schools and it is usually studied alongside other related subjects such as biology, physics and mathematics. It is a core subject in the study of many science courses such as Medicine, Biochemistry, Microbiology, Pharmacy, Engineering and Agriculture among others.

Chemistry as a school science subject is not tied to a single gender. Hudson (2012) in his analysis discovered that the role of gender in chemistry performance and other subject areas in general, has precipitated a variety of studies over time and will no doubt continue to do so. Some studies revealed that gender has influence on both enrolment and academic performance of students. National Bureau of Statistics (2010) in British Council (2014) indicated that female students constitute only 38% in secondary school enrollment in public schools in Northern Nigeria. The Federal Ministry of Education (2004) disclosed that enrolment in secondary school in Nigeria by 2003 was 43% female and 57% male. The greater percentage of female in the figure was obtained from Southern part of Nigeria. In respect of gender and academic performance the study of Novak & Musonda (1991) for example showed that female students tend to construct less integrated and less complex (poor) concept maps while other studies such as Ganiyu and Isaac (1997) showed no gender influence on students' ability to construct concept maps. Male and female students were capable of constructing well-integrated and

complex concept maps. Also, Afuwape and Oludipe (2008) conducted research on the achievement of graduating pre-service integrated science teachers for a period of three years and revealed that there was no significant difference in academic performance in integrated science between males and females. In another study, Liu and Wang (2005) investigated the decline on students' academic self-concept among high school students and there was a significant effect for gender with female students having significantly higher perceived academic effort (academic self-concept subscale) than their male counterparts. This study therefore aimed at adding to the debate on gender influence on secondary school students' enrolment and academic performance, but this time on chemistry in Sokoto State, Nigeria.

2. Statement of the Problem

It is no longer news that, scientific, medical and technological disciplines in Nigeria and Sokoto State in particular are dominated by male gender leaving a very minor percentage to their female counterpart. Students of Medicine, Nursing, Engineering, Pharmacy, Medical and Laboratory Sciences are mostly male who studied chemistry and other science subjects and performed well in the science subjects at their secondary school level examinations. It was in respect of this that this paper investigated the effect of gender on secondary school students' enrollment and academic performance in chemistry in Sokoto State, Nigeria.

2.1. Objectives of the Study

The main purpose of this study was to find out the influence of gender on enrolment and academic performance of secondary school students in chemistry. Therefore, the paper aimed at finding the:

- Percentage of female students' enrolment in chemistry in science and technical secondary schools of Sokoto State.
- Difference between male and female students' academic performance in chemistry in science and technical secondary schools of Sokoto State.

2.2. Research Questions

For the purpose of this study, the following research questions were set.

- What is the percentage of female students' enrolment in chemistry in science and technical secondary schools of Sokoto State?
- What is the difference between male and female students' academic performance in chemistry in science and technical secondary schools of Sokoto State?

2.3. Null Hypothesis

This research paper has the following null hypothesis which was tested at 0.05 levels of significance.

- Ho: There is no significant difference between male and female students' academic performance in chemistry in science and technical secondary schools of Sokoto State.

2.4. Significance of the Study

The result of this research would show the percentage of male and female students in chemistry in science secondary schools under the Ministry of Science and Technology, Sokoto State, Nigeria, thereby making the ministry and state government to be aware of the number and percentage of both male and female students. It also would also reveal the influence of gender in the study of chemistry in secondary schools. The paper will also serve as a valuable document for those who have concern on educational development in general and science and technology in particular for educational planning to be gender sensitive.

2.5. Scope and Delimitation of the Study

The study covers science and technical schools under Sokoto state ministry of science and technology. The students' academic performance in chemistry test used in this research was delimited to Organic and Inorganic Chemistry topics covered by senior secondary three students prior to the study. Sample for this research were chemistry students drawn from Senior Secondary School Three (SSS3) classes of the sampled schools.

3. Materials and Methods

The research assessed the influence of gender on enrolment and academic performance in chemistry among students in science and technical secondary schools under Sokoto State ministry of science and technology. It employed Descriptive Survey and Co-relational Designs. The descriptive survey made use of Students' Enrolment Evaluation Form (SEEF) for students' enrolment by gender, which was analyzed using frequency and percentages and was used to ascertain the percentage of students' enrolment by gender. The co-relational design was adopted by the researchers in order to compare students' academic performance in chemistry by gender. The students' scores in Students' Academic Performance in Chemistry (SAPCT) were computed using t-test and used to answer research question number two, i.e. what is the difference in the academic performance between male and female students in chemistry in science secondary schools in Sokoto State?

3.1. Population of the Study

The population of this research comprises all science and technical secondary schools under the ministry of science and technology, Sokoto with a total of 1,719 number of students.

3.2. Sample and Sampling Technique

Considering that only one school (i.e. Government Girls College Sokoto) is a female school the researchers purposively sampled Government Girls College Sokoto (female students) while one male school, Nagarta College Sokoto was purposely selected for the study being it having equal number of student-teacher ratio with the girl school. From the two schools, 90 senior secondary three (SS3) students were purposively selected (i.e. 45 from each school).

