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The Influence of Gender on Job-Competencies Requirements of Chemical-Based Industries and Undergraduate-Competencies Acquisition of Chemists in South West, Nigeria

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***Abstract*—**Developing young people's employability is a key policy issue for ensuring their successful transition to the labour market and their access to career oriented employment. The youths of today irrespective of their gender need to acquire the knowledge, skills and attitudes that will enable them to create or find jobs as well as cope with unpredictable labour market changes throughout their working lives. In a study carried out to determine the influence of gender on job-competencies requirements of chemical-based industries and undergraduate-competencies acquisition by chemists working in the industries, all chemistry graduates working in twenty (20) chemical-based industries that were randomly selected from six sectors of chemical-based industries in Lagos and Ogun States of Nigeria were administered with Job-competencies required and undergraduate-competencies acquired assessment questionnaire. The data were analysed using means and independent sample t-test. The findings revealed that the population of female chemists working in chemical-based industries is low compared with the number of male chemists; furthermore, job-competencies requirements are found not to be gender biased while there is no significant difference in undergraduate-competencies acquisition of male and female chemists. This suggests that females should be given the same opportunity of employment in chemical-based industries as their male counterparts. The study also revealed the level of acquisition of undergraduate competencies as related to the needs of chemical-based industries.

***Keywords*—**Acquired, attitude, employability, knowledge, required, skill.

I. Introduction

THE scientific and technological development of any nation depends largely upon the acquisition and application of scientific principles [1], therefore if a country is to advance in this existing world of science and technology, the general community (male and female alike) need to increase in scientific and technological knowledge and competence. Recently, there has been rising global consciousness both at the grassroots and policy levels regarding the impact of gender issues in education and national development. There is also the growing consciousness that women constitute more than half of the world's population. Thus, issues regarding women in national development and Science and Technology education, which is a vital tool in the development of nations cannot be ignored.

Science and technology encompass a broad range of activities, women's participation in science and technology therefore refers to the extent that women have been able to utilize this tool in capturing the same opportunities available to men, ranging from research to high-skilled employment in firms [2]. According to [3], the involvement of women in knowledge production is through their participation in academic activities. These entail both the education and subsequent employment of women. The education phase develops skills and empowers, whereas higher up the academic ladder, the person as a professional begins to contribute to science and technology development.

In Nigeria, in spite of the Federal Government insistence on equal opportunities for all as well as the gradual growth of female education, especially in the science and technology sector since late 1980's, there is still a low level participation of women [4]. This low level participation has resulted in women scientist shortage and thus shortages of their crucial skills in the labour market. Efforts have been made by the government and organisations such as Girls in Science and Technology (GASAT), Women in Engineering (NIE), National Science Foundation (NSF) among others to address the issue of low participation of women in science and technology through policies and organisation of conferences and seminars. However, there has been some improvement in both enrolment and employment in science and technology based establishments respectively [5]. It is therefore logical that in an age dominated by science and technology, attention should be drawn to the gender influence on competencies required and poor representation of women in science and science related careers if they are to be part of the development process.

II. Purpose of the Study

The main purpose of this study is to determine the influence of gender on job-competencies requirements of chemical-based industries. The specific objectives are to:

1. Determine the level of women participation in chemical-based industries.
2. Determine if job-required competencies are related to gender

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3. Determine if graduate-acquired competencies are affected by gender

III. Research Questions

The following research questions are raised and answered.

1. What is the level of women participation in chemical-based industries?
2. What are the differences in the job-required competencies by gender?
3. What are the differences in the graduate-acquired competencies by gender?

IV. Hypotheses

The following hypotheses are raised.

1. There is no significant difference between male and female chemical-based industry job-required competencies.
2. There is no significant difference between male and female chemistry graduates acquired competencies.

V. Methodology

The study adopts descriptive survey and correlation research designs. A correlation research was used to establish the relationship that exists between chemical-based industries job-required and chemist-acquired competencies.

The study made use of multistage sampling techniques. Chemical-based industries were stratified into twelve sectors depending on their products. Six (6) sectors of industries were selected from these using simple random sampling. The industries randomly selected are: Breweries, Foams and Mattress Industries, Food and Beverages Industries, Paint industries, Pharmaceutical Industries and Toiletries and Cosmetics Industries. A total of twenty industries were then randomly selected.

The population for the study comprises of chemists working in chemical-based industries in Lagos and Ogun States of Nigeria. All chemists in the employment of the 20 randomly selected chemical-based industries that are available were selected and administered with the questionnaire. The number of chemists in the chemical-based industries varies depending on what is being produced in the industry and how big the industry is. A total of 103 chemists were administered with the questionnaire.

