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Postgraduate Science & Technology Education in Nigeria: A Gender Perspective

BY

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ABSTRACT

Science and Technology (S&T) arc the driving force behind industrialization and has become a critical factor for national development. The potential contribution of women in S&T has been and is still undervalued and under utilized. Women are almost entirely marginalized in science and technology development and transfer. Previous research has shown that more males are attracted to S&T careers relative to females globally. This paper presents the result of a survey conducted in the six geo-political zones of Nigeria, on the enrollment and graduation of female S&T graduates in Nigeria. Purposive sampling technique was used to select 2110 respondents with 81% response rate Information was elicited from postgraduate (PG) students and S&T based departments and faculties in S&T based tertiary and Research Institutions using questionnaire and personal interview. The results showed that in science courses, the percentage of female PG students enrolled ranged between 10% and 41% while that of engineering female students was between 10.9% and 33.3%. The percentage of female PG students graduating in engineering courses decreased over the years. This suggests that some of the female PG

students abandon their program midstream. It should be noted that many of the female PG students embark on a PG program but discontinue with the program either due to employment or domestic responsibilities. This paper concludes that it is essential to design and implement policies that will encourage the advancement of Nigerian women in postgraduate studies and careers.

INTRODUCTION

Globally, Science and Technology (S&T) are tools recognized as drivers for increased wealth and continuous improvement of standards of living. The economic development and overall growth of nations is increasingly being defined by globalization and advances in Science and Technology (S&T). This implies that in spite of the abundance of knowledge brought about by globalization, the new global economy is virtually divided based on access to knowledge and ability to exploit it (Siyanbola, 2006). Science and technology are basic components of human activity and as such provide the means for nations to meet their economic, cultural and social needs. S&T also provides the means by which people can meet their physical, emotional and cultural needs and aspirations. The equitable distribution and creation of science and technology is therefore a necessary prerequisite for the development and improvement of the human well being (Papon and Barre, 1996).

In a climate of significant national economic restructuring, it is critically important that the nation's work force attain and maintain a state of technological and scientific readiness that will enable it to thrive in the global economy. To ensure this readiness, it is essential that the potential of all sectors of the population be fully utilized. Despite the importance of S&T, research has shown that women who represent about half of the world population are underrepresented both in education and practice of their profession (Imhanlahimi and Cloebhose, 2006; Aderemi et al, 2009). One of the key identified reasons for this is that young girls do not satisfactorily enroll in science and mathematics while at secondary school

(Mandu, 2009). The general trend has been that females less often study mathematics, physical sciences, engineering, computer studies, and allied fields at every level of education from elementary school to graduate school (Robertson, 1988; Statistics Canada, 1990). Girls and women remain substantially under-represented in mathematics, science, and technology in school and in the workplace. Although this problem is recognized, its complexity is widely underestimated and causes are not well understood. There are reviews on prevailing explanations, that gender differentials occurs in qualities such as self-confidence (Collis, 1991; Oakes, 1990; Robertson, 1988), or on school practices that allow males to dominate classroom interaction and monopolize such technology as computers. There are also disadvantageous features in higher education and the workplace (Acker and Oatley, 1993). Chipman and Thomas (1987) however found out that "interest" is a strong predictor of scientific and technological careers, and that men and women who become scientists are very similar in their interests and vocational values. It appears also that either such interest is differentially distributed between the sexes, or some other factors intervene to deter women from such careers.

Brush (1991) shows that not only do women choose science and technology less often in school, but in both school and the workplace they encounter obstacles and disincentives not faced by men. Several writers report that women who enroll into science and technology courses and graduate studies in universities leave them at a greater rate compared to men (Matyas, 1985; Morrell, 1991), or end up in non-science careers (Nevitte, Gibbons, & Codding, 1988). Also, Adepoju (2009) reported that in Europe, male graduates tend to outnumber women graduates in Science, mathematics and computing programmes (except in Belgium and Spain), and in engineering programmes.

