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Research Article

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Motivational Factors and Future Expectations that Influence the Choice of Engineering Programmes by Female Undergraduate Students in Nigeria

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Abstract This study investigated the motivational factors and future expectations that influence the choice of engineering programme by Nigerian female undergraduate students. The study adopted the descriptive survey research design using a sample of forty female engineering students in Rivers State University, Port Harcourt. Purposive sampling method was employed to select the study participants. The study was guided by two research questions. The instrument for data collection was structured questionnaire which was face-validated by three experts in the university and had a reliability coefficient of 0.85 using Cronbach Alpha method. The data collected were analysed using mean and standard deviation. It was found among other things that genuine interest, self-confidence and the drive to succeed were key motivational factors why female undergraduates choose engineering programmes. On the issue of expectations, the findings revealed among others that higher societal status, pursuit of higher education, job security and financial stability were the future expectations of female engineering students. Based on the results of the study, it was recommended that teaching and training styles should be flexible to accommodate the female students. Early awareness, career counselling and training programmes in engineering should be functional in all levels of education.

Keywords Motivation, career, choice, expectations, engineering, female undergraduates

Introduction

It is an acceptable truth that no society can reach heights of greatness unless there is an ample supply of dedicated men and women in all fields critical to its growth and development, and that is when such society can be recognized. For decades, engineering have contributed to the economic and technological growth of nations, however in this profession, women constitute a very small number compared to men around the world, both in academia and workplaces [1-5]. At the Rivers State University (RSU), records collected from its Faculty of Engineering, revealed that between the years2013 and 2015, female enrolment was about 10% - 12%; with only 10% female enrolment in civic engineering, 8% in electrical engineering, 3% in marine engineering and 2% in mechanical engineering.

Though the Nigerian government have made efforts to improve women education in technical and engineering fields, however low rate of female enrolment and participation in engineering and other technical courses still persist [3]. These 'failed' efforts may be linked to, among other things, unawareness, no career counselling, discouragement, cultural beliefs, stereotyping and gender segregation which persist in parts of the country [6-8]. Such negative situations produce unsupportive environment, low self confidence, and lack of interest in engineering programmes for females in Nigeria. Based on the foregoing, there is need therefore to attract women to participate and succeed in engineering programmes with appropriate incentives to motivate these women.

The study of engineering brings about certain expectations for an individual concerning the future. The future expectation refers to what the students hope to get from their chosen careers after graduation. Each student has personal expectations of the engineering programme, which tends to motivate these women thus leading to improved academic performance. Since diversity is necessary for innovation, the need arises to attract and retain more females in the engineering sector and this requires using the appropriate incentives for motivation of female folks.

Problem of the study

Around the world, there is large gender disparity in the engineering and other STEM sectors. Historically, the engineering profession reveals male dominancy and a systematic marginalisation of women [9]. Based on cultural norms, the appeal of engineering fields to the female folk is likely to be less pronounced and some consider engineering to be a 'boy thing'. It is a cause for concern that many females have feelings of marginalization and do not feel welcome; consequently the population of female engineers in the society is very low in comparison to male engineers. There seems to be limited motivation given females to overcome negative attitudes and perception towards engineering. Mathematics/science phobia, low self-confidence, discouragement, social environment, to mention but a few, reduces interest in engineering. In some cases, the stereotyping of female to non-technical careers is so entrenched such that most female students still look at less technical fields (such as education, secretarial studies, administration) as their realms and none of them would want to enrol in any technical areas of study [7, 10-11]. In Engineering sector, the intellectual contributions of both genders is crucial for innovation and success; therefore, more females need to be encouraged to enrol in engineering programmes, to take part in more difficult tasks and to progress in their fields of engineering.

While the number of Nigerian women pursuing engineering programmes and those in the labour force still form a small percentage of the overall engineering students' enrolment as well as labour force, it becomes necessary to identify factors that influence Nigerian female students' decision to study engineering in universities. This study is therefore designed to determine the motivational factors that influenced the choice of engineering programmes by female undergraduate engineers as well as to identify their future expectations on completion of course of study.

Research Questions

The following research questions guided the study:

1. What factors motivate female students to choose engineering as a course of study in Rivers State University, Port Harcourt, Nigeria?
2. What are the female engineering undergraduates' future expectations after graduation from their engineering programme?

Literature Review

The literature is reviewed under the following three sub headings; motivation of female learners; females' participation in engineering programmes; and expectations of female engineering students.