Required and Acquired Competencies Assessment Questionnaire (RACAQ); a survey questionnaire with two sections were administered to chemists working in the twenty industries. The questionnaire assesses the competencies in the cognitive (knowledge), psychomotor (skill) and affective (attitude) domains. Respondents were asked to identify the undergraduate course contents, skills and attitude that are relevant to their work experience in their various industries and those acquired from undergraduate education on a four-point scale. The skills and attitude parts of the Questionnaire were adapted from the employability profiles outlined for chemistry graduates by [6] and the research report of [7] on Employability skills explored.

VI. Data Analysis and Results

A. Research Question 1

What is the level of women participation in chemical-based industries?

A total of 97 out of the 103 chemists indicated their gender on the questionnaire filled. The 97 chemists comprise of 30 (30.93%) female and 67 (69.07%) male. The figures showed that female chemists working in chemical-based industries are only about one-third. The male chemists more than double the number of female.

B. Research Question 2

Is there any difference between male and female chemical-based industry job-required competencies?

The three components of competencies are given consideration in providing an answer to this research question. Using the descriptive statistics, the mean values were calculated and compared for both female and male job-required competencies.

1. Knowledge

Table I shows the analysis of perception of female and male respondents as regarding the knowledge of chemistry required and acquired by chemical-based Industries from graduates of chemistry. The eighteen (18) chemistry core courses are considered.

The analysis from Table I shows that for all the core courses in chemistry, there is a slight difference between the male and the female perception on the knowledge of courses required by the industries with the mean values of males slightly higher than those of females except in SIWES and Project where the mean values of females are slightly higher.

The level of significance was tested using the independent sample t-test on equality of means. Thus, it can be generally said that the knowledge of course contents required by the industries for graduates to work effectively is independent of gender.

2. Skill

The comparison of the mean values of both female and male skills requirement of chemical-based industries from Table II shows that there is no difference in the mean values.

From the independent sample t-test for equality of means, it is observed that all the p values are greater than 0.05 for all the skill variables. This implies that there is no significant difference between the perception of male graduates and female graduates in the skills requirement of the chemical-based industries. The null hypothesis is accepted. Thus, the skill requirement of the industries for graduates to be employed is not gender-based.

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TABLE I
GENDER ANALYSIS BY CORE COURSE

Core Courses		REQUIRED				ACQUIRED			
	Gender	N	Mean	T	Sig	N	Mean	t	sig
General Chemistry I	Female	30	2.0161	-0.88	0.381	28	2.5427	-0.820	0.414
	Male	66	2.1491			66	2.6219		
General Chemistry II	Female	30	1.9427	-0.454	0.651	28	2.4731	-0.449	0.654
	Male	66	2.0201			66	2.5121		
Physical Chemistry I	Female	30	1.7879	-0.443	0.659	27	2.4974	-0.949	0.345
	Male	66	1.8756			66	2.6306		
Organic Chemistry I	Female	30	1.6000	-0.694	0.489	28	2.3548	0.307	0.759
	Male	65	1.7397			65	2.3174		
Inorganic Chemistry I	Female	30	1.2333	-0.209	0.835	27	2.0381	0.228	0.820
	Male	64	1.2773			64	1.9987		
Analytical Chemistry I	Female	30	2.3556	-0.865	0.389	28	2.5117	0.920	0.360
	Male	67	2.4913			65	2.3859		
Structure and Bonding	Female	30	1.1017	-0.299	0.766	28	2.0607	-0.391	0.697
	Male	66	1.1606			66	2.1258		
Physical Chemistry II	Female	29	1.2948	-0.863	0.39	28	2.1488	0.028	0.978
	Male	66	1.4788			64	2.1445		
Inorganic Chemistry II	Female	30	1.3433	-0.13	0.897	29	2.3078	0.585	0.560
	Male	65	1.3702			63	2.2273		
Organic Chemistry II	Female	30	1.8870	-0.552	0.582	27	2.4048	0.341	0.734
	Male	65	1.9973			64	2.3639		
Atomic & Mol. Struct; Symmetry	Female	29	0.8706	-0.402	0.689	27	1.7482	0.293	0.770
	Male	63	0.9490			62	1.6868		
Applied Spectroscopy	Female	27	2.2222	-0.051	0.959	26	2.24	-1.084	0.283
	Male	64	2.2344			60	2.4167		
Chemical Kinetics	Female	30	1.6970	-0.454	0.651	28	2.3238	0.339	0.735
	Male	62	1.7888			62	2.2804		
Analytical Chemistry II	Female	30	2.0039	-0.226	0.822	27	2.28	0.910	0.365
	Male	67	2.0470			65	2.1254		
Chemistry of Lanthanide and Actinides	Female	27	1.1296	0.2	0.842	25	2.2261	1.491	0.140
	Male	65	1.0769			62	1.8952		
EXPTAL CHEM	Female	26	2.4231	-1.454	0.15	23	2.5909	0.248	0.805
	Male	57	2.6842			54	2.5556		
SIWES	Female	25	2.7200	0.176	0.861	24	2.7826	0.746	0.458
	Male	62	2.6935			60	2.6833		
PROJECT	Female	25	2.7200	1.46	0.149	24	2.7391	0.638	0.525
	Male	63	2.5238			58	2.6552		

3. Attitude

From the mean values presented in Table III, it can be observed that there is no difference in the mean values of female and male perception of attitudinal requirements of chemical-based industries. Thus, the attitude requirement of the industries for graduates to be employed is independent of gender.

