

Full Length Research Paper

Analysis of the participation and performance of males and females in Nigeria in science and technology programmes: A case study of ten years National Diploma in Nuhu Bamalli Polytechnic, Zaria

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The enrollment and assessment of performance of National diploma students in Science Laboratory Technology Programme in Nuhu Bamalli Polytechnic, Zaria were studied. The study covered ten academic sessions: 1995 – 2005. Sample means, percentage and students T – test were employed to analyze the data obtained for the study. The enrollment of male and female students was compared: the results showed lower enrollment and percentage pass for females, the average range of enrollment being 60 – 70% for males and 15 – 45% for females. Statistical analysis has revealed significant difference with p values less than 0.05. This shows differences exist in the participation and performance of male and female students of the Science Laboratory Technology Diploma programme in Nuhu Bamalli Polytechnic, Zaria.

Key words: Gender, analysis, Science Laboratory Technology.

INTRODUCTION

The dawn of the 21st century has been marked by a transformation in which knowledge has become the central focus and driving force of human development, which pushes the boundaries at a dramatic speed and across a broad range of activities.

Knowledge – based society is one in which science and technological knowledge affects all social levels. So knowledge becomes a strategic resource for everyone (Beijin Declaration, 1995). Knowledge in science and technology, as commonly understood, provides the intellectual capital or mental labour that can be exchanged for earning a living.

In the African world, especially Nigeria for instance, women form half of the population, half of the school entrants, half of the college graduates and half of the consumers of technology products, but they have little involvement in the forces that drive the changes which have such a great impact on their lives (Beijin Declaration, 1995).

The significance now attached to increasing the parti-

icipation of Nigerian women in technology and technological education reflects two world – wide trends. The first is the way in which technology is permeating all domains of activity in the contemporary world, with pervasive roles in national economic development and in our every day experience. It is not only that occupations involving technology are on the increase, but populations in general, men and women, are engaging with the processes, products and effects of technology on a day to day basis. The second is recognition of the need for action by the international community in securing the advancement of women and the elimination of gender – based discrimination, particularly in the fields of education and employment (Ellis, 1990).

Arriving at gender equality, or as it is generally understood, offering the same opportunities to women as are available to men is an objective that strengthens human rights and social justice as laid out in international laws and is supportive of the globalization process by capturing the potential contribution of women to development. Science and technology, being the major drivers of development, produce a window of opportunity for women to influence the development process through participating in the advancement and application of know-

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ledge. Greater involvement of women in science and technology is a vital interest for society at large. How that is achieved is not the problem of women alone, but one that requires the whole of society to engage in and address (Jayaweera, 1991).

The origin of this under representation of women has been largely structural: it is created in and through the social structures of institutions and the segmentation of the labour market, and internalized in values and beliefs about appropriate roles and expectations. These factors are manifested in a host of barriers to women's participation, both general and specific to the technological domain (Swarbrick, 1986).

Science and technology, which are the indisputable foundations of political and economic power in our modern world, are still marked by various length and dimensions of deep seated gender inequality that works mostly to the disadvantage of women. Women's exclusion, paradoxically enough, starts from the early phase of their education, when feminine identities are defined in the manner which, overall, tends to reproduce the ideology of domesticity among girls and encourages a rejection of science and technology. These translated into stereotypes and result in women being kept away from scientific positions and denied technical job.

Further, the accumulated experiences and knowledge of women are excluded and, as a consequence, do not feature in the human scientific patrimony; almost by instinct, women are not considered to be capable of creating science and technology and as a consequence are reduced to the role of passive recipient, even helpless victims. Thus, while it may be true that some of the historic advances that have been recorded in science and technology would seem to have been empowering to women in certain domains, the logic of domesticity within which much of these advantages have occurred has, in fact, tended to be disempowering even as the gap between men and women in the field of science and technology continues to widen. Still, for all the obstacles that they experienced, women have never ceased devising clever and ingenious combination to enable them to master things, most of the times away from the lime light of official science (Adeyinka, 2001).

Developing countries must train more scientists if they are to compete in a globalized economy. Nigeria as such cannot afford to waste human potentials, male or female, yet girls or women in the country are faced with many arrays of internal and external obstacles to careers in science. There are psychological, cultural and economic barriers that keep Nigerian women away from science. Science education is a must for radical development of the nation. Nigeria has a population of over 133,000,000 (Adeyinka, 2001), of which 50.7% are females. Its 2006 census revealed a population figure of 120 million, of which 50% are females. So taking gender in relation to science as an important issue cannot be over emphasized in the Nigerian society.