Motivation of Female Learners

Motivation is fuelled by desires and ambitions and can be applied to every action and goal [12]. Motivation is defined by Cole [13] as what impels or inhibits behaviour. Cole went further to state that motivation is concerned with why people do or refrain from doing thing. Motivation therefore is the impetus or the driving force that induces or propels someone into action. Usually, a motivated person engages in an activity more vigorously and more efficiently than an unmotivated one [14]. It is important to recognize that motivation depends on the goals to be achieved and the conditions for achieving them [15]. In the aspect of learning, motivation directs learners' thoughts, behaviour and actions toward the attainment of their goals and it brings about meaningful learning; promote self-regulated learning, and high academic performance [16]. For females studying engineering, it is important to have enabling and supportive environment to increase participation and reduce 'drop outs' in the programme. This environment includes family, religion, social life, and teaching-

learning environment among other things [17]. Many research shows that an engineering environment that truly welcomes women acts like enabler for the women to attain engineering degree (s) as it provides a means for women excel as students and as professional engineers [18-20].

Females' participation in engineering programmes

According to Fox and Colatrella [17], the participation, academic performance, and advancement of women in the academic field of science and engineering reflect the academic structure, academic environment and evaluative practices of the school. Stephen and Makotose [21] noted that most female engineering students have difficulty in coping with manual task which engineering sometimes entails, but this physical shortcoming should not be a reason to rule out females from engineering programmes because females are intellectually competent to contribute in engineering designs and improvement. Arsad, Buniyamin, and Manan [22] observed that female students who continue in electrical engineering programme performed better than the males and were able to manage their performance from start to graduation. This is due to the females' self efficacy and strong ability in fundamental engineering background which greatly influenced their overall performance. Thus students who take responsibility for their own learning fair better and achieve deep understanding and good performance.

In addition, Orabi [23] analyzed the course work of both sexes using assignments, projects, exams and class participation in chemical engineering. The result revealed that the credentials were equal and in some case the women did better than the men both in academic performance and in confidence as they progressed in the curriculum. Orabi therefore concluded that it is not academic capacity that hinders women from pursuing engineering topics and career in engineering. Therefore, on average girls perform as well as boys such that in some cases the females exceed or have the same grades in engineering, literacy, writing and general knowledge and the way lectures were presented contributed to that result [18-19, 23]. In their study, Stephen and Makotose [21] revealed that 77% of lecturers indicated that the female engineering students are as intellectually competent just as boys to comprehend all the engineering tasks; therefore the academic performance of female engineering students is as good as that of the male students. According to Adlyn [24], many women, especially self-motivated ones, have positive perception, good attitudes and high expectations towards engineering. This implies that motivation is a key required by females to enrol in engineering and other technical programmes.

Expectations of female engineering students

According to Shehab, Walden, and Wellborn [25], some students stated that the high demand for engineers in the job market was a key reason of choosing engineering major. The idea was so influential for students such that there was increase in awareness of career opportunities in engineering, which influenced female students to continue in the engineering programme. Smith and Dengiz [26] also mentioned that the primary reasons for women trying to be engineers are availability of wide variety of job opportunities and the ease of finding a job. Women want respect and support for themselves, and a professional career such as engineering has potential to give them.

According to Mugo [27], most female students choose engineering programme because they believe engineering is a prestigious and well-paying career. Mahani and Moki [9] noticed that universities have used the societal view of engineering as an effective recruitment strategy to attract and enrol women into engineering; as a result some of these female students continue to progress in engineering education to an impressive extent. Women are among the poorest people in the world [2], therefore the pursuit of engineering career by some women is a means to escape poverty as it is seen as a high income career. Ezeji [28] found out that factors that made 83.3% of students considered in their choice of careers according to their importance were salary, security, interesting work, working conditions and opportunities for advancement. From this survey salary rate the most importance and it has proved to be a good motivator of people.

Stephen and Makotose [21] suggested that improved self confidence and self-efficacy are also benefits the students gain by the time of graduation and beyond. As reported by Fouad and Singh [11] that women who were self-confident in their abilities to navigate their organization's political landscape and juggle multiple life roles reported being highly satisfied with their jobs as well as their careers. While in the report of Aderemi, Hassan,

Siyanbola & Taiwo [29], 30% of female undergraduate students in engineering programme plan to acquire further qualifications and also advance in their career.

Materials and Methods

The study was conducted in Rivers State University (RSU), Port Harcourt in south-south geographical region of Nigeria. The university has seven engineering departments that formed the Faculty of Engineering. A descriptive survey research design was adopted for the study. A total of forty female students from the Faculty of Engineering in RSU as at 2015 / 2016 academic session participated in the study.

To determine the opinions of female engineering students, a structured questionnaire entitled "Motivational Factors and Future Expectations of Female Engineering Students Questionnaire" (MFFEFESQ), developed by the researchers, was used as instrument to collect data for the study. The instrument was divided into two sections, A and B. Section A sought information on motivational factors that had influenced the choice of engineering programme by female engineering undergraduates, while section B focused on the future expectations of females in engineering programme. The questionnaire was based on a five-point Likertscale of Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (D) and Strongly Disagreed (SD) with numerical values of 5, 4, 3, 2, and 1 respectively. The instrument underwent face-validation by three experts and its reliability was tested using Cronbach Alpha which gave a reliability coefficient value of 0.85.