3.3. Instruments for Data Collection

The instruments used for data collection were Students' Enrolment Evaluation Form (SEEF) and Students' Academic Performance Test in Chemistry (SAPTC). The SEEF only requires the number of males, females and total students per school which were obtained from the ministry of science and technology, Sokoto. The SPTC contained twenty objective questions to be responded by the sampled students of the sampled schools.

3.4. Validity of the Instruments

Validity of an instrument is the degree to which it measures what it is expected to measure. The validity of SPTC was determined by experts in science education from the department of science education, Sokoto State University, Sokoto as well as senior chemistry teachers in science secondary schools in Sokoto, who made some modifications and amendments to the test items in line with the present senior secondary school chemistry syllabus.

3.5. Reliability of the Instrument

The reliability of SPTC was determined after pilot test was carried out at Government Science Secondary School Yabo. In the pilot test two set of scores were obtained through test retest method. A reliability index of 0.75 was obtained via Pearson Product Moment Correlation Coefficient (PPMC).

4. Results

The data of students' enrolment by the schools was obtained from Ministry of Science and Technology, Sokoto via Students' Enrolment Evaluation Form (SEEF) and was presented in Table 1.

S/N	Name of School	Students' Gender	No. of Male Students	No. of Female Students	Total
1.	Nagarta College Sokoto	Male	725	00	725
2.	Government Science Secondary School Yabo	Male	783	00	783
3.	Government Science Secondary School Gwadabawa	Male	478	00	478
4.	Government Girls College Sokoto	Female	00	715	715
5.	Government Technical College Farfaru	Male	1,218	00	1,218
6.	Government Technical College Binji	Male	402	00	402
7.	Government Technical College Runjin Sambo	Male	516	00	516
8.	Olusegun Obasanjo Technical College Bafarawa	Male	702	00	702
	Total		4,824	715	5,539
	Percentage (%)		87%	13%	100%

Table 1: Students' Enrolment in Science and Technical Schools in Sokoto State

However, data obtained from Students' Academic Performance Test in Chemistry (SAPTC) were analyzed using descriptive statistics and were used to answer research question number two as contained in Table 2.

Variables	N	Mean	Std. Dev.	Diff. in Mean Score
Male	45	10.1154	4.90949	
				0.0422
Female	45	10.1154	5.25352	

Table 2: Descriptive Statistics of Male and Female Students' Academic Performance in Chemistry

Table 3 below shows male and female students' academic performance in chemistry classes.

Variables	N	Mean	Std. Dev.	Df	T-Cal	T-Crit	Remark
Male	45	10.1154	4.90949				
				88	0.10	1.66	Retained
Female	45	10.0732	5.25352				

Table 3: T – Test Analysis of Academic Performance of Male and Female Students in Chemistry

5. Discussions

From Table 1, it was revealed that out of eight science and technical schools under the ministry of science and technology, only one school belongs to female students while seven are for male students. Of the total population of 5,539, only 715 students are female constituting 13% while the remaining 87% of the population are male students. This indicated very low percentage of females (girls) enrolment in science and chemistry in particular which is in line with National Bureau of Statistics (2010) in British Council (2014) which reported very low percentage of female students' enrollment in secondary school of Northern Nigeria. The study revealed that, Sokoto state ministry of science and technology is not giving due and necessary consideration to girl child education, making it gender insensitive. By implication, students' enrolment is influenced by gender in favor of male and this answer the first research question. The finding explained why Sokoto state female indigenes are not adequately represented in professions like medicine, nursing and laboratory science who would take care of their wives, sisters and daughters brought to hospitals as patents.

In respect of second research question, Table 2 revealed that the performance of Male and Female students is very closer to one another with a mean score of 10.1154 (Std. Dev. = 4.90949) and 10.0732 (Std. Dev. = 5.25352) respectively. Therefore, very small difference in mean score exists. However, as a difference in academic performance between male and female students in chemistry was revealed, the researchers went ahead to test whether the difference is statistically significant by testing the null hypothesis using t - test as indicated in Table 3.

H_{01}**:** There is no significant difference between the academic performance of male and female students in chemistry.

Table 3 shows t – test analysis of the performance of male and female students in chemistry. The t_{cal} is 0.10 which is less than t_{cri} value of 1.66 leads to retaining the null hypothesis. This revealed that there is no significant difference between the academic performance of male and female students in chemistry which is in line with the findings of Afuwape and Oludipe (2008) and that of Hudson (2012) which revealed no significant difference between males and female's students in academic performance in integrated science. The finding however contradicts that of Liu and Wang (2005) who found a significant effect for gender with female students having significantly higher perceived academic effort than their male counterparts in chemistry.

6. Conclusion

The paper revealed that girl child education was not given necessary attention by the Sokoto State Ministry of Science and Technology. There is need for equity in the ministry in term of gender sensitivity during students' enrolment. The paper concludes that female students can perform as well as their male counterparts did in chemistry. Therefore, gender has no influence on students' academic performance in chemistry.

7. Suggestions for Further Studies

The paper suggested for further research to be conducted in other aspects of chemistry beyond organic and inorganic chemistry in other schools offering chemistry under different ministries in the state and beyond.

8. Recommendations

Based on its findings, the paper recommends the following:

- Establishment of more female science and technical schools in Sokoto state.

- Enrolling more female students and encouraging them to study science in their secondary education to enable the state have more female doctors, nurses, laboratory scientists and many more.

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