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THE INFLUENCE OF GENDER OF UNDERGRADUATE CHEMISTRY/ CHEMISTRY EDUCATION STUDENTS ON PAINT PRODUCTION FOR ENTREPRENEURSHIP AND SUSTAINABLE DEVELOPMENT IN NORTH CENTRAL NIGERIAN UNIVERSITIES

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ABSTRACT

The study compared male and female undergraduate Chemistry students' learning outcomes on paint production who were trained using entrepreneurial skill package in two federal and two state universities in North Central Nigeria. Four hypotheses guided the study. The study employed non-randomized post-test only quasi experimental design. The research instrument was a validated and reliable 56-item Linkert type questionnaire which was administered on 236 undergraduate male and female Chemistry students to obtain responses on the difference between their mean score performances on paint production. The respondents were asked to indicate their gender on the instruments. Data collected were analyzed using t-test. The findings of the research showed that there were no statistical significant differences between the performance of the two dependent groups of male and female undergraduate Chemistry students on paint production using the developed entrepreneurial skills package. However, there was a significant difference between the male and female undergraduate Chemistry students in performance in favour of the male students.

Key words: Entrepreneurship Gender Influence Paint production Sustainable development

INTRODUCTION

The promotion of gender equality and empowerment of women is the goal of the eight millennium development goals (MDGs) in which the United Nations (UN) members had since met in the year 2015. A study guided by Chaochao Yang, Qian (2020) indicated that boys showed higher learning interest and achievement in science, while girls had slight greater variability in creativity in scientific topics than boys. This is contrary to the studies by Bhutta, Ansari & Ahmad (2024) who found that girls outperformed boys in science while they observed no gender difference in Mathematics. However, girls recalled more life experiences about science and technology in life than boys. According to Cheung's review (2009), girls found Chemistry more enjoyable than boys. Nair-Bedouelle lamented that the lack of gender equality in science is not just a problem that affects women; .it also impedes a country's development. Different authors have defined gender in a variety of ways including social, construct, a role and a social institution. Nguru (2023) defines gender as the expectation a society sees about someone simply because the person is a woman or man, and what they expect as men or women. Gender refers to the social meaning associated with being a male or a female, including the construction of identities, expectations, behaviours and power relationships that derive from social interactions (Olasehinde & Olatoye, 2014)

The outcry of several science educators and the general public concerning the man (masculine) and woman (feminine) has created a lot of difference between these two sexes

in form of aptitudes, abilities, desires, roles, responsibilities and behavioural patterns. Gender has not only treated women as subordinate to men and child bearers but has also subjected them to discriminations. In most parts of Africa, women inherent freedom, dignity, integrity and equality as determined by men. This low perception of the society about women is the prototype of discrimination that brings about unemployment and poverty.

Gender has continued to be an issue of concern to educators and researchers. This is evident from the reports of Elena, Belinda and Walter (2019) that gender has impact on science education, that girls found Chemistry more enjoyable than boys. Furthermore, Babajide (2010) observed that science is a male dominated subject and that females tend to shy away from scientific and technological fields. Boys therefore, appear to have a natural positive attitude to technical and science subjects, while girls show negative attitude (Ezirim, 2006). This negative attitude in the opinion of Babajide (2010) is due to the acceptance of the myth that boys are better in science subjects than girls.

Chemistry being an investigative science subject which deals with the procedures and processes of making things would serve as a medium through which the basic chemical knowledge and skills required by Chemistry graduates and youths to be employable are acquired. This is the reason why science, in the opinion of Obiajulu (2014), has been acknowledged as the bedrock of national development and also that chemistry's contribution to quality of life and nation building are worthwhile in all aspects (Festus & Ekpete, 2012).

The present trend of mass unemployment in Nigeria shows that science education, including Chemistry education in Nigeria universities is not preparing the Nigerian graduates as it ought to. The Nigerian educational system is supposed to focus on the problem of its people, particularly the youth. As noted by Susianna (2011), unemployment is the result of not only the prevalence of limited job opportunities but also the job seekers incapability of meeting the requirements and qualifications needed by the business sector. Thus, any job seeker needs to be equipped with certain knowledge, skills and attitude regardless of gender. The attitudes needed by anyone intending to become an entrepreneur and a job seeker are entrepreneurial attitudes. The lack of a developed entrepreneurial skill training package for the teaching of Chemistry has to be properly tackled for science education to produce Chemistry graduates with sufficient skills for self-reliance.

In view of the forgoing condition, Chemistry education is expected to equip students at the university level with education for self- reliance. The teaching of Chemistry for entrepreneurship requires that Chemistry teachers be more efficient, creative, resourceful, innovative, industrious and more patient to make the teaching of this important and lucrative subject more meaningful, relevant and interesting to learners. Teachers are to teach Chemistry to learners in a manner that they can be on their own after graduating from the university. Hence the teaching and learning of Chemistry for skill acquisition is considered not merely a necessity but a matter of survival. Therefore, teaching and learning Chemistry for skill acquisition is a panacea to unemployment for both boys and girls.