The researchers administered the instrument on the respondents with help of a research assistant and other engineering lecturers in the university. Statistical mean and standard deviation were used to analyze the data collected to answer the research questions. The decision rule was based on real limits of numbers of 4.50- 5.00 (Strongly Agree), 3.50 – 4.49 (Agree), 2.50 – 3.49 (Neutral), 1.50 – 2.49 (Disagree), 0.50-1.49 (Strongly Disagree) were used. Hence, any questionnaire item with a mean value greater than or equal to 3.50 was accepted, while item with mean value range of 2.50 to 3.49 was neutral and item with mean value less than or equal to 2.49 was rejected. Standard deviation values close or wide apart were used to determine the homogeneity in opinion among the respondents

Results

Research Question 1

What factors motivate female students to choose engineering as a course of study in Rivers State University, Port Harcourt, Nigeria?

Table 1: Mean and standard deviation on factors that motivated female undergraduates to choose engineering

S/No.	Item Statement	$\bar{x}$	(SD)	Remark
1	I enjoy mathematics and science subjects	4.40	0.74	Accept
2	I was good in mathematics and science subjects	4.15	0.77	Accept
3	It will provide a great salary opportunity	4.20	0.79	Accept
4	I passed science subjects in O'level certificates	4.18	0.78	Accept
5	Engineering course was demanded by parents	2.10	1.24	Reject
6	My parent(s) choose the course	1.90	1.15	Reject
7	My parent is an engineer	1.90	1.13	Reject
8	Engineering is my family's occupation	1.68	1.00	Reject
9	I have friends studying engineering course within RSU	2.78	1.39	Neutral
10	I have friends studying engineering course outside RSU	2.90	1.43	Neutral
11	Engineering field interest me	4.25	0.84	Accept
12	I want to be like my role model	3.08	1.38	Neutral
13	I was advised by my secondary school teachers	1.93	0.92	Reject
14	Engineering seems easy since I like calculations	3.65	1.29	Accept
15	A female engineer has positive impact in the society	4.08	1.02	Accept
16	I see a great career opportunity	4.40	0.78	Accept
17	I am confident in my ability to study any engineering	4.25	1.06	Accept

	course			
18	I want to explore my natural intellect	4.10	1.01	Accept
19	I have the physical strength required in my engineering course	3.88	1.04	Accept
20	Engineering course will provide my financial security	3.85	0.89	Accept
21	Engineering gives a good prestige in the society	4.00	0.96	Accept
22	I plan to practice in my area of engineering	4.23	0.80	Accept
23	I plan to further my study in my area of engineering	4.30	0.69	Accept
24	Believe in my personal capability	4.25	0.59	Accept
25	I want to succeed	4.60	0.59	Accept
26	I believe it will give me job security	3.88	1.09	Accept
27	I had no choice in the matter	2.28	1.28	Reject
28	Engineering was the available option since I had a low cut-off mark	1.33	0.57	Reject
29	I just want a degree	1.80	0.99	Reject
30	I have many friends working in engineering field	2.68	1.25	Neutral
31	My friends prefers engineering course	2.10	1.01	Reject
32	The world is changing and my engineering field will help me explore it	3.98	1.07	Accept
33	I do not want to disappoint my family	2.75	1.43	Neutral
34	I do not want to disappoint my friends	2.35	1.29	Reject
35	Engineering field is demanded in Nigeria	3.30	1.34	Neutral
36	Engineering field is demanded abroad	3.18	1.28	Neutral
37	I was offered scholarship to study engineering	1.90	1.06	Reject
38	Curiosity for engineering course	3.45	1.15	Neutral
39	I have prior experience in engineering	2.40	1.16	Reject
40	I am an ambitious person	4.30	0.69	Accept

No. of Respondent = 40

Data presented in Table 1 show that the respondents rejected items 5-8, 13, 27-29, 31, 34, 37 and 39 as factors that motivated them [female undergraduates] to choose engineering programmes. The respondents had neutral views on items 9, 10, 12, 30, 35, 36 and 38, while the rest of the items (mean scores above 3.50) were accepted by respondents as motivational factors that influenced their choice of engineering programme. The standard deviation values range from 0.57 to 1.43 indicates that the responses from the respondents are not far from each other.

Research Question 2

What are the female engineering undergraduates' future expectations after graduation from their engineering programme?