The participation of women in S&T education has been low around the world (Kishore, 2008; McCarthy, 2003; Ellis, 2003). World Women's level of representation in 'harder' sciences such as physics and engineering

is persistently low (Aderemi, et al, 2009). The United States of America Report by the National Science Foundation, (2003) reveal that for every 5-6 men who graduate from an engineering programme, there is only one woman, while the percentage of women in chemical and agricultural engineering is slightly higher, and in electrical and mechanical engineering there are fewer women - less than 14%. A study reported by Aderemi, et al., (2009) on women's enrollment in tertiary-level engineering, medical, and health-related courses in Africa, Caribbean and Latin America and Asia show that rates for participation in engineering courses range from 1.6% in Kenya to 26.5% in Colombia, and for medical and health-related courses, where women are more highly represented around the world, the rates range from 24.7% in Kenya to 68% in Nicaragua, the exception being a participation rate of 77% in the Philippines (Huyer and Westholm, 2000). In Sweden, women made up only 11% of employed non-academic scientists and engineers in 1985 (Aderemi, et al., 2009).

Women made up less than 8% of scientists and engineers in scientific institutions in Japan in 1992. In the 'Associated Countries' of the EU, the percentage of science, mathematics and computing graduates show wider variation, ranging from 9.1% in Norway to 66.7%' in Cyprus, most countries are in the 40% range. For engineering, the percentages are lower, from 13.9% in Norway to 28.6%' in Latvia and Israel (with Bulgaria and the Czech Republic close behind at 27% (European Commission, 2003).

In Africa, while the overall enrollment of women in higher education is still much lower than men's, enrollment, in science courses it is lower still. Research findings by Huyer (2004) and UNESCO (2006) have shown that enrolment, retention and transition data in many developing countries reveal that girls and women lag behind boys in early childcare throughout primary, secondary and higher education. In Nigeria, there is a gender gap in science and technological education with girl-child and women at a disadvantage (Adepoju, 2009). Till date, gender equality remains elusive most especially in Nigeria's science and technological education (Adepoju,

Okotoni, Akinola and Olayiwola, 2009). Also, in Ghana, at the University of Science and Technology in 1986/87, women made up 16% of students in the natural sciences, 2.1 % in engineering, 21.9% in the medical sciences, 10.2 % in the Faculty of Agriculture, and 10.9% in the Faculty of Architecture. A 1992 study showed that less than 10% of the total enrollment in science and engineering courses in Nigerian Universities are female (STAN, 1992).

Globally at the postgraduate level, the low enrollment of female undergraduates in science and Technology disciplines has resulted to the turnout of few numbers of female graduates and yet fewer numbers of these female graduates enroll for postgraduate training. Data gathered by Colwell (2005) reveal that in the United States of America though 40% of the doctorates degrees are earned by females however less than 20% of this constitute the physical sciences and mathematics while less than 10% of this fraction earn their PhDs in the engineering discipline.

The main aim of this work is to study the gender perspective of postgraduate science & technology education in Nigeria. The objectives are to: (i) study the enrollment and graduation pattern of females in S T postgraduate studies in Nigerian Tertiary Institutions in the pas 10 years; and (ii) suggest appropriate policy recommendations to enhance the proper positioning of women in S&T in order that the nation may benefit from their training.

METHODOLOGY

Area of study

The six geopolitical zones of Nigeria were covered in the survey. Abuja was selected for the North Central zone, Bauchi for North East, Kano for North West, Port-harcourt for South South, Lagos for South West and Enugu for South East. In each of the zones, the study covered universities, polytechnics and research institutes in the fields of engineering

and the natural sciences excluding medical, pharmaceutical and agricultural sciences.

Research Instrument

Structured questionnaires and 4 sets of interview guide were employed to solicit information from female S&T graduates. Questionnaires were administered and the educational institutional records on enrollment and graduation figures were obtained.

Sample Population and Sampling Technique

Purposive sampling technique was used to administer 2110 questionnaires in all of the six geo-political zones of Nigeria with 81% response rate. The exams and records unit of tertiary institutions were visited in each of the zones.

Pre-test and Validation of Questionnaires

A pilot test was conducted in Ondo state to validate the questionnaires that were designed. At the end of the pre-test, the questionnaires were amended to reflect the experience gained at the pre-test and thereafter used for the main survey.

Data Analysis

The information that was gathered was sorted, edited and coded. The Statistical Package for Social Sciences (SPSS) and Microsoft Excel was used for data analyses. Quantitative methods of analyses specifically descriptive statistics was used. Among the descriptive statistical techniques were frequencies, means, percentages and cross tabulations.