In attempting to give credence to the idea that Chemistry teaching and learning for skill acquisition is crucial for the development of the individual and society at large, Adeyemo (2009) asserts that entrepreneurial skills are the basic skills necessary to enable an individual start, develop, finance and succeed in his/her home enterprise. In the same vein, Ogalanya (2009) posits that for some decades now, emphasis had shifted from teaching science for acquisition of knowledge to teaching for skill acquisition which for sure will lead to functional effective living. Skill acquisition would be possible when practical

approaches are used in lesson delivery rather than lecture methods. In Nigerian universities today, the most often used instructional strategy is the lecture method. No wonder Obi and Amba (2013) post that some Nigerian graduates are not critical thinkers and as such wait to be employed either by government or companies. Also, experience has shown that every year Nigerian colleges and universities are producing millions of graduates without private and public sector to employ them. These authors decry that youth unemployment in Nigeria has assumed a dimension that is now called A MONSTER. The authors' lamentation is strengthened by report of the Nigeria Bureau of Statistics (2013) which showed that as a developing nation, Nigeria has turned out many graduates including Chemistry graduates, who are roaming the streets in search of non-existing white collar jobs. This situation is contrary to the aims and objectives of Nigeria education, as contained in the National Policy on Education (FRN, 2014), which stresses on the development of a self-reliant nation. Also, the goals of science education in Nigeria include among others; cultivating, knowing, inquiring and having rational mind for the conduct of good life and democracy, producing scientists for national development and providing understanding of the complexity of the physical world, the forms and the conduct of life (Effiong & Okon, 2012).

Chemistry graduates ought to have acquired sufficient skills that would make them self-reliant and prepared to enter into the world of work and then make progress. Chemistry education should prepare individuals to be self-employed in various enterprises, because as the backbone of all sciences, it is contextually versed with topics and concepts that have so much to offer its students and graduates for self-employment. However, Nigerians are currently facing unemployment related problems because science education, including Chemistry education is not being taught in our universities to prepare the graduates to function well in the nation. In the same vein, Abdu (2014) lamented that the teaching of Chemistry in Nigeria is not practically done as it ought to, that the practical relevance to the development of skills needed for entrepreneurial development is mostly theorized because of lack of competent teachers or lack of equipment to enable that. Hence, the resultant effects are students/graduates without hands-on-skills and minds-on-experience.

Nigerian unemployment rate ranged from 14.60% to 23.90% between December 2006 and December, 2011. Youth unemployment from the age group of 15-30 years old is one of the serious problems currently faced by Nigerians. Others include poverty, diseases and politically and religiously motivated problem of insurgency which made people not to invest in the Nigerian economy and that has affected the Gross Domestic Product (GDP). This has led to shortage of companies and factories which might have created jobs for a good number of the youth. This ugly situation is not in the best interest of Nigeria as a nation which is yearning to catch up with the developed nations. This assertion is confirmed by Omiku and Okechukwu's (2013) report on Nigeria which unfolded the draft document of Vision 2020, anchored on two principal targets that would be achieved by the year 2020. One of the targets is Gross Domestic product (GDP) of not less than $900 billion.

Research evidences on male and female students' learning outcomes in science showed that there was no significant difference between male and female students in overall science achievement (Olasehinde & Olatoye 2014). However, many studies have agreed with the observation that male students usually outperform female students in areas of mathematics and science. Hudson (2014) argued that, the male students outperformed the female cohort in science because male students' natural self-confidence and belief in the importance and need for mathematics had a positive influence on male performance.

It is further observed that there is a gender gap in reading (in favour of girls) (OECD,

2011), whereas the most pronounced gender disparities in mathematics (in favour of boys) (Minint, 2011). Gender differences in educational choices appear to be related to students' attitudes (motivation, interest) in studying a particular subject rather than their ability and school performance. Gender gaps in performance are smaller than gender gaps in field of tertiary study, indicating that young women often do not translate their good school performance into field of studies.

Entrepreneurship can be defined as the readiness of an individual to take a risk and start a new business in order to realize profit. The person who decides what to create for whom and how is called an entrepreneur. To be a successful entrepreneur one has to possess certain characteristics. The characteristics that mostly describe entrepreneurial competence include planning and managing projects in order to achieve objectives, mostly in a complex environment, including creativity, innovation and risk-taking ability. This paper provides overview of findings of various entrepreneurial competence researches by comparing the crucial aspects of competences that entrepreneurs are expected to have. A variety of studies shows the connection of entrepreneurship competences and gender, clamming that women worldwide own and manage less business than men, they tend to focus on different business sectors than men and have different socioeconomic conditions such as education, social status, financial capacities and similar (Minniti & Naude, 2010)

Undergraduate chemistry students need to possess basic skills necessary to enable them become self-reliant. There are a number of qualities and entrepreneurial skills they need to have, including personal attributes and chemistry knowledge skills like measurement, mass volume, concentration, and preparation of standard solutions. Regardless of university type, gender gaps and class of degree, either B.Sc or B.Sc (Ed) chemistry, the fact remains that our Nigerian universities should teach chemistry practically for its economic benefits.

