Coping with Gender Inequality in Academic Achievement in Physics in Federal College of Education, Pankshin

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Abstract
This paper examines the claims and studies made by scholars and educators on the under-achievement in science of female students in comparison to their male counterparts. The searchlight beams on Physics as a science subject in Federal College of Education, Pankshin, Plateau State, Nigeria. The pooled variance formula for student t-test is employed to test the null hypothesis advanced for the study. The finding indicates a digression from findings of earlier studies. It shows that there is no significant difference between the achievement of male students in Physics and the achievement of their female counterparts in the same subject (male mean score of means = 55.79 and female mean score of means = 53.83).

Introduction
Like their male counterparts, women are found in almost all fields of science and have greatly contributed to the scientific and technological growth of their nations. Deborah 1. Jackson, an African American Physicist, was involved in the development of photonic flight hardware for the Cassini space probe. Ann T. Nelms, a Nuclear Physicist wrote a book (using physics formulae and technical mathematics) that is used extensively by the Atomic Energy Commission to speed up its experiments. Myra Willard, a chemist, participated in testing materials to be used in the Space programme for the "Project Surveyor". The goal of the "Project Surveyor" was to design and build space vehicles to land on the moon (Bryant, Jnr and Swinton, 2001). This is just to mention a few women found in science and technology.

However, a mere observation of women in science world-wide indicates a gross under-representation of the women in science. In a study on the participation of women in science courses in Nigerian Colleges of Education, Oyedokun (2001) ascertains that only 25.95% of the total 1,029 students admitted to study Physics in the 1997/98 academic session were female students. In the 1998/99 session, only 36.38% of the total 962 students admitted to study Physics were female students. Of the 192 Physics lecturers in Nigerian Colleges of Education during 1997/98 session only 18. (9.38%) of the lecturers were female lecturers. During 1998/99 session, a decrease in number of the female lecturers was observed even though there was an increase in number of the Physics lecturers. Only 15 (7.69%) of the 195 Physics lecturers were female lecturers. Similarly, analyses of female students admitted into Nigerian Colleges of Education to study Biology and Chemistry in both the 1997/98 and 1998/99 sessions and female lecturers in these departments also revealed low representation.

In Nigeria, a bid to improve the participation of women in science and technology resulted in government's establishment of female science and technical colleges. What is more worrisome is the claim of under achievement in science of the female students in comparison to their male counterparts. Studies have also been undertaken concerning the under achievement of female students in science and technology. Findings have always shown that female students achieve low.

Table 1 shows students' achievement in science by subject from 2000 to 2004 May/June West African Examination Council (WAEC), Senior School Certificate Examination (SSCE).

Table 1: Students achievement in the pure science subjects (WAEC, SCE, 2000-2004).

Year	Subjects	Total entry	Number that sat for exams	Number of students that have credit (grades 1-6)	% passed at credit level (grades 1-6)	Number of students that fail	% failure
2000	Biology Chemistry Physics	639020 201369 193052	620291 195810 188312	119769 62442 56604	19.30 31.88 30.05	315919 81065 59237	50.93 41.39 31.45
2001	Biology Chemistry Physics	1029962 311606 295963	995345 301740 207993	231475 109397 9964	23.25 36:25 3.46	468216 110664 78487	47.04 36.67 27.25
2002	Biology Chemistry Physics	917041 2713 72 261687	882119 262824 254188	278122 90488 120765	31.53 34.42 47.51	333696 94856 51606	37.82 36.09 20.30
2003	Biology Chemistry Physics	911219 288324 280818	909101 282120 275369	392249 143839 130982	43.14 50.98 47.56	251858 61619 53079	27.70 21.84 19.27
2004	Biology Chemistry Physics	838945 275078 270028	821966 269774 265262	253483 105133 135359	30.83 38.97 51.02	291581 92237 52313	35.47 34.19 19.72

Source: WAEC Statistics of entries and results ( ).

