

Challenges Faced by and Opportunities Available for Female Students Pursuing Engineering Programs in Public Colleges in the Nairobi Area, Kenya

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Abstract:- The paper aimed at establishing challenges faced by and opportunities available for females pursuing engineering programs in public tertiary colleges in the Nairobi area. The study was conducted at eleven middle-level public colleges in the Nairobi area offering engineering programs. Descriptive research design was used to describe the variables associated with women's opportunities and challenges in engineering courses. Census method was used for the target population of 317 female students. Validity and reliability of the questionnaire was tested through a pilot study. Questionnaires were randomly distributed amongst the target population. Data obtained were subjected to the SPSS program for descriptive statistics and presented in form of tables. The findings of the study were that the majority of the female students (>80%) confirmed that engineering as a course posed a challenge to them, with handling heavy machines being their main challenge. On the other hand, the majority of the respondents (>60%) confirmed that they had not received any support from the government, relevant bodies, or even international organizations.

It was concluded that female students pursuing engineering programs in public tertiary colleges in the Nairobi area are faced with more challenges and opportunities are scarce.

It was recommended that these institutions should provide an enabling environment that will open up more academic and career opportunities for women intending to pursue engineering at higher levels or those who wish to work in engineering areas in industries or organizations.

Keywords:- Opportunities, Challenges, Engineering, female and Public-Colleges.

I. INTRODUCTION

The growth of any economy is dependent on a country's human resources in various sectors of the economy. One such profession that is critical to advancing any country's economy is engineering. It provides manpower that mans and maintains a country's various industries. Hill, Corbert, and St. Rose (2010) indicate that Science, technology, engineering, and mathematics (STEM) are widely regarded as critical to the national economy" (p.2). First-world countries like America, France and Britain are industrialized and prosperous due to their advancement in technical education (World Bank, 2004). For the UK,

Silim and Crosse (2014) citing Kumar et al. (2014) reported that engineering is a diverse industry that plays a significant part in maintaining the UK's competitive edge in the global economy. They further elaborated that apart from engineering being integral to economic growth, the profession is well-paying and in high demand.

Despite the engineering profession being important for the economy, "the industry struggles to recruit a diverse workforce" (ibid). A diverse workforce is a workforce comprising both men and women which Silim and Crosse (2014) believe is one way of reducing the skills shortage in the engineering industry. However, Fingleton et al (2014) point out that "women are underrepresented in engineering in contrast to professions such as law and medicine" (p.3).

For example, in Canada, 16% of engineers represented women in the year 2011 (Hango, 2013). In the United States, only 20% of women were engineering graduates and only 11% were practising engineers (Fingleton et al, 2014).

In Kenya, the situation is not any different. Mugo (2012) says that although the ratio of men to women studying at public universities had increased, "the number of women remains lower than that of men in science and technical courses" (p.3)

Globally, countries are determined to provide quality technical education including engineering to both male and female students. However, there are still gender disparities existing in the field of engineering where women continue to be few. According to Meiksins et al, (2017) "the small numbers of women in engineering have less to do with ability and more to do with the reality that engineering continues to be perceived as a masculine field and to present itself in ways that don't speak to the values and objectives that many young women emphasize" (p.305).

In developing countries like Ghana, teachers did not provide an environment where female students can participate equally with male students in engineering courses (Peterson, 2007). This is a demonstration that male students often receive more attention and praise from teachers in engineering and technology classes while female students often receive less attention which is usually in form of negative remarks.

The situation is similar in Kenya. Kombo (2004) reported that most teachers offer male students' greater higher attention in engineering classes compared with female students who are treated with intimidation. Abagi,

Sifuna and Omamo (2006) add that engineering fields like mechanical, building and construction have been dominated by males. Furthermore, Sheila (2001) argues that the negative treatment in the field of technical education leads to gender disparities in productivity and employment opportunities.