RESULT AND DISCUSSION

Socio-economic Characteristics of the Female Science and Technology Graduates (FSTG)

Geographical Spread

Fig. 1 shows the geographical spread of the women. The Federal Capital Territory Abuja which is the Nigerian capital city had the -highest respondents of FSTG (35.3%) while Lagos and Kano, had about 10.8% and 3.9% respectively.

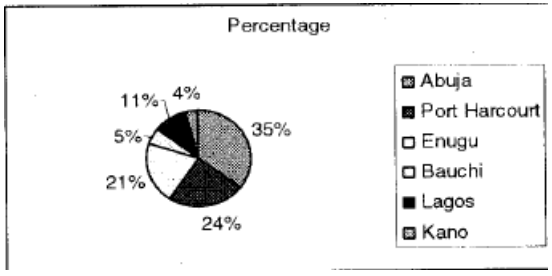


fig. 1 Geographic Spread FSTG Respondents

Age of Respondents

The largest proportions (42.5%) of the FSTG were aged between 20 and 30 years followed by 39.2% in the 31-40 years bracket. About 15.5% of the respondents were aged between 41 and 50 years while only 2.8% were above 50 years. This result suggests that most of the respondents were young with about 81.7% less than 40 years old.

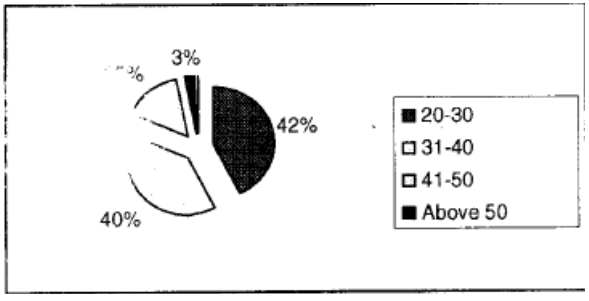


Fig. 2 Age of FSTG Respondents

Marital Status

As at the survey time, about 40.2% of the respondents were single while 52.9% were married. Other respondents were either separated (2.6%), divorced (2.4%) or widowed (2.0%) all totaled about less than

10%. Further analysis showed that 73.1% of the single respondents were aged between 20 and 30 years while a similar percentage of those in age bracket 31-40 and 41-50 were married. Respondents that were separated, divorced or widowed were aged 41 years and above. For the married respondents, 62.7% of the spouses are Civil Servants, 19% work in private organizations while about 16% are self-employed. Only a small proportion of the spouses (2.3%) are clergy men. This result shows that with about 80% of the spouse being not self employed mobility of the FSTG would be highly linked or restricted by that of the husband.

Educational Accomplishment and Information on Undergraduate Studies

Tertiary Institutions Attended, Degrees Obtained and Class of Degree of FSTGs

A high proportion of the FSTG (68.5%) had at least a first degree from the University. Of the 1345 respondents, 68.8% were graduates of universities, 23.7% were graduates of polytechnics while 7.4% finished from Colleges of Education with the National Certificates of Education (NCE). Of the Polytechnic graduates, 14.2% obtained the Higher National Diploma (HND) certificates while 6.0% received the Ordinary National Diploma (OND) certificates. Among the university FSTG about 10.4% graduated with a First Class Honors degree, 49% had Second Class Upper Division, 35.8% Second Class Lower Division and about 4.8% a Third Class. Amongst the FSTG of Polytechnics, 53.5% graduated with Upper Credit, 44.8% had Lower Credit and only 1.7% graduated with a Pass certificate. Figure 3 shows the distribution of Class of degree obtained by the FSTGs. This result indicates that the women not only have the ability to study S&T courses but also performed excellently (see also Table 1).

