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Women and Engineering Education in Nigerian Universities

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Abstract: This study examined gender inequality in enrolment for engineering education in Nigerian universities. Women enrolment and involvement in the practice of engineering education, was from available records, found to be too low compared to the number of men in the same field. Finally, strategies for increasing women enrolment in this area so that in the world of work, they would not only enhance their productivity, but also their status, were proffered.

Key words: Gender inequality, women, engineering education, women involvement

INTRODUCTION

Engineering like every other discipline has a philosophy, which is formulated and articulated to highlight both the teaching and research programme of the discipline and gender is not a criterion for studying it. However, the relative paucity of women in engineering education in Nigerian universities deserves attention. Besides, Nigeria with over 120 million people and with females over 50%, cannot afford to "lock out" the females in the area of engineering education, especially in the highest citadel of learning- the university, if the nation is to develop technologically, have sustainable economy and compete with the developed world, since the application of engineering education tends to bring development in terms of electricity, water supply, telecommunications, transportation by road, rail, seas and air, buildings, machines just to mention a few. The females on their part cannot expect to reverse the problem of marginalization in certain job placements and appointments if they refuse to delve into the areas, where their male counterparts have dominated.

Recognizing the very low status of women in the life of work, Win (cited in Aigbomian, 2002) noted that women are clustered in low-paid sex-segregated, dead-end jobs-jobs that usually are extension of house works. Women are often found manning pumps at petrol stations, cleaning, cooking and serving food at restaurants, while the more privileged ones provide staff at primary schools, in hospitals as nurses and in offices as clerical officers, stereographers and secretaries. Adavbiele (2000) noted that since engineering makes the difference between a poor person and a rich person, a civilized society and a primitive society and now, a recognized man and a neglected woman, women should thrive at the same level in this field if they are to be recognized on equal level. Adavbiele and Idialu (2002) in discussing gender inequality in technical education also emphasized this point and stated that women could not just sit down, hoping to get recognition from the men on equal basis when they refuse to do what the men are doing. In education, women are found mostly in the area of humanities. Those few who care to read the sciences are mostly in biology and biology related fields. In physics, mathematics, chemistry and especially the applied form of these courses, the engineering education, they are very few. Yet, women would like to be seen as equal in all respects-civilized, fashionable by wearing good clothing, shoes, Jewelries, have nice 'make-up'; live in good houses, ride flashy cars, etc., which their non-involvement in engineering education do not help to bring about. Therefore, any strategies, which are proffered, to reverse this trend and make women available with their men counterparts to provide these basic necessities of life will be a welcome development. It is against this background that this study is undertaken to determine the number of women enrolment in engineering education, their involvement in the practice of engineering education, the effects of this gender inequality and finally to point out the ways forward.

The engineering education: The philosophy of engineering is to search for organized knowledge and the system of values or gains, which informs that search. The organized knowledge involves the design and development of devices, the management of human

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resource to economically use natural resources and the legality of such use; the values may be social, political, economic, ecological, etc. needs. Adavbiele (2000) put it, it is clear that engineering's impact and artefacts on the Nigerian society have been respectively profound and indices of progress and never more so than today. For many, including governments, engineering education's ability to contribute to wealth generation and economic development makes its encouragement a national priority. A study asserted that "Survival and success will depend on designing, making and selling goods and services that the customer wants at the time he wants and at a price he is prepared to pay; innovating to improve quality and efficiency; and maintaining an edge over all competition", which might yield productive innovations

For Nigeria now, a return to a situation without that which engineering makes available such as food, clothing, electricity and water supply, telephones and televisions, refrigerators, washing machines, good roads, cars, trains, aeroplanes, houses to live in and sewage and waste disposal systems, information technology, etc. would be widely considered to be utterly retrograde. Nigeria in her fourth democratic period, with women constituting more than half of the population, if it must make progress, there is certainly the need to get women involved in that field that yields the greatest progress. The main content of politics, which is the allocation of values, is economics; the main content of economics, which is concerned with production and distribution of goods as well as the rendering of services, is technology and the main content of technology, which is the application of science (mostly the science of engineering) is engineering. Adavbiele (2000) in a useful background study, therefore, stated that if the women must be seen to be capable of doing what men can do, engineering is an area that stands to prove that challenge.

Statement of the problem: In spite of the efforts of successive governments and women organizations to encourage women to stand the same shoulder with men in all fields of endeavour, the number of women in engineering education has not increased compared to their population. Thus the purpose of this study is to answer the questions as follow:

- Do personal characteristics, home, finance, school and society predispose women from engineering education?
- What strategies can be proffered to encourage women to have interest in studying engineering?