Despite all these challenges, a number of proposals have been suggested to enhance the representation of women in the engineering profession. These proposals include: developing college–industry partnerships; create opportunities (Fouad, and Singh, 2011). female mentorship and sponsorship programs (Joseph, 2016, n.p.). Of the above proposals, financial support seems to enhance persistence. As Melksins et al (2017) assert “when a student received a loan payment grant, it increased their graduation (compared with a control group) and increased graduation rates of female students with a wider range of GPAs” (p.320)

Although proposals have been put forth to enhance women’s participation in engineering, their underrepresentation has still persisted. The realization that female students face more challenges than opportunities in engineering courses impelled this study to determine the challenges faced by and opportunities available for female students undertaking engineering courses in Kenya with a special focus on public Technical and vocational education and training institutions in Nairobi county. Consequently, the following research questions guided this study.

- What challenges are women engineering students facing?
- What opportunities have been availed to women to enhance their participation in engineering programs?

II. METHODS AND MATERIALS

A. Research design

In this study, a descriptive research design was adopted. The study surveyed the women students in their study environments to understand the challenges and opportunities availed to them while participating in the engineering profession. Data for this study was collected using questionnaires and analyzed using descriptive statistics.

B. Target population

The target population for the study comprised three hundred seventeen (317) diploma female engineering students in middle-level colleges in the Nairobi area.

C. Sampling Procedures and Designs

The study used census instead of sampling the populations. A census is the “study of the entire group of elements or individuals in a population” (Shenoy and Pant, 1994, p.54). This was because of three reasons. One is that the respondents were located in the same geographical area. Two, the population was not too large and therefore studying all the elements of the population was manageable within the available resources. The third reason was that given the nature and uniqueness of the respondents in this study, census was the only way to ensure that objectivity was obtained and bias minimized.

D. Data Collection Procedures

The data was collected by the use of questionnaires which were prepared and distributed to the respondents to secure responses from them. It had both closed-ended and open-ended questions. The questionnaire was self-administered. Respondents were given at least one week to fill in the responses.

E. Data Analysis Techniques and Procedures

After collecting the data, the information was summarized, analyzed and interpreted. Data presentation and analysis employed the use of both quantitative and qualitative data analysis techniques. Quantitative data analysis obtained involved the use of descriptive statistics which involved the use of tables, frequencies and percentages to analyze the responses. Thematic analysis was used to analyze the qualitative data obtained.

III. RESULTS AND DISCUSSION

Table 1 shows that a majority of the women students undertaking engineering courses are young, aged between 18 and 22 years which comprises 75.1% of the total number of students under study. This is followed by the 23 to 27 years age bracket which comprises 24.4% of the respondents. These findings show that majority of the women students in TVET institutions are young people who are direct from high school.

Age	Frequency	Percentage (%)
18 – 22	166	75.1
23 – 27	54	24.4
28 – 32	1	0.5
33 – above	0	0
Total	221	100

Table 1: Age of Women Students Studying Engineering Courses

A. Challenges of women engineering students

The women reported that engineering course poses a lot of challenges to them. From table 2, more than 80% of the respondents agree that the engineering course they are pursuing poses challenges to them. Less than 20% felt that the course does not pose any challenge to them. This is a clear indication that for the majority of women, the engineering course they are undertaking poses many challenges to them.

Response	Frequency	Percentage (%)
Yes	196	88.7
No	25	11.3
Total	221	100

Table 2: Whether the engineering course poses any challenge to women students

B. Challenges faced by women students

Table 3 indicates that most women seemed to be facing a big challenge with the heavy equipment they cannot handle as it ranked number one. This was followed by a curriculum that does not cater for women students, a lack of faculty advisors to encourage women students, a lack of prior

experience and a lack of role models. These five challenges had a frequency of more than 65 each. Those challenges that were ranked low with a frequency of less than 40 each included the respondent being the only woman in the class, discrimination by classmates and lecturers, unapproachable lecturers and sexual harassment by lecturers.