Attrition of women from science is well documented (NSF, 1989; Siebett, 1992, 1991). Although both men and women leave the "pipeline" along the way, studies have repeatedly shown that a higher percentage of women leave, especially during the undergraduates years.

Girl's alienation from science and technology subjects begins early. Even from the age of five, both girls and boys have definite views about what constitutes "men's work" and "women's work", according to research undertaken by the engineering council in 1991. With little variation across the social classes, girls and boys believe for example, that car repairs and woodwork are exclusively meant for men while mending and washing clothes are within the province of women.

Girls show less confidence in their ability to learn than boys do (Betz and Hachett, 1993; Brody and Tobin, 1985; Matsui and Ohnishi 1990) and are less willing to approach new materials (Reyes, 1984). Girls are less confident in their Mathematics performance. When predicting future grades in Maths, girls are less optimistic than boys, even if they have equal ability (Eccles, 1983; Heller Person 1981; Topasak, 1990). Even when they are successful in school, girls' confidence often remains low (Meyer and Koezala, 1990). By the time women enter college, their confidence in their ability to do math is practically uncorrelated with their actual ability (Singer and Stake, 1986). There is a common belief that females are less mathematically capable than males. This belief is fairly constant across populations (Eccles, 1987). Classroom studies have shown that this belief is in place by the time children enter the third grade (Crawford et al, 1989): this belief is mirrored by students' parents. By the time children enter kindergarten, parents expect girls to do better at verbal tasks and boys to do better at math (Lummis and Stevenson, 1990). This belief continues through elementary school (Baker, 1983) and on throughout the academic process (Hyde and Linn, 1988).

This belief is not entirely proven to be true in all findings. Although evidence from the many studies performed on gender differences in Mathematic is inconsistent, small but statistically significant differences exist in the norm (Benbow, 1992). These between – gender differences are generally quite small compared to variability within each gender. Furthermore, these differences are becoming smaller over time (Linn and Hyde, 1988). There are no significant differences in Mathematics achievement between boys and girls in elementary schools, and they are few differences at any age (Silver, 1992). Although these differences are small, parents and teachers often expect large discrepancies between boys' and girls' performance in math class. Because others' expectations can have a strong influence on one's attitudes and behaviour, parents' and teachers' negative expectations put girls at a distinct disadvantage in the classroom (Snyder, 1979).

Parents treat boys and girls differently from birth. They are more physically active with boys than with girls, and

give boys more spatially complex toys and more opportunities to explore their physical worlds (Newcombe, 1998). These differences may contribute to the well documented gender differences in spatial ability.

Teachers' expectations can have a direct influence on students' grades, with students who are expected to do well consistently out performing those who are expected to do poorly (Feldman and Theiss, 1982). Teachers expect less academically from girls than from boys and treat girls quite differently from the way boys are treated. Boys are praised for their ability when they do well, and criticized far not working harder when they do not. Girls are complimented on their hard work and neat performance when they succeed in the sciences; they are told that they are not bright when they fail (Stockard and Nelson 2001). Boys also are attended to by teachers more than girls are, receive more help from teachers on areas in which they have problems academically and are called on more often to give answers in class (Becker, 1981; Reyes, 1999).

Statement of the problem

1. In Africa, there are fewer girls that have access to primary education. And of those children that do have access, fewer girls than boys learn about science.
2. At tertiary institutions, there are fewer girls than boys that opt for science based programmes. For example the male to female ratio in the science programme in Nuhu Bamalli Polytechnic is 4:1.
3. Fewer women pursue scientific and technological careers and fewer reach the top professional, managerial or policy making positions.

Significance of the study

This work is meant to alert, the entire people of Nigeria, using Technology Nuhu Bamalli Polytechnic Zaria as a case study, to see the need for all-male and female- to be vitally involved in science and technology; and to ensure that it is not gender based. They should see the urgency for all to be scientific inclined, judging from the numerous benefits that are accrue to it. Nigeria, as a signatory to numerous international conventions and chapters, such as millennium declaration, the Beijing platform of action and the conventions on the elimination of all forms of discrimination against women, should endeavor to enhance girls and women participation and development, particularly in science and technology.

Objectives of the research

1. To document and compile information based on the performance of the female students in science laboratory

education.