From table 1, the percentages of students that failed in WAEC, SCE Biology, Chemistry and Physics examinations in the years 2000 to 2004 were higher than those of the students that passed. The only exception was the 2002, 2003 and 2004 examinations: In 2002 the percentage of students that passed in Physics was higher than that of those that failed. In 2003 an improvement was observed. The percentage of students that passed in all the three science subjects were higher than those of students that failed.
However, in 2004 only Chemistry and Physics recorded higher' pass percentages than fail percentages.

It is important to note, however, that in many cases students who manage to pass in such examinations as cited above do so through fraudulent means. Reports on irregularities and examination malpractices were received before, during and after the conduct of the examinations (WAEC: Test Development Division, 1998). Nevertheless, not all cases of irregularities and malpractices were detected for reports to be written on.

Despite government's commitment to the upliftments of Science education in Nigeria, Mbah, Obinyan and Onyene (1999) opined that the achievement of science students, especially female students, continue to drop by the year. Blair, Jones and Simpson (1975) were of an earlier view that the low achievement of female students in schools (mostly in science subjects) over the years could stem from attitude of parents towards female education and the cultural background of the female students. In their study on perceived factors that cause low achievement of female students in science Josiah, Ade-Afolabi and Archy (2001) found out that 63.5% of the sample used in their study attested to cultural background as a contributing factor to the low achievement of female students in science subjects

Statement of Problem

Over the years there have been series of student on the under-achievement of female students in the sciences. Female student's poor achievements in certified external examinations like the West Africa Examination Council (WAEC), Senior School Certificate Examination (SSCE) have been observed in comparison to the achievement of their male counterparts

(WAEC, 1991 and Okeke, 2001). This low female achievement at the secondary school level has obviously affected to a large extent the pool of female candidates for science and related courses in tertiary institutions. Possible causes of low female achievement in sciences and allied courses have been proffered by researchers (Piwuna, 2001; Brewton, 2001 and Josiah, Ade-Afolabi and Archy, 2001). These causes of low female achievement in sciences include psychological and cultural issues.

It is based on the aforementioned that the researchers considered it important to conduct a study to justify the claims by comparing the academic achievement in Physics of female students in Federal College of Education, Pankshin, Nigeria with that of their male counterparts.

Purpose of Study

This study was carried out to determine the difference, if any, in the achievement of male and female students in Physics.

Research Question

In the course of testing the null hypothesis, the following question will be answered: Do male students achieve significantly higher in Physics than their female counterparts?

Hypothesis

The null hypothesis postulated for the study was "There is no significant difference between the mean Physics achievement score of male students and the mean Physics achievement score of female students

Methodology

Population and Sample

The study population consisted of all the students admitted to study Physics from the re-introduction of Physics as a department in the Federal College of Education, Pankshin and those who graduated from that institution, from 2000/2001 academic session to 2004/2005 academic session. A total of 72 students formed the population.

The lottery method of the simple random sampling technique was used to select a sample of 22 students (comprising 14 male students and 8 female students).

Instrumentation

To gather data for the null hypothesis advanced, the researchers interacted with the moderated examination scores of the sample in the Department of Physics, Federal College of Education, Pankshin, Plateau State. Information concerning the number of male and female samples was obtained from the personal departmental files of the sample. The questions administered during the examinations were essay types covering the NCE Physics syllabus.

Data and Method of Data Analysis

The data used in the research were moderated scores of individual samples in all the Physics courses they were examined from NCE I to NCE II.