Challenges faced	Frequency	Rank
Equipment heavy to handle	111	1
The curriculum does not cater for women students	81	2
No faculty advisors to encourage women students	73	3
Lack of prior experience	71	4
Lack of role model	65	5
The only woman in the class	32	6
Discrimination from classmates	24	7
Sexual harassment from lecturers	17	8
Unapproachable lecturers	14	9
Discrimination from lecturers	7	10

Table 3: Challenges faced by women students

Other challenges faced by women students include the following: lack of opportunity to lay down our challenges and problems; a large number of men in class; lack of confidence in some teachers; discrimination from male students; lack of practical experience; inadequate resources, books/ equipment for practical; workshop environment not suitable for women; feminine thinking about engineering; discouragement from family and friends; lack of attachment opportunities in good companies; lack of knowledge in some engineering areas; too much work as there is too much mathematics involved; engineering subjects are tough as some ideas and issues are difficult to understand; house chores that leave us with little time to concentrate on studies; isolation by others who fear you; fatigue in the workshop because of standing for long.

The challenges encountered by the female respondents might be due to the lack of direct interactions, which were more likely to occur in field-specific, hands-on learning environments.

C. Support for women students in the engineering program

From table 4 below, less than 40% of the women students had received support from the government while more than 60% indicated that they had never received any support. This implies that the government has no incentives to encourage women students to pursue engineering courses.

Item	Response	
	Yes	No
Whether students had received any support from government organizations or agency	37.1%	62.90%
Whether students had received any support from an engineering association	5%	95%
Whether students had any support from any international organization	2.30%	97.70%

Table 4: Whether students had received any support

Furthermore, only a small percentage of 5% of the respondents indicated that they had received support from an engineering association while a majority of the respondents comprising 95% said that they had not received any support from any engineering association. These findings reveal that engineering associations like the Institute of Engineering Technologists and Technicians (IET) or the Engineering Board of Kenya (EBK) have not deliberately encouraged women students to pursue engineering courses.

From the survey data obtained from respondents, a very small percentage of 2.3% said they had received support from international organizations while a bigger percentage of 97.7% said they had not received any support at all. This means that women engineering students are rarely getting support from international organizations to encourage women engineering students.

D. Other organizations that had offered support

Other organizations apart from the above that have given them support include Non -Governmental organizations, bursaries, Constituency Development Fund, Kenya Airport Authority, and Kenya Power & Lighting Company.

E. Kind of support received

Table 6 indicates that most of the respondents who received financial assistance since it had a frequency of 68 while a good number who received work-study opportunities or industrial attachment since it had a frequency of 48. Mentoring and free membership in an engineering association had the least frequency of 18 and 6 respectively.

This can be interpreted that most of the organizations offer financial support to aid women in their engineering education compared to other kinds of opportunities like a free membership in an association, and job opportunities after completing their courses among others.

Kind of support received	Frequency	Rank
Financial	68	1
Work-study opportunities/industrial attachment	48	2
Mentoring	18	3
Free membership in an engineering association	6	4

Table 5: The kind of support received from the above organizations

IV. CONCLUSION

From the above findings, it is evident that women students pursuing engineering programs in public tertiary colleges in the Nairobi area are faced with several challenges in their pursuit of a career in engineering than opportunities. The opportunities available that guarantee women’s participation in engineering are more financial support than job opportunities.

V. RECOMMENDATIONS

From the above conclusion, it is recommended that:

- Organizations and associations look forward to encouraging women to pursue engineering courses either by providing more work-study opportunities, free membership, and job opportunities after completion of their training among others.
- Training institutions to provide an enabling environment for women to pursue their courses.
- Curriculum developers to revise the curriculum to make it gender-friendly.
- The community to be enlightened on technical and vocational courses so that when parents are bringing up their children, especially girls, they can realize their talents when they are young and nurture them.

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COMPETING INTERESTS

The authors have no competing interests.

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