Table 2: Mean and standard deviation on future career expectations of female undergraduates in engineering programme after graduation

S/No.	Item Statement	$\bar{x}$	SD	Remark
41	Get full time job in a good company	4.35	0.70	Accept
42	Work part time at home	2.95	1.01	Neutral
43	Work part time in a company	3.13	1.09	Neutral
44	Be self employment	3.93	0.97	Accept
45	Get government employment	3.68	1.05	Accept
46	Work in a NGO that support female engineers	3.65	0.86	Accept
47	Do a job that help female engineers	3.90	0.87	Accept
48	Get higher degree (Masters)	4.35	0.77	Accept

49	Get higher degree (PhD)	4.13	0.91	Accept
50	Have job security	4.30	0.79	Accept
51	Increase my career networking opportunity	4.48	0.60	Accept
52	Increase my social networking opportunity	4.33	0.69	Accept
53	Financial independence	4.40	0.87	Accept
54	Increase my status in the society	4.38	0.74	Accept
55	Boost self confidence (self esteem)	4.55	0.55	Accept
56	Start an engineering company	3.98	1.03	Accept
57	Start a non-engineering company	3.13	1.09	Neutral
58	Be a full time housewife	1.43	0.96	Reject

No. of Respondent = 40

The data presented in Table 2 show that with exception to items 2, 3, 17, 18, the respondents agreed on the rest of the items as their future expectations after graduation from the engineering programme. The respondents had neutral views on item 2, 3 and 17, while item 18 was rejected which suggest that some of the respondents prefer to be housewives. The standard deviation values range from 0.60 to 1.09 implies that the responses of respondents are close to each other.

Discussion of Findings

The findings presented in Table 1 concerned the motivational factors that influenced female undergraduates to choose engineering as a course of study. The items accepted by the respondents as motivational factors among others include interest, self-efficacy, self confidence ambitious personality, prestige and financial security. This finding is supported Stephen and Makotose [21] and Adelakun, Oviawe and Barfa [1] that females' genuine interest, self confidence, determination and competency play major role in career choice, and that support at home and within the school system can reduce the gender disparity and its effect on females in engineering programmes. The results also agree with report of Smith and Dengiz [26] that interest in mathematics is related to females' choice to study engineering, and Mugo [27] that prestige and financial stability attract women to study engineering.

In Table 2 the findings concerned with the future expectations of female engineering students after graduation from their programme. It was found that among other things, the respondents expect the engineering degree to give improved self confidence, higher societal status and higher educational level. This is consistent with the reports by Mahani and Moki [9], Mugo [27] that most females choose engineering programme because they believe it is prestigious and would increase a woman's worth to the society. In addition, job security and financial stability are high expectations as most of these respondents will start earning for themselves and their families. This is indicated in the findings (see Table 2) which revealed that majority of respondents want to work, preferably, in engineering establishments where their engineering skills would be useful, however they may also accept jobs in non-engineering sectors on full time or part time basis due to the low demand of female engineers in the job market in Nigeria. This finding is in agreement with the report of Badekale [7] and Mugo [27] that those high job prospects attract women to study highly technical courses in STEM and TVET. On the other hand marriage and/or low job opportunities were rejected as expectations that may push some of these females to follow the so-called traditional role of women in the society which is to become housewives and mothers. This finding is not in line with the views expressed by Adelakun, Oviawe and Barfa [1] and Marder [8] that females may have interest in engineering fields but stereotyping, non-supportive workplace and entrench beliefs act as barriers to their practice of engineering in the workforce. Therefore, providing the right incentives and high possibility that their future expectations will be fulfilled, female engineering undergraduates were encouraged by their own unique motivators to complete the programme and also younger girls in secondary levels may be inspire to be engineers.

Conclusion

It has been found that the motivational factors that influenced female undergraduates' choice of engineering programme was interest, ability and self confidence among other things. These factors helped female

engineering undergraduates to participate in the programme and to succeed in it. To this effect, family members, teachers and other stakeholders need to be supportive and encouraging in order to attract more female students to study engineering. This will ensure that females are not left behind in technological advancement in Nigeria .In doing this, effective incentives can be provided to motivate young girls in secondary school level to pick interest in engineering and other technical fields of study, and can also help boost the females' self confidence in their abilities and academic performance.

Recommendations

Based on the findings of this study, the following recommendations are made;

1. There is need to create awareness of engineering from primary level through assignments, excursion and other approaches, which can convey a positive attitude toward engineering as a non-gender specific area of study.
2. Career guidance and corrective measures should be part of school systems at all educational levels to help females easily understand their own personal motivating factors which could strengthen females' resolve to choose, persevere and succeed in engineering fields.
3. Educational opportunities in engineering and other technical programmes need to be provided through adequate training programmes to increase females' interest.
4. Government needs to set up policies and laws for the implementation of equal opportunities for females and males while improving the educational sector especially in STEM and TVET
5. Engineering curricula could be modified in such a way that it does not deter women from undertaking the programme.

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