MATERIALS AND METHODS

This study is a descriptive survey, which considers a sample chosen from a larger population of the number of women enrolment and involvement in the practice of engineering education, whether as students or lecturers vis-à-vis the men in Federal, state and private universities in Nigeria. The main instrument used to gather data for the study was questionnaire for the number of women. The questionnaire was formulated after a review of related literature and other scales that have been used in similar situations. Contact was made with correspondents using electronic mail (E-mail) addresses in some selected universities, with each correspondent helping to administer the questionnaire to three to 5 universities for the researchers while the researchers themselves visited at least 2 universities from each zone of the 6 geo-political zones of the country. The questionnaire had 3 sections. Section A sought information on the background of the respondents. Section B had 35 items addressing reasons for the paucity of women in engineering education. Items 1-8 sought information regarding personal characteristics of women; items 9-15 sought information on the home; items 16-20 solicited for information relating to finance; items 21-28 sought information relating to school and items 28-35 were meant to obtain information regarding the society. Section C had 10 items, which were to provide information on the strategies for increasing women enrolment involvement in the practice of engineering education. All the items in sections B and C were placed on a Likert-type scale, with responses ranging from strongly agree, agree, undecided, disagree and strongly disagree. Two professors on educational research methodology validated the questionnaire. Based on their recommendations, the questionnaire was reviewed and used for the study. Responses were equally collected from outside the academia: from the 36 states and the Federal capital territory. The essence was to ensure that the respondents did not have privilege information about the questionnaire, which could cause biased response. A hypothesis formulated was that there is no significant difference between the means of the opinion held within and outside the academia.

Analysis of results: The data were analyzed using the t-test and regression methods. The t-test method is preferable in this study in that it is indicative of existence of real difference in sample mean. The approach does eliminate factors other than the true difference in effects of the 2 methods of test and therefore is more sensitive. Besides, its use does not involve the application of F-test to 1st validate the result. However, the t-test of the

hypothesis only indicates acceptance or rejection. Therefore, it is required to obtain a level of confidence interval, which apart from giving a measure of reliability, also provides index of reliability, r. This is the essence of using a second method, which involves variance approach to regression that determines the level of reliability.

On a pair sample t-test, there results a set of differences and the null hypothesis will be that the mean of such differences is zero. With the aid of SPSS computer compiler, 37 separate sample results, one from within and the other outside the academia are compared. On paired sample t-test, this gives 36 degrees of freedom and from tables at the α-risk of 5%, the acceptance region is found to be $|t| \leq 3.69$. The rejection region is, therefore $t > \pm 3.69$. With a two-tailed test, (which compares the opinion held within and outside the academia), t was calculated to be equal to -2.848. Hence, the mean difference is not significant at the 5% level and as such there is no sufficient evidence to accept that women number is likely to increase in the field of engineering.

Further analysis was carried out to obtain a level of confidence interval (the regression), which apart from giving a measure of reliability does provide index of reliability (r). With the aid of SPSS computer complier, the value of r or the percentile overall fit is found to be 94.1% This further indicates that there is no sufficient evidence to indicate that women interest to read engineering will correspondingly increase in line with their population. These findings are discussed subsequently.

RESULTS AND DISCUSSION

With the government deploring the general public attitude, which regards technical education as somewhat inferior to other types of education and government new policy that art-science enrolment be made 40:60%, the number of students reading engineering education has increased. However, the same cannot be said of the number of women enrolling, especially at the graduate level. Therefore, women equity in terms of enrolment merits attention. Of the total population of 526,780 from Nigerian universities that provided enrolment data, only 178,995 representing 34% of the enrolment figure are women (Okebukola, 2002). Even at this, Adavbiele (2000) provides the scenario of Ambrose Alli University, Ekpoma where there are only 52 undergraduate and 2 graduate female students offering engineering education out of 2235 undergraduate and 47 graduate students respectively in the various engineering departments in the university. This is essentially the case for all the universities, which run engineering education in Nigeria (Table 1) for 2003/2004 academic session (Adavbiele, 2000). The percentage of women to men is even worse for the universities in the northern part of the country and only the University of Nigeria, Nsukka in the eastern part has a little above 10%. Most of the first generation universities have women population, range between 3.0-4.5% compared to men.

