IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 4 Issue 9, September 2017
ISSN (Online) 2348 – 7968 | Impact Factor (2016) – 5.264
www.ijiset.com

The Significance of Specialization On Engineering Training In Nigeria

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Abstract

The downward global trend experienced over several decades ago in engineering training programmes in tertiary institutions either in terms of content or in terms of the curriculum taught is no doubt worrisome to employers of labour and other concerned bodies. It seems there is no common global consensus at present on what is the best structure or set of specialization options these specializations have in determining the future shape of the engineering degree or profession. However, there have been substantial improvements with respect to the curriculum in tertiary institutions with the emergence of 'non-core' modules which together form part of some extra specialization 'options' or even a combined degree. From the study, it was established that 92% of the respondents strongly agreed that specialization options within the engineering degree provide better motivation to progress and open-up employment prospects, while 74% of the respondents affirmed that specialization have helped them to achieve their career goals. 60% of the respondents in computer engineering agreed that specialization is very useful, whereas, 40% are very familiar with the various options available. This paper takes a look at the significance of specialization on engineering training in Nigeria both from students and industry/employers viewpoint.

Keywords: *Training, Engineering, Specialization, Industries, Landscape, Academic standard, Curriculum.*

1. INTRODUCTION

This paper accesses the significance of specialization on engineering training in Nigeria as regards engineers with specialized skills that can solve complex engineering problems which can aid in industrial development and boost economic growth [1]. Technological and industrial development of any nation depends on its ability to develop its citizens towards the area of science and engineering [2]. In recent years, the composition and nature of the industries that engineers typically serve has evolved and with it the range of opportunities available to graduates. The calibre of engineering graduates from tertiary institutions across the globe has been the major concern by employers of labour over the years. Employers mostly complain of inadequate skills required especially in the current cutting edge technology, having low practical know-how and lack of confidence [1].

Companies who operate in some of the newer industries may not be quite so interested in graduates with a sound grounding in the production of large scale commodity (as the traditional engineering education typically provided), but may prefer graduates with some specialist education in their particular area [2]. There is also an increasing demand among employers for graduates who possess not only technical competencies, but also a range of the so called 'soft' skills or 'higher order' skills; skills such as communication, presentation, team working, leadership, and so on, as well as perhaps some knowledge of business management, the humanities and law [3]. Going by the quality of training acquired by graduates of tertiary institutions in Nigeria in the area of engineering education, most of them are engaged into several re-training by the industries in order to build their skills for the fact that they are considered to be un-employable at the first intake level [4]. It has also become increasingly difficult to attract well motivated school leavers and those with high academic ability to study engineering among the myriad of opportunities and career paths that now exist. Academic providers have, by and large, responded to these changes by complementing the core engineering degree with a range of additional options [5]. However, there seemed not to be any co-ordinated action or global vision or goal for engineering among educational providers in doing this; some provide specializations in for example, the basic sciences, some provide environmental streams, some have industry specific options, and some add on elements (or indeed whole degrees) of other disciplines including business, law, medicine and the arts [6]. The general philosophy of engineering education in the university is to produce graduates of high academic standard and of immediate value to the industry; common foundation years at 100 and 200 levels for all engineering disciplines; workshop practice, laboratory work and tutorials; design project with bias towards local applications; broad-based engineering practice and interaction between students and professionals; project in the final year on which the students work alone under supervision; special skills and in-depth study in a particular area of the programme through optional courses or electives; and adequate knowledge in the area of engineering management, economics and law [7]. The unprecedented