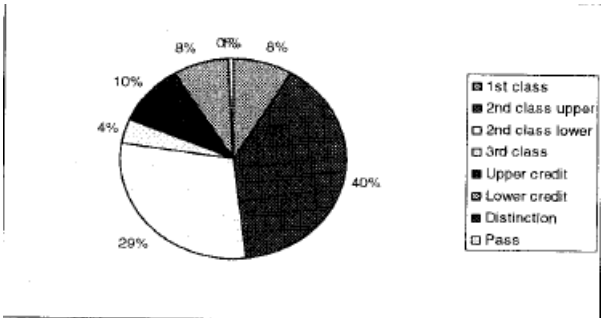


Fig. 3: Class of Degree of FSTG Respondents

Table 1 Field of study of FSTG and Class of Degree Obtained

Fields of Study	1^{st}	2^{1}	2^{2}	3	U^{c}	L^{c}	Pass
Science	52	262	181	23	50	34	0
Engineering	25	119	68	6	22	6	0
Environmental Design & Management	4	21	19	6	9	5	0
Agriculture	4	38	16	5	5	9	0
Science Education	-	3	10	-	-	-	-
Total %	8.5	44.2	29.3	4.0	8.6	5.4	0.1

Key: 1^{st}: First Class

2^{1}: Second Class Upper

2^{2}: Second Class Lower

3: Third Class

If: Upper Credit

L^{c}: Lower Credit

Pass: Ordinary Pass

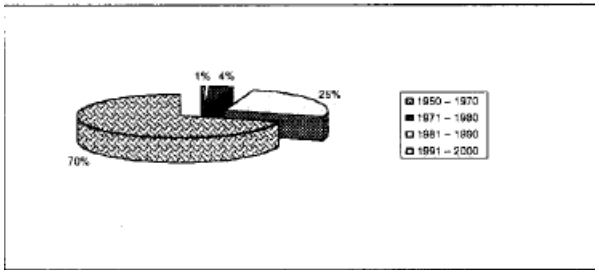


Fig. 4: Year of graduation of FSTG

Figure 4 shows the year of graduation of the respondents. The number of females studying S&T has increased tremendously over the years with 70% of the respondents graduating between 1990 and 2000. This suggests an increased awareness amongst females and the interest and capability to cope or excel in these courses as affirmed by the Class of degrees obtained at the tertiary level.

Trend in Female S&T Enrolment and Graduation (1995-2004)

Postgraduate Female Enrollments and Graduation

Figures 5 to 8 shows the percentage of registered postgraduate (PG) students by sex and the percentage of graduation for the duration studied across the zones. The percentage of female PG students registered for S&T were lower than for undergraduate female students. This implies that fewer graduates of S&T return for PG studies. There is fluctuation in the enrollment of female PG students in S&T courses. Although the number increased slightly in the last four years, but the proportion compared to male enrollment was still low ranging between 30% and 71%.

Fig. 5: Postgraduate Enrolment by sex in Science based Faculties between 1995 and 2004

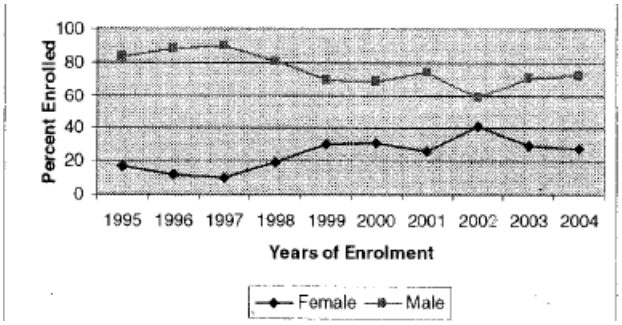


Fig. 6: Postgraduate Enrolment by sex in Technology based Faculties between 1995 and 2004