Education generally and engineering education in particular have now become universal. Beyond this trite

Table 1: Disparity in enrolment between male and female students in universities offering engineering education

University	Males	Females	Females to males (%)
Abubakar Tafawa Balewa University, Bauchi	823	11	1.3
Ahmadu Bello University, Zaria	1124	22	2.0
Ambrose Alli University, Ekpoma	2282	54	2.4
Bayero University, Kano	1234	30	2.4
Enugu State Univeristy, Enugu	1223	46	3.8
Federal University of Technology, Akure	2304	61	2.7
Federal University of Technology, Minna	1456	21	1.4
Federal University of Technology, Owerri	1880	72	3.8
Federal University of Technology, Yola	934	18	1.9
Igbinedion University, Okada	114	4	3.5
Imo State university, Okigwe	765	34	4.4
Madonna University, Onitsha	68	3	4.4
Nwamdi Azikwe University, Akwa	1544	54	3.5
Obafemi Awolowo University, Ile-Ife	1112	45	4.1
Rivers state University of science and Technology, Port-Harcourt	2068	62	3.0
Univeristy of Agricultue, Abeokuta	1220	45	3.7
Univeristy of Agricultue, Makurdi	880	23	2.6
Univeristy of Agricultue, Nmudike	1121	40	3.6
Univeristy of Benin, Benin City	2480	112	4.5
Univeristy of Uyo, Uyo	943	31	3.3
University of Calabar, Calabar	1234	46	3.7
University of Ibadan, Ibadan	1822	65	3.6
University of Ilorin, Ilorin	2023	64	3.2
University of Jos, Jos	980	43	4.4
University of Lagos, Lagos	2008	82	4.1
University of Maiduguri, Maiduguri	124	2	1.6
University of Nigeria, Nsukka	2644	270	10.2

* Statistics is for 2003/2004 sessions and no attempt was made to list universities with less than two engineering departments

statement, Okebukola and Salawu (2001) and Makhubu (1997) maintain that there are limitations or constraints, which impose restriction on access for women. Disparity in engineering enrolment in favour of men has become increasingly conspicuous in the university. The relative paucity of women in university education generally and engineering education in particular are being attributed to a number of factors, which include and not limited to the following facts:

A very high illiteracy rate among mothers in Nigeria precludes some parents from acting as motivators or role models in education (Azeke, 1984). Girls in such circumstances are thus relegated to studying anything, without reason, when the opportunity comes to them to acquire university education. The emerging scenario in university, especially for the females, is the push or craves by candidates for a degree irrespective of the discipline. Besides, there is the problem of limited admission chances or limited and poor job opportunities.

Aghenta (1981) and Bamanjo *et al.* (1987) had drawn attention to the fact that tracking of curricula in secondary schools had tended to make females aspire to less engineering courses leading to such professions as teaching, nursing, home economics, secretaryship and so on. The problem of ill equipped girls' secondary schools and the general scarcity of teachers (which if available at all are mostly males) in the sciences and technical course had further compounded the situation. Thus, not enough females are coming through the secondary for admission into the university, since by their training; there is the tendency (where the secondary schools are exclusively for girls) for the females to crave for courses that will lead to 'white-collar' jobs.

There are social norms or taboos, which regard women who compete on equal basis as 'possessed' or having masculine features, which make them looked more or less like men and therefore, not fertile to have children (Olasehinde, 1994). Some men, especially those who major in the Arts or Humanities dread to marry those females who read engineering education and as a result, some women in order not to offend their suitors resort to opting out from seeking admission to study engineering education. Restricted freedom of movement imposed by some culture like the 'purdah' reduced the access of women to regular education, particularly engineering education in the university, which cannot be done through correspondence.

According to Sonaike (1989) and Olaitan (1996), there is no encouragement for women to pursue engineering education, particularly for those who are already married, as child bearing may contribute to the reason why they may not want to study engineering, which they feel is more tedious.

The general trend is that even when women have proved their mettle and secured good degrees in various fields of endeavour, particularly in various areas of engineering, they still meet with such basic prejudices that make it difficult for them to secure jobs. This ultimate frustration may account in part for why the prospective female undergraduates veer away from the sciences to pursue 'softer' academic options or abandon any ambition for higher degrees attainment altogether that would have qualified them to become university lecturers or engineers in industries or government establishments. Traditionally, the females are less career-oriented or concerned with salaries and benefits than their male colleagues (Ifayefunmi, 1990).

Adavbiele (2000) said that some female students hold the view that the reason why they are not in the engineering education fields today is because they felt they lack the physical strength to carry out what is involved in the world of work. Said one of them, 'how do I carry a block, a trowel and climb a ladder, if she had read civil engineering, for instance'. The fact is that some of them do not know what the practice of the profession entails. In the world of work for engineering graduates, the females are less than 1%. Adavbiele (2000) noted that in Ambrose Alli University, for instance, there is only one female engineering lecturer and in the non-teaching cadre, there is no single female worker whereas in the same university, there are 41 male engineering lecturers and 34 non-academic staff, which includes registered and pupil engineers. The female-male ratio in this case is more than 1:18.