expansion of the higher education system in Nigeria has arisen partly because of the significant growth of engineering education. The Nigerian University system at present consists of 152 institutions, comprising 40 Federal institutions, 44 State and 68 Privates universities [14]. The main component in the significant expansion in engineering education is private institutions; hence most of the private institutions should be encouraged to establish engineering faculties. It has been pointed out by many researchers of higher education that the concept of an engineering discipline is not a straight forward one [8]. Engineering disciplines are so different from each other and it is hard to come up with a concise definition that would fit all of them to the same degree [8]. In academic and professional settings, an engineer can be defined as a person capable of using scientific knowledge, especially math and science, to solve real-world problems [9]. This conception, however, makes it difficult to count engineering populations across institutions within a country and from one nation to another [10]. It is believed that specialization is one key feature of modern economic systems, enabling industries and other business operations to increase productivity [1]. In view of this the demand for specialized skilled engineers is regularly sort for, as such, institutions are saddled with the responsibility of producing engineering graduates with specialized skills leading to a variety of available options within an engineering discipline. The engineering sciences are the vehicle of technological progress and are in no doubt facing major challenges. In order to cope with these tasks, new ways are being sought in the present as well as trained engineers in different sciences are sought-after all over the world [11]. The challenging degree courses in engineering are basically geared towards the demands of real life. Each university should be integrated into an international network of business enterprise and research institutes. Everyone involved benefits from this, especially the students, who often write their degree thesis in cooperation with partner firms. In both developed and developing countries of the world, engineering training especially at foundation levels (year 1 and 2), it is generally and globally agreed that mathematics, Material Science, Mechanics and Humanities must be taught [6]. Mathematics is the language of the engineer; Material Science teaches about matter that, when transformed, it becomes a reality. Mechanics is the tool kit for the engineer, while Humanities teaches the engineer on how to handle the complex relationship between Man and machine much better [12]. At subsequent engineering levels (year 3 to year 5), candidates pursue various fields of engineering with varying specializations like Mineral Resources Engineering with specializations such as Mining Engineering, Mineral Processing Engineering, and Geological Engineering; Civil Engineering with specialised fields such as Water Engineering, Highway Engineering and Structural Engineering. The purpose of this study is to assess the significance of specialization on engineering training as well as beam at the engineering training landscape as it is presently constituted in Nigeria and uncovers that while there is coalition of additional options on a practically general premise, the methods by which such options are joined into the overall structure of the degree varies, typically on a country or regional specific basis [16].

2. METHODOLOGY

This study was designed as a descriptive survey [13]. This type of study involves a planned collection of data over a large area for the purpose of making description. Considering this point, the study covers universities, public and private organizations in Nigeria.

2.1 Population

The population (sample size) comprises 200 participants made up of university undergraduates (private and public), employees and management staffs of organizations.

2.2 Sample and Sampling Techniques

Purposive sampling technique [2] was adopted and participants involve undergraduates (50%), employee (35%) and management staff of industries (15%) all drawn from 20 institutions in Nigeria. The eight (8) engineering disciplines selected for inclusion in this study were: computer, mechanical, metallurgical/materials, chemical, electrical/electronics, civil, mining and petroleum. Identification of the disciplines was guided by respondent submissions based on the type of engineering discipline studied. The disciplines included are those that are recognized and accredited by the National Universities Commission (NUC), Council for the Regulation of Engineering in Nigeria (COREN) and professional engineering associations like Nigerian Society of Engineers (NSE).

2.3 Instrument

The instrument used to collect data for the study was 10-item questionnaire arranged under three (3) clusters according to the three (3) research questions under investigation – specialization option, its usefulness to the degree and participants familiarity. Questionnaires were administered on a one to one basis and the survey is strictly for engineers and those with engineering background/training, participation was voluntary [3].

2.4 Method of Data Analysis

The data collected were analysed using percentages [15]. The aggregate response of respondents to the question is outlined in Table 1 while Tables 2 and 3 show results based on each engineering discipline sampled. Participants were asked to list the various options available within their type of engineering discipline. We constructed a gross measure of familiarity within engineering options by summing each participant's response. Tables 1 to 3 show the spread of various responses.

Participant's responses to the usefulness of specialization on engineering training were coded and scored.

3. RESULTS

Table 1: How do you think the specialization option within your engineering discipline compares with the actual degree?

Sampled Questions / Response code	**1**	**2**	**3**	**4**	**5**
(i) Does it provide a better motivation to progress in your specialization?	136 (68%)	48 (24%)	7 (3.5%)	-	9 (4.5%)
(ii) Does it keep your career option open?	102 (51%)	58 (29%)	32 (16%)	8 (4%)	-
(iii) Has it helped you to achieve career goals?	83 (41.5%)	65 (32.5%)	42 (21%)	10 (5%)	-
(iv) How does it compare to your overall employment prospect?	71 (35.5%)	85 (42.5%)	25 (12.5%)	10 (5%)	9 (4.5%)

1 = Very Applicable; 2 = Applicable; 3 = Averagely Applicable; 4 = Fairly Applicable;
5 = Not Applicable

Table 2: Indicate your opinion on the usefulness of specialization within the engineering degree?