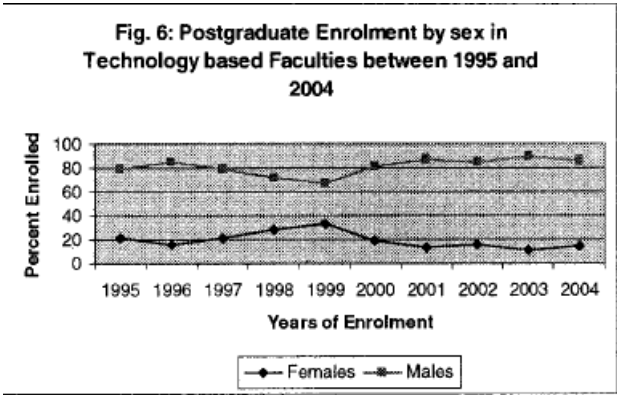
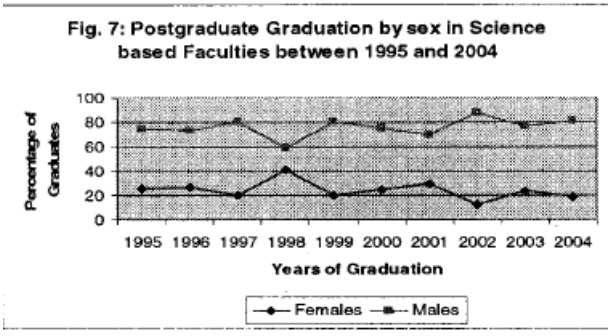
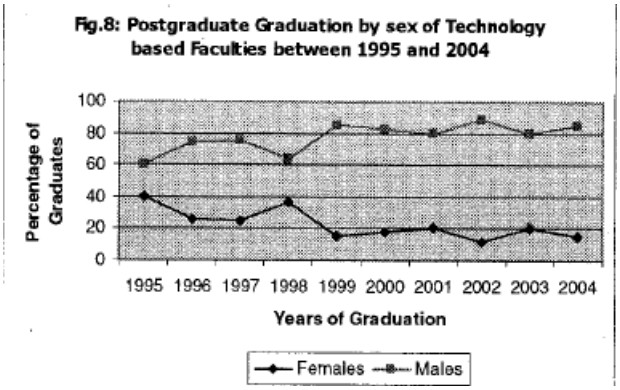


Fig. 7: Postgraduate Graduation by sex in Science based Faculties between 1995 and 2004





Challenges Encountered by FSTGs

Challenges during the cause of study

On challenges encountered in the course of study, genua discrimination (39.4%) topped the list followed by sexual harassment (25.1%), financial constraint (31.4%). Other issues but of less significance (i.e. indicated by only a small number of respondents 0.6%) was domestic related or personal problems. However, a small fraction (<1%) indicated that they found the academic curriculum challenging. Most of those who had domestic challenges were married; some had babies during the course of study and were distracted by domestic responsibilities. S&T courses are quite challenging demanding one's full concentration, but combining this with domestic duties makes studying a daunting task.

The Role of Mentors

Some (49.6%) of the FSTG had role models that encouraged them to study S&T courses (a perceived male dominated environment) while 50.4% had no role models. Of those who had role models, 36.5% of the role models were male while 63% had female role models. Although about 50% of the respondents had no role models or mentors but for those who had, a high proportion are female which suggests the need to publicize the

successes of female achievers as this will encourage the younger ones to follow in their footsteps.

Motivation

When asked what motivated the women to study S&T courses, their responses showed that personal interest (40.8%) was the greatest motivational factor followed by academic competence (26.3%). Some 14.2% of the respondents felt they wanted to challenge the status quo (i.e. the common belief that girls cannot cope with S&T courses because it involves a lot of mathematical computations). Better financial returns from high paying jobs motivated about 17.7% of the respondents to study S&T courses. Parental influence was not a significant factor in choice of course studied as less than 1% of the respondents indicate this option. The ability to challenge the status quo is because of the endowment in understanding S&T subjects.

Thus, personal interest and academic competence are the main factors motivating female pupils to study S&T (See Figure 9). The brilliant academic record on graduation of respondents do support this result i.e. class of degree obtained on graduation.

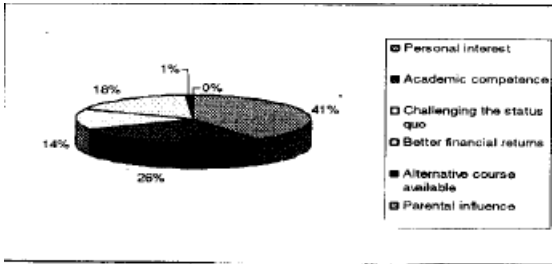


Figure 9: Motivation to Study S

Employment challenges

Above 95% of the FSTG attested that they did not have prompt employment after graduation. Some of the reason given for this include:

lack of funds for logistics (21.8%); limitation by the class of degree (15.5%); desire to acquire further degree (22.8%); poor government economic policy (1.7%); Domestic responsibility (0.4%); gender discrimination (0.1%) and lack of suitable employment (36.8%) topped the list. Only very few (0.8%) indicated that they had no hindrance to prompt employment.