The mean and pooled variance formulas for the student t-statistic were employed in analyzing the data. The mean (Xi) was employed to compute the average of individual sample's course scores. The mean score of the means (X) was also computed
(see Appendices E and F for the mean scores (Xi) and mean of the means (X)]. The pooled variance formula for the student t-statistic (which was used to test the null hypothesis) is given below.

$$t = \frac{X_m X_f}{\frac{(n_m-1)S_m^2 + (n_f-1)S_f^2}{n_m+n_f-2} \; 1+1}{n_m n_f}$$

Where: Xm = mean score of the means of the male sample
X_f = mean score of the means of the female sample
N_m = number of male sample = number of female sample
n_f = variance of number of male sample
S_m^2 = variance of number of female sample
S_f^2 = variance of number of female sample

Analysis of Data

To determine which of the student t-statistic formulae to use Hartley's Fmax test (a test for homogeneity of variance) was conducted using

$$F_{max} = \frac{S_L^2}{S_S^2} = \frac{S_m^2}{S_f^2}$$

Where S_L^2 = large variance
S_s^2 = small variance

Table 2: Summary of the F_{max} test

Gender	S^2	F_{max}-cal	F_{max}-critical	df	L
Male	100.48 (S_m^2)	1.02	2.86	13	0.05
Female	98.88 (S_f^2)				

F_{max} -cal = calculated value of F_{max}
F_{max} -critical = value of F_{max} from table
df = degree of freedom = n - 1 = degree of freedom for the largest group L = level of significance

From table 2 above F_{max}-cal < F_{max}-critical. Since F_{max} -cal <F_{max} critical the researchers assumed that the variances of male group and female group of the study sample are homogeneous. Hence, the decision to use the pooled variance formula for student t-statistic.

Table 3: Summary of the student t-test performed on the mean score of the Means (X) of the male and female samples.

Gender	N	$\dot{X}$	S	t-cal	t-critical	df	L
Male	14(n_m)	55.79($\dot{X}_m$)	10.02(S_m)	0.60	2.086	20	0.05
Female	8(n_f)	53.83($\dot{X}_f$)	9.94(S_f)				

P>0.05

S_m = standard deviation of male sample
S_f = standard deviation of female sample
df = degree of freedom = $n_m + n_f - 2$
L = level of significance for two - tailed test

t -cal = calculated value of student t-statistic
t- Critical = value of student t-statistic from table

From table 3, t-cal < t-critical. This implies that the null hypothesis cannot be rejected. It is upheld since there is sufficient evidence to claim that no significant difference exists between the mean scores of means of male. Physics students and female. Physics students; the mean score of means of male sample being 55.79 and that for their female counterparts being 53.83. This signifies that the achievement of male students in Physics is not significantly different from the achievement in Physics of their female counterparts.

Discussion

In an attempt to test the advanced hypothesis, it was discovered that only 20.83% of the total students admitted into Federal College of Education, Pankshin from 2000/2001 to 2004/2005 academic sessions to study Physics were women. This signifies female under-representation in Physics, a concurrence with earlier findings of Okeke (2001) and Onwuakpa and Akpan (2001). A more striking revelation is the lack of sufficient evidence to reject the null hypothesis for this study. This implies that the achievement of male students in Physics in Federal College of Education, Pankshin does not differ significantly from the achievement of their female counterparts in the subject. This finding is a digression from findings of earlier studies of Okeke (2001), Onwuakpa and Akpan (2001), Mbah, Obinya and Onyene (1999) and Blaid, Jones and Samson (1975) but in agreement with Okooboh's (2002) finding on similar research.

A possible explanation for the change in achievement status of the female students is that factors that were militating against their achievement in science may be on the verge of being overcome.

Conclusion and Recommendations

It is hoped that this research finding will spur female science students in other institutions to aim at bridging the gap in achievement, where there is one between them and their male counterparts.

However, it worthy to note that most school laboratories are ill equipped, with facilities. So science teaching suffers a colossal setback. Government and stakeholders should, therefore, endeavour to equip the science laboratories in Government Girls science and technical schools and similar schools with standard facilities and equipment.

in conclusion, despite the fact that there is no, significant difference in the performance of female students to male students but it has been observed that there is a drop in the numbers of females at each level of the academic ladder and many highly trained female are lost to science and physics in particulars, this under representation of female in sciences threatens the goals of science in achieving excellence, as well as being wasteful and unjust. This situation therefore needs the intervention of government

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