Engineering discipline/ response code	1	2	3	4	5
Computer	18 (60%)	12 (40%)	-	-	-
Mechanical	20 (28.6%)	17 (24.3%)	-	33 (47.1%)	-
Metallurgical/materials	24 (50%)	6 (12.5%)	-	18(37.5)	-
Chemical	28 (93.3%)	2 (6.7%)	-	-	-
Electrical/electronics	23 (76.7%)	3 (10%)	4 (13.3%)	-	-
Civil	10 (50%)	6 (30%)	4 (20%)	-	-
Mining	8 (80%)	2 (20%)	-	-	-
Petroleum	10 (100%)	-	-	-	-

1=Very useful; 2= useful; 3= averagely useful; 4= Fairly Useful; 5= Not useful

Table 3: Participants' familiarity with the various options available within their degree

Engineering Discipline/ Response code	1	2	3	4	-

Computer	12 (40%)	18 (60%)	-	-	-
Mechanical	-	7 (17.5%)	-	33 (82.5%)	-
Metallurgical/Materials	6 (20%)	6 (20%)	-	18 (60%)	-
Chemical	12 (40%)	12 (40%)	6 (20%)	-	-
Electrical/Electronics	4 (13.3%)	22 (73.3%)	4 (13.3%)	-	-
Civil	10 (50%)	10 (50%)	-	-	-
Mining	10 (100%)	-	-	-	-
Petroleum	10 (100%)	-	-	-	-

1= Very Familiar; 2= Familiar; 3= Averagely Familiar; 4= Fairly Familiar; 5= Not Familiar.

4. DISCUSSION

The assessment of specialization options within engineering disciplines as compared with the actual degree was carried out**.** The aggregate response of participants was compiled and from table 1, it is evident that in terms of how specialization motivates respondents, only 4.5% of total engineering disciplines considered in the survey believe it does not motivate with over 90% believe it motivates. On the basis of whether it keeps career option open, a spread of opinion was observed with 51% (102) of the total participants believe it is very applicable, no participant believe that it is not applicable. In terms of how it has helped to achieve career goal, more than 40% representing 83 participants believe it is very applicable with only 10% respondents who think it is fairly applicable. Respondents generally believe that specialization is applicable in terms of overall employment prospects even though a spread in thought was observed with 71 of participants representing 35.5% of the total respondents who believe it is very applicable, 42.5% 85 respondents believe it is applicable and 4.5% representing 9 participants strongly believe it is not applicable. Generally, from table 1, it is apparent that in one way or the other, specialization within an engineering discipline is valuable as it helps for better motivation, opens up career options, helps to achieve career goals and increase students' employment prospects. Assessment of participant's opinion on specialization within the engineering degree, and to conveniently analyse this, respondents were asked to tick from a list of options based on how useful specialization is within their individual engineering degree in table 2. Interestingly, across all engineering disciplines presented in this survey, it was affirmed that specialization is very useful, with petroleum engineering having 100% respondents' assertion that specialization is very useful. This was closely followed by chemical engineering where a whopping 93.3% representing 28 participants that also ticked the option (very useful) with only 6.7% (2 respondents) who even though they believe in its usefulness but not a very strong assertion of the fact that it is very useful to the core engineering degree. Interestingly also, 7.5% of respondents from mechanical engineering discipline disagree with this assertion. Their choice could be likely that they are fairly familiar with the various options available in their chosen engineering discipline. Assessment of participant's familiarity with the various options available within their degree, this question was posed to participants to find out their awareness/familiarity with the various options available within their degree. Though from studies carried out findings revealed that options available in each particular engineering discipline varies on institutional basis and from country to country basis as well. Hence, it became difficult to access clearly whether individual participant's response was based on a generalised premise. However, the assessment made as shown in table 3 was conducted based on options available on the participant institutions website in Nigeria. Based on a generalised premise, all the participants were familiar with at least two or more options available within their degree. The percentage spread between those that chose very familiar and familiar indeed showed that respondents are truly knowledgeable of the options present within their degree.

5. CONCLUSION

Considering the findings and discussion above, it was concluded that the concept of specialization option among Nigerian engineering undergraduate, graduate employees and

management staffs of organizations was well conceived and it is believed that the employability of an engineering graduate depends largely on his ability to specialize, hence specialization in all engineering degrees is needful in order to attract employers of labour. Also, specialization opens up career options and helps achieve career goals. On a global premise, engineering degrees incorporate specialization options of one form or the other, and this is well accepted globally. The nature and depth of specialization varies enormously and is set to evolve further in future years. This is so because of varying conceptions of the engineering profession that is seen to exist not only between countries, but even within them. Nigerian government policies has favoured the establishment of private institutions since the return of democracy in 1999 and this giant stride has no doubt led to the growth of private universities in Nigeria even though at present, those offering engineering programmes are little. At present in Nigeria only 45% of our Nigerian universities are offering engineering programmes, this number can be increased if the awareness and benefits of specialization is made known to private investors.

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