CONCLUSION

The result of the survey suggests that there has been increased awareness amongst female secondary school pupils and the interest and capability to cope or excel in S&T courses at the tertiary level. This calls for continued efforts in enlightenment of the society on change of attitudes to gender roles to enhance the acceptability of women into ventures so called male dominated professions.

The enrollment and graduation pattern in Science and Technology courses at postgraduate level for the span of 10 years revealed that female enrollment and graduation was lower than that *of* males. This calls lor government intervention to set up initiatives that will encourage greater participation of girls in studying S&T courses. Such measures could include immediate employment after graduation, scholarships and award of bursaries, deliberate admission quota to be given to female students or applicants to ensure that a minimum number are offered admission.

Domestic issues and responsibilities constitute primary challenges that female S&T graduate students' face that affect their performance and progress in their studies. Child bearing and rearing are positive contributions the female make towards providing human resource and should therefore not be a limiting factor in the advancement of women. Many developed nations have low birthrates because the -women do not want their careers to hinder their professional progress and now the government of these nations pays the women who choose to give birth as a form of encouragement in order to boost their population growth.

Role models or mentors encouraged KSTG to study S&T courses (which is a perceived male dominated environment) was a motivating factor for some of the FSTG. The study revealed that most of these role models - a high proportion of them are females, which suggests that, there is the need to publicize and celebrate the successes of female S&T professionals and achievers as this will encourage the younger ones to follow in their footsteps.

RECOMMENDATIONS

Suggested recommendations made includes: (1) the need to initiate affirmative actions to increase female graduate enrollment in the S&T sector, (2) The government should create a conducive environment to female S&T workforce during their reproductive years, (3) need to showcase successful female scientists and engineers. Other measures that may be adopted to promote the participation of women in 'he S&T profession include: instituting purposive recruitment and retaining policies; establishing networks for women with careers in S&T and creating a culture of mentorship and role models. It is essential to design, implement and monitor gender-sensitive policies and programmes, at all levels that will foster the empowerment and advancement of women.

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ملخص البحث

تعتبر العلوم والتكنولوجيا القوة للتصنيع وقد أصبحت عاملا حاسما في التنمية الوطنية وما تزال مساهمة المرأة الممكنة في مجال العلوم والتكنولوجيا تواجه بالتقليل من قيمتها والاحتقار وتبقى المرأة مهشمة بصورة كاملة تقريبا في عملية التنمية العلمية والتكنولوجيا ونقلها. وقد بينت البحوث السابقة أن من الذكور يجتذبهم سلم العلوم والتكنولوجيا أكثر من الإناث على النطاق العالمي. وتقدم هذه الورقة نتيجة مسح تم إجراؤه في المناطق السياسية الجغرافية من نيجيريا حول انخراط وتخرج الإناث ممن يتخرجن في مجال العلوم ولتكنولوجيا في نيجيريا واستخدمت عينة هادفة لاختير (٢١١٠) مستجيب بمعدل استجابة قدرها (٨١%) وتم اطلاق المعلومات من قبل طلبة خرجين وإدارات وكليات العلوم والتكنولوجيا في مؤسسات الأبحاث المستندة إلى العلوم والتكنولوجيا باستخدام استبيان ومقابلة شخصية. وأظهرت النتائج أنه في مساقات العلوم تراوحت نسبة الطالبات الخريجات بين (١٠%) و (٤١%) بينما كانت نسبة الطالبات المهندسات تتراوح بين (١٠.٩%) و (٣٣.٣%) وانخفضت نسبة الطالبات الخريجات في مساقات الهندسة خلال هذه الأعوام. ويوحي هذا بأن بعض الطالبات الخريجات تخلين عن برنامجهن في منتصف الطريق. ولابد من ملاحظة أن كثيرا من الطالبات يقدمن على برنامج نا بعد التخرج إلا أنهن يتوقفن عن البرنامج إما بسبب الوظيفة أو مسؤوليات منزلية وتخلص هذه الرسالة إلى أنه من اللازم تصميم وتنفيذ سياسات تشجيع النساء النيجيريات على السير قدما في مجال الدراسات ما بعد التخرج.