From the independent sample t-test on equality of means, it is observed that all the p- values are greater than 0.05 for all the required attitude variables. This implies that there is no significant difference between the perception of male graduates and female graduates in the requirement on graduates' attitude by the chemical-based industries. The null hypothesis is accepted. Thus, the attitude requirement of the industries for graduates to be employed is independent of gender.

C. Research Question 3

Is there any significant difference between male and female chemistry graduates acquired competencies?

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TABLE II
GENDER ANALYSIS BY SKILL

Skills		REQUIRED				ACQUIRED			
	Groups	N	Mean	T	Sig.	N	Mean	t	Sig.
Team work	Female	30	2.9333	-1.063	0.295	29	2.6552	1.222	0.225
	Male	67	2.9851			67	2.4627		
Communication	Female	30	2.9667	-0.091	0.928	29	2.8621	3.563	0.001*
	Male	67	2.9701			67	2.4776		
Planning	Female	30	2.8667	-1.288	0.205	29	2.6552	2.26	0.027*
	Male	66	2.9545			66	2.3788		
Organising	Female	30	2.8333	-1.071	0.291	27	2.7778	3.105	0.003*
	Male	66	2.9394			66	2.4091		
Decision making	Female	28	2.8214	0.384	0.702	28	2.6786	2.551	0.013*
	Male	66	2.9091			63	2.3333		
Leadership	Female	28	2.8929	-1.475	0.15	29	2.6552	3.127	0.002*
	Male	66	2.8636			66	2.2424		
Problem solving	Female	30	2.9000	-0.303	0.762	27	2.7778	1.436	0.156
	Male	67	2.9851			67	2.5970		
Management	Female	28	2.7143	-0.244	0.808	28	2.4286	2.291	0.024*
	Male	67	2.7463			66	1.9848		
Information	Female	28	2.6071	0.932	0.354	29	2.3448	3.313	0.001*
Technology	Male	66	2.6364			64	1.7500		
Self Motivation	Female	29	2.8966	-0.569	0.571	28	2.7143	2.809	0.006*
	Male	67	2.8209			65	2.3231		
Innovative Skills	Female	29	2.8276	-0.994	0.326	28	2.6429	3.246	0.002*
	Male	66	2.8788			66	2.0606		
Creative Skills	Female	30	2.8000	-1	0.326	28	2.6071	2.567	0.012*
	Male	67	2.8955			65	2.1692		
Time Management	Female	30	2.9000	-0.483	0.63	28	2.8214	4.012	0.000*
	Male	67	3.0000			67	2.3284		
Computer Literacy	Female	29	2.6552	-1.102	0.273	30	2.1667	1.832	0.07
	Male	66	2.7121			64	1.7969		
Ability to Manipulate Instruments	Female	27	2.5556	0.791	0.431	29	2.1034	0.875	0.384
	Male	63	2.6984			61	1.9016		
Investigative	Female	29	2.8621	0.089	0.929	28	2.3929	1.471	0.145
	Male	66	2.7879			65	2.1077		
Observational	Female	30	2.9000	-0.452	0.652	28	2.7143	2.517	0.014*
	Male	66	2.8939			65	2.3538		
Production	Female	29	2.8276	0.259	0.796	29	2.3448	2.067	0.041*
	Male	66	2.8636			67	1.9104		
Quality Control	Female	30	2.9667	-1.024	0.309	28	2.6071	2.781	0.007*
	Male	67	2.9552			67	2.0597		
Entrepreneurial skills	Female	30	2.3333	-1.063	0.295	28	2.2500	2.425	0.017*
	Male	66	2.5152			65	1.6769		