2. To sensitize relevant ministries of education and other key persons in education about the status of female participation in science based education to meet the needs of girls.
3. To provide information on innovative interventions in these areas by both formal government departments and agencies on how to improve the participation of where research is needed.
4. To find out statistically if there is any significant differences between male and female students performance in the Department of Science Laboratory Technology, Nuhu Bamalli Polytechnic, Zaria,

Research questions

1. Are there any gender differences in the enrolment of student in the Department of Science Laboratory Technology, Nuhu Bamalli Polytechnic, Zaria?
2. Are there any significant differences in the students' performance?

Hypothesis

No significant differences in the performance of male and female students in National Diploma Programme in Science Laboratory Technology, Nuhu Bamalli Polytechnic, Zaria.

Real pass in this research means passes with a minimum of lower credit. Passes with ordinary pass are not considered as real pass since the student cannot use the grade to go for Higher National Diploma immediately.

Delimitations

The research covers results of performance of Science Laboratory Technology students of Nuhu Bamalli Polytechnic, Zaria within the period of ten years.

Limitation

1. The study is limited to the students' enrolment within the period of ten years.
2. Examination results are used as criteria for evaluation.
3. There is a limitation to the student's background in terms of parental and initial academic background because questionnaires cannot be administered due to unavailability of the students within the period of the studies

Basic assumption

1. The students' enrollment is a true representation of

Table 1. Number and percentages of male and female students' enrollment for each session.

Session	No. admitted	Male	Female	% male	% female
1995/96	20	15	05	75.0	25.0
1996/97	84	54	30	64.3	35.7
1997/98	69	49	20	71.0	29.0
1998/99	79	57	22	72.2	27.8
1999/2000	46	27	19	58.7	41.3
2000/01	54	46	08	85.2	14.8
2001/02	49	34	15	69.4	30.6
2002/03	102	68	34	66.7	32.3
2003/04	106	78	28	73.6	26.4
2004/05	117	82	35	70.1	29.9

Source: Examination and Records Office, Nuhu Bamalli Polytechnic, Zaria.

gender choice for the programme.

2. The result of the students' performance for each year is authentic and true representation of the students' performance.

METHODOLOGY

The study is a survey conducted on Science Laboratory Technology Diploma students of Nuhu Bamalli Polytechnic, Zaria on gender enrollment and performance of the programme.

The survey consists of ten years admission and examination results obtained from the department and examination and records unit of the institution.

Population of the Study

The study covers the number of male and female enrollment during the ten years academic session, that is 1995 – 2005. It also focuses on the percentage pass between male and female for each session. The pass means students with lower credit and above. An ordinary pass graded is not considered as a pass for the candidate because it does not qualify the student to go for Higher Diploma Programme immediately.

The data were collected from the academic office of the polytechnic, for the number of students enrolled during each session and the examination results were obtained from both the department and examination and records unit of the polytechnic.

Instrumentation

Sample means, percentage and students T – test were employed to analyze the data obtained for the study. The results were obtained and presented in tabular forms.

RESULTS AND DISCUSSION

The result on Table 1 of students' intake for ten years shows that the percentage enrollment of female is considerably low, far less than 50%, with the highest of only 41.3% during the 1999/2000 session.

The lowest enrollment of female is in 2000/2001 session with a percentage of 14.8%. For those that graduated during the ten years observation, it shows that percentage pass for female students is still very low, with the highest of 46.9% during the 1999/2000 session and the lowest of 15.2% during the 2004/2005 session (Table 2).

To test the significance of the gender performance, of percentage pass with minimum of lower credit for male and female is drawn on Table 5.

Data analysis

The student's enrollment favours male as expected. In most cases, it ranges from 60 – 75% with an average of 70.3% and that of female 28.8% as indicated on Table 1. The percentage of students that graduated during the study period ranges from 53 – 84% for male and 15 – 27% for female (Table 2).

Statistical analysis using standard error of mean and students't – test for the percentage pass of male compared to the total number of the students is not significant, but that of the total number of students and the percentage of female is quite significant with P – value 0.0002. Also percentage pass for male is also significant with P – value of 0.0036. All test results with P – value less than 0.05 is said to be significant as shown in Table 5. This result has made null the hypothesis that states that there are no significant differences in the performance of male and female students in National Diploma Programme in Science Laboratory Technology Nuhu Bamalli Polytechnic, Zaria.