This is a sad picture when compared to the number of females to males in the society and besides this, the effects on women cannot be overemphasized as will be examined subsequently.

The fact that women are few in engineering has a lot of social-economic and political implications for them. Politically, while countries like Turkey, Canada, India, Britain and Pakistan have had women presidents or prime ministers, the Nigerian woman seems to be contented with becoming first lady, minister of women affairs, member of university council and at best have three women vice-chancellors so far. Whereas a woman have been known to be a deputy president in the then USSR and now Russia (the same woman went to space) and another, a secretary for foreign affairs in USA while many have actually joined their men counterparts in the developed world to visit space and make great impact in their national development through engineering creativities. The opposite picture is that the Nigerian women still resort to playing a second fiddle-mounting campaign for better life for rural woman, as if it is words alone that will do the magic. They want to preside over

political parties or professional associations when they cannot form or run one. Since women have not really come out to compete on equal basis, the men look down on them as if they are inferior.

Social-economically, Adavbiele (2000) reiterated that women are seen as people who want to wear 'umbrellas' 'sky-scrappers' or 'mansions' in the name of 'head ties', but lack the skills and wits to bring those things into existence. They regard ownership and operation of factories as the prerogative of men, all to their own disadvantage. They want to be boss to men, but refuse to compete on equal basis. When their vehicles break down, they abandon them looking for the males to troubleshoot the faults and if their rooftop leaks, it is the men they will invite to amend it. The fact is that one cannot have control over people when there is no control over things that these people will need or use. Women create the impression by their absence or few numbers in engineering that they are weaker than the male colleagues who are there in great numbers.

We have entered a millennium when not only an aspect of education but also all aspects of it, including engineering education, is supposed to be for all. This implies that something must be done and of course, quickly by women, to be on track.

Strategies for reducing the gender inequality: Now that more attention is being paid to manpower production in science and engineering and entrepreneurial and business management training, to support technological development in the public and private sectors, women need to wake up.

Since teachers constitute role model for their students, more women are expected to take up appointments in the university as engineering lecturers. Aigbomian (2002) noted that the girls, on seeing the female teachers would realize that these fields are not exclusively for men.

Women must view engineering education as that, which they require to improve their ranking, standard of living and quality of life. It is left for women to reverse the issue of manpower supply and demand, which is tilted in favour of the men. The education of women should be effectively tilted with a bias towards engineering education with a focus on the creation and awareness at the primary school, absorption and thinking in secondary school and actualization through larding how to design in university and proceeding to become lecturers in university or engineers in the industry.

Wadi and Haddad (1990) pointed out that to encourage better participation of women in gainful employment, access to entrepreneurial developments should be provided for them to facilitate their self-employment.

There should be marked improvement of the academic facilities in girls' secondary schools, especially for science and science-related courses to ensure parity of opportunity in all disciplines.

Women should brace up to the challenge to sit at the same table to take decision on matters affecting them rather than allow the men alone to take decision on matters affecting them.

Government should provide adequate protection for women from all forms of harassment from their male students and lecturers alike. This implies the imposition or appropriate sanctions, administered promptly, for any breach or manifest disorder of conduct (Federal Government of Nigeria, 1990).

An aggressive literacy campaign should be mounted for society in general and the parent cohort in particular, to generate a greater awareness of the need for women to take full advantage of media communication and participate meaningfully in engineering education and thus in national affairs (Birke, 1985).

Guidance and counselling should be intensified right from primary school through secondary school for women to compete on equal basis in all fields of endeavour, particularly in engineering education. Women should be counselled at their early age to know what is entailed in engineering and the prospects associated with it Okorie (1988).

There should be a new orientation that where a man can work, a woman having the same training can also work.

No doubt, it is a welcome development that the National Association of Women Academics (NAWACS) and Association of Professional women Engineers of Nigeria (APWEN) were formed and now there is Forum for African Women Educationalist (FAWEN), but it is required that their presentations in the area of engineering education must be able to match with that from the men, if they are not to be regarded as playing a second fiddle.

CONCLUSION

University education and in particular, engineering education, has become universal to mankind, which includes women, for technological development. The women have the intelligence, they equally have the physical capability to explore and dominate in any field, or even to become managers in companies like steel plants, power generation and transmission, oil industries, etc and head ministries of science and technology, petroleum, mining and power, agriculture, etc; not just ministry of women affairs (viewed as relegation) as there is no ministry for men affairs. Therefore, what have been responsible for few women to delve into engineering

education are lack of encouragement, interest, societal norms, school problems, guidance and counseling and not their ability. Having more women in this field will not only enhance their productivity, but also their status.

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