TABLE III
GENDER ANALYSIS BY ATTITUDE

Attitudes		Required				Developed			
	Codes	N	Mean	T	Sig	N	Mean	t	Sig
Self reliance	Female	29	2.8276	-1.021	0.313	30	2.7667	1.779	0.079
	Male	66	2.9091			67	2.5821		
Open mindedness	Female	30	2.7667	-0.853	0.396	29	2.5517	-0.004	0.997
	Male	66	2.8485			67	2.5522		
Flexibility	Female	29	2.8966	1.187	0.239	30	2.5000	1.144	0.256
	Male	66	2.8030			65	2.3385		
Perseverance	Female	29	2.8966	0.061	0.952	28	2.8214	1.453	0.151
	Male	65	2.8923			66	2.6818		
Adaptability	Female	29	2.9655	0.74	0.461	30	2.7333	0.632	0.529
	Male	67	2.9254			67	2.6567		
Pragmatism	Female	26	2.5385	-1.689	0.101	27	2.3704	0.099	0.922
	Male	63	2.8095			62	2.3548		
Honesty	Female	30	2.9333	-0.446	0.656	29	2.7586	0.46	0.647
	Male	67	2.9552			67	2.7015		
Initiative	Female	30	2.9333	-0.113	0.911	29	2.5862	0.617	0.538
	Male	66	2.9394			67	2.4925		
Respect	Female	29	2.8621	0.578	0.565	30	2.7667	1.876	0.065
	Male	67	2.806			67	2.5373		
Integrity	Female	30	2.9333	-1.063	0.295	29	2.7931	1.201	0.233
	Male	67	2.9851			67	2.6567		

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1. Knowledge

From Table I, the analysis of perception of males and females regarding the knowledge of chemistry acquired by graduates working in chemical-based industries showed that the mean values are the same and further test of hypothesis showed that all the p-values are greater than 0.05, signifying that for all the core courses in chemistry, there is no significant difference between the male and the female perception on the knowledge of courses acquired by the graduates, using the independent sample t-test on equality of means. The null hypothesis is accepted. Thus, it can be generally said that the knowledge of course contents acquired by chemistry graduates is independent of gender.

2. Skill

Analysis of the skill acquired by the graduates from Table II shows that attributes such as Team work, Problem solving, Computer Literacy, as well as Ability to Manipulate Instruments and Investigative skill do not have significant values at p = 0.05, whereas other skill attributes recorded significant values. Thus, skills, which include Communication, Planning, Organising, Decision making, Leadership, Management, Information Technology, Self-Motivation, Innovative Skills, Creative Skills, Time Management, as well as Observational, Production, Quality Control and Entrepreneurial skills show that there is a significant difference between the perception of male graduates and female graduates in skill acquisition. This further revealed that the level of skill acquisition is greatly dependent on individual ability.

3. Attitude

Similarly, as reported for the attitude requirement, the independent sample t-test on equality of means shows that all the p- values indicate insignificance for all the acquired attitude variables. This implies that there is no significant difference between the level of acquisition of male graduates and that of female graduates as may be demanded by the chemical-based industries. Thus, the attitude requirement of the industries for graduates to be employed is independent of gender.

VII. Discussion

The analysis has revealed that competencies requirements of chemical-based industries is not gender based and competencies acquisition of chemistry graduates working in chemical-based industries is not gender based. Hence, employment opportunities should not be gender biased. However, from the data collected, the figures indicate that there are more male chemists employed in chemical-based industries. If the policy on gender equality is to be followed then, this study has further revealed that the policy has not been fully implemented in Nigeria.

Reference [8] noted that gender composition of occupations in both the formal and informal sectors of a country is an important indicator of the economic opportunities open to women. According to him, the participatory level of individual in each sector could be determined by the enrolment of males and females in schools and their participation in certain school subjects and career. Reference [9] reported low enrolment of females in sciences and technological-related courses at the University level of education. It was also observed that females take the least resistance by opting for disciplines designated as feminine such as liberal arts, education, nursing, law and shy away from courses in Sciences, Engineering, Medicine and Mathematics, which have been designated as masculine subjects. Also, [4] stated that science courses have been interpreted as men's work while [10] analyzed the admissions of students into Faculties of Engineering and Science based courses for three consecutive years at the University of Lagos.

Findings from the study revealed that more male enrolled in the two faculties and that the status quo had remained even with the improved access to education by both genders. However, [11] noted that the issue of gender influence on students' performance in science is not straight jacketed.

Reference [12] reported that nearly six million young women and men enter the labour market each year but only 10% are able to secure a job in the formal sector, and just one third of these are women. The report further showed that women occupy fewer than 30% of all posts in the public sector and only 17% of senior positions. Though, [13] posited that females and males appear to possess equal potential to develop the skills required for the pursuit of science, it is both a waste of talent and a deprivation to individuals that the two sexes do not participate equally in science.

VIII. Conclusion

In spite of the Federal Government policies on gender equalities, studies have continued to show that the "affirmative action" is yet to be fully implemented in Nigeria though there has been some improvement in both enrolment and employment in science and technology based establishments respectively. Females should be given equal opportunity as their male counterparts when it comes to employment into chemical-based industries.

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