DISCUSSIONS

The results have shown that male performance is better than female during the period of the study. It has been re-

Table 2. Number and percentages of male and female students graduated for each session.

Session	No. graduated	Male	Female	% male	% female
1995/96	18	13	05	72.2	27.8
1996/97	62	42	20	67.7	32.3
1997/98	64	50	14	78.1	21.9
1998/99	71	49	22	69.0	31.0
1999/2000	39	21	18	53.8	46.2
2000/01	23	18	05	78.3	21.7
2001/02	41	28	13	68.3	31.7
2002/03	79	49	30	62.0	38.0
2003/04	58	40	18	69.0	31.0
2004/05	66	56	10	84.8	15.2

Source: Examination and Records Office Nuhu Bamalli Polytechnic, Zaria.

Table 3. Number of male and female students graduated with grade levels for each session.

Session	Number graduated		Level of grades for males				Level of grades for females			
	Male	Female	Distinction	Upper credit	Lower credit	Pass	Distinction	Upper credit	Lowers	Pass
1995/96	13	05	-	02	05	06	01	01	02	01
1996/97	42	20*	02	12	25	10	-	03	08	09
1997/98	50*	14*	-	05	22	23	-	02	06	06
1998/99	49*	22	-1	08	28	12	01	04	08	09
1999/2000	21	18	-	02	09	10	-	04	08	06
2000/2001	18	05	-	04	06	08	-	-	01	04
2001/2002	28	13	-	08	10	10	-	01	07	05
2002/2003	49	30	-	10	14	25	-	07	13	10
2003/2004	40	18	01	06	13	24	-	02	06	10
2004/2005	56	10	-	03	25	28	-	01	06	03

Source: E and R: Nuhu Bamalli Polytechnic, Zaria.

ported that boys perform better than girls on item that has to do with calculations (Jacobson, 1990). Science laboratory programme comprises mainly of physics, mathematics, chemistry and Biology in which physics, mathematics and chemistry involves a lot of calculation.

There is a common belief that females are less mathematically capable than males: this belief is fairly constant across populations (Eccles, 1997). Classroom studies have shown that this belief is in place when children enter their junior secondary schools (Grawford et al., 1989). Although, the differences in performance are usually small, parents and teachers always expect large discrepancies between boys' and girls' performance in Mathematics class (Feingold, 1988).

Parents' and teachers' negative expectations put girls at distinct disadvantage in classroom: many parents accept their sons' mathematical success as evidenced and inert ability, while they think of their daughters' success as hard work, compensating for inert, lack of

ability. Parents treat boys and girls differently from birth; they are physically active with boys than girls. These differences may contribute to well documented gender differences in spatial ability (Halpen, 1992). This spatial ability is an important component of mass mathematics skills and facilitates comprehension of abstract mathematical concepts used in geometry, trigonometry and calculus.

These aspects of Mathematics are the most important in science based programme. Brand (2005) pointed out that more men than women take up careers in mathematics or sciences. This implies that boys are superior in numeral aptitude science reasoning and spatial relationship, while girls are superior in verbal fluency and memory.

Physics is a major component of science programmes which involves a lot of calculations and reasoning. So the vigour and discipline it takes to study physics and science in general may affect performance and even enrollment in science laboratory programme. This assertion can be

Table 4. Total percentage passes with the minimum of lower credit.

Session	Total No. graduated	No. of male	% Pass male	No. of female	% pass female
1995/96	11	07	63.6	04	36.4
1996/97	50	39	78.0	11	22.0
1997/98	35	27	77.1	08	22.9
1998/99	50	37	74.0	13	26.0
1999/2000	23	11	47.8	12	52.2
2000/01	11	10	90.9	01	9.1
2001/02	26	18	69.2	08	30.8
2002/03	44	24	54.5	20	45.5
2003/04	28	20	71.4	08	28.6
2004/05	35	28	88.0	07	20.0

Source: Nuhu Bamalli Polytechnic, Zaria.

Table 5. Statistical analysis of male and female students' performance in Science Laboratory Technology.

Analysis	% pass male vs. % pass female	Total no. passed vs. % pass male	Total passed vs. % female
Mean \pm SEM	9.200 \pm 1.652 N=10	22.10 \pm 3.478 N=10	9.200 \pm 1.652 N=10
95% confidence interval	4.810 to 20.99	-2.745 to 21.14	12.03 to 32.17
Are means significantly. Different	Yes	No	Yes
P value	0.0036	0.1230	0.0002

(P < 0.05) significant.

supported by Ohakwe (1999) findings which state that female students exhibit poor attitudes towards the study of mathematics, and this is portrayed in their achievement in this subject in public examinations. Failure in physics and mathematics will invariably deter the students from pursuing science based programmes, science laboratory technology inclusive. It is also reported that boys perform significantly better than girls in manipulative reasoning task (Baker and Leary, 1995).

Women in general do have a strong presence in science and technology. This is attributed to two (2) broad issues: First, women's perception of their role and functions in the society and societal expectation of their contribution.

Women's involvement in science and technology encounters barriers in regard to discipline and academic or professional level of responsibility; women are divided into two spheres called the management of home and family and the fulfillment of job responsibilities. Family commitments, either as the women's choice or as a result of cultural enforcement, have impaired women's capacity to meet their potentials and put them at a disadvantage in many science and technology related jobs that are dynamic and qualitative in nature.

Gender differences also exist in selection of academic fields in which to specialize. Women are more inclined towards art and social sciences than the natural sciences

and engineering. Recent studies conducted in Federal University of Technology, Minna indicate that the percentage of females in the Faculty of Sciences ranges from 21.4 – 34.3%, with an average of 26.4% annually. The figure declines in Faculty of Technology where the percentage decreases from 16.5 – 10.5%, with an average of 14% (Kehinde, 2006). This result is comparable to the findings in this research work of which low enrollment of female in science and technology based programme is noticed.

The figures are quite low and need to be addressed because the demand for personnel in science and technology is increasing. The masculinity of science is another reason that girls tend to give when avoiding the subject at school and those that do it tend to perceive science as a difficult subject with little relevance to their future which of course accounts for their poor performance (Lie and Sjoberg, 1984). Onekutu (2002) also added that science in most culture is defined as a masculine domain.

Conclusion

The studies revealed that the enrollment and performance of female is comparable to most of the literature findings. Society as a whole contributes to females' ability

or capability to opt for science based programme. However, the hypothesis that there are no significant differences in the performance of male and female students in National Diploma Programme in Science Laboratory Technology has been disproved.

Women's involvement is rather through a gradual and spontaneous transformation, closely tied to the knowledge push in the human development process. The development of women and the progress of science and technology are therefore related to one another. The transition to a knowledge based economy would seem to be unsuccessful if half of the human resources are not engaged in the process of innovation.

It is necessary to recognize that the participation of women in science and technology is no longer simply an issue of gender equity, it is also an issue that should be considered in national economic development. Women are both consumers and producers, they can make a difference if they are involved and considered in economic development plans. With science and technology at the heart of economic development, women's participation in Science and Technology is therefore an essential part of economic development strategies.

In order to arrive at a greater involvement of women in economic development through their participation in science and technology, systematic and coherent policies are required such that gender issues are brought into the mainstream at all levels, including education, employment and governance. New technologies could assist in this endeavor if promoted. Information technology is empowering women by making education accessible, and raising women's skills.

The skilled labour market, be it in research or in the production sector, enables women to engage in activities which are largely intellectual. Women's participation would enhance skilled human resources to countries at the forefront of knowledge development, which currently relies on foreign migrant scientist. In developing country like Nigeria, women could contribute their traditional knowledge to help modern technologies to adapt to local conditions.

RECOMMENDATIONS

To improve on the enrolment and performance of girls in science and technology, the following are recommended:

1. Government should encourage female studying science in our tertiary institutions by creating room for scholarship.
2. Career guidance and counselling unit should be strengthened in our secondary schools, so as to get more female students to go for science based programmes.
3. Females who have made success in science technology and mathematics should be encouraged to visit secondary schools and have talk and share their experiences of success with the girls. This will motivate

the girls to enrol and improve their performance in the sciences.

4. Gender discrimination that arises from social stereotyping which affects our attitudes and expectations should be addressed so as to change the attitudes to gender roles, as this would affect acceptability of women who venture into male dominated profession.

5. The initiative by the federal government to create more jobs through industrial development should be encouraged, as this would create more employment opportunities for the under-utilized human resource to be put into optimal use.

6. The government should initiate affirmative action to employ more women in science and technology sectors as has been done by some countries such as South Africa and Britain.

7. Working conditions should be improved to elongate maternity leave and flexible working hours to accommodate this period in a woman life while contributing their potentials to economic growth and development of the nation.

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