The purpose of teaching chemistry should be to assist the students to become skilled and self-employed. The present trend of mass unemployment in Nigeria shows that science education, including chemistry education being taught in schools does not prepare Nigerian graduates to function well in the nation undergoing transition from rural economy to modern economy. The study further observed that the lack of entrepreneurship ability among chemistry graduates could be attributed to the lack of skills occasioned by absence of training modules by teachers. Thus, the concern of the research was to develop a training module that would be used in the teaching and learning of chemistry to enhance the chemical entrepreneurial skills of graduates so that they could acquire the right entrepreneurial habits, attitudes and saleable skills.

HYPOTHESES

The following null hypotheses were stated and tested at 0.05 level of significance:

1. There is no significant difference between the performance mean scores of male and female undergraduate Chemistry students who were trained using the developed entrepreneurial skill training package for paint production.
2. There is no significant difference between the performance mean scores of male and female state undergraduate Chemistry students who were trained using the entrepreneurial skill package for paint production.
3. There is no significant difference between the performance mean scores of the male and female Federal University undergraduate Chemistry students who were trained using the package on paint production.

4. There is no significant difference between the mean scores of the B.Sc (Ed) male and B.Sc.(Ed) female undergraduate Chemistry students who were trained using the entrepreneurial skill training package on paint production.

METHODOLOGY

The study employed the non-randomized post-test only quasi experimental design. A sample of 236 undergraduate Chemistry students and 60 Chemistry lecturers, drawn from a population of 1,640 consisting of all the Chemistry lecturers and their 400- level undergraduate Chemistry students in North Central Zone, Nigeria. The researcher developed instrument, known as Undergraduate Chemistry Students' Questionnaire (UCSQ), was used for data collection. The instrument was pilot tested which yielded a coefficient of 0.68. The developed entrepreneurial skill training package on undergraduate Chemistry student's skill acquisition in North Central Zone, Nigeria was used to train both male and female undergraduate Chemistry students. The treatment lasted eight days during which data were also collected using UCSQ and CLRS. The data collected were analyzed using independent sample t-test to test the hypotheses at 0.05 level of significance

RESULTS

Hypothesis 1:

There is no significant difference between the performance mean scores of male and female undergraduate Chemistry students trained on paint production using the entrepreneurial skill training package developed.

Data in Table 1 were used to test hypothesis one.

Table 1: Independent Sample t-Test Analysis for Male and Female Undergraduate Chemistry Students on Paint Production Module

Independent variables	N	Mean	SD	Df	t-cal	P- value
Male	173	50.87	8.56	234	0.889	0.209
Female	63	52.45	7.71	113.13	-1.72	
Total	236					

From Table 1, the result shows that P-value is 0.209 which is greater than 0.05. Based on the result, the null hypothesis was rejected and it was revealed that there was significant difference between the skills and competences acquired by male and female undergraduate Chemistry students in paint production. The result shows that learning took place and that male and female undergraduate Chemistry students did not learn equally. This reveals that if male and female undergraduate Chemistry students are engaged with the right equipment, positive result would be achieved, but in favour of the male gender.

Hypothesis 2

There is no significant difference between the performance mean scores of male and female state undergraduate Chemistry students who were trained using the entrepreneurial skill training package developed on paint production

To test hypothesis 2, data in Table 2 were used.

Table 2: Independent Sample t-Test Analysis for State University Male and Female Undergraduate Chemistry Students on Paint Production.

Independent variables	N	Mean	SD	DF	t-cal	P- value
Male (state university)	167	50.52	8.17	2.24	-2.418	0.016
Female(state university)	69	53.38	8.49	1.22	-2.38	
Total	2. 36					

Table 2 shows that p-value is 0.016 which is less than 0.05. Based on the result, the null hypothesis was rejected. It was revealed that there was significant difference between the skills and competences acquired by male and female undergraduate Chemistry students' performance in paint production in the state university.

Hypothesis 3

There is no significant difference between the mean scores of male and female federal undergraduate Chemistry students trained on paint production using the entrepreneurial skill training package

Data in Table 3 were used to test this hypothesis.

Table 3: Independent Sample t-Test Analysis for Male and Female Federal Universities Undergraduate Chemistry Students on Paint Production Module

Independent variables	Means	Std Dev	df	t-cal	P-value
Male (federal university)	49.61	8.98	234	-5.86	0.000
Female (federal university)	67.17	9.93	125.3	-5.94	

From Table 3, the result shows that p-value is 0.000 which is less than 0.05 level of significance. Based on the result, the null hypothesis was rejected. It was revealed that there was significant difference between the skills and competences acquired by the male and female federal university students. The result indicated that learning took place and male federal universities did not learn as much as their female counterparts.

Hypothesis 4

There is no significant difference between the mean scores of the B.Sc and B.Sc(Ed) degree undergraduate Chemistry students who were trained using the entrepreneurial skill training package developed in paint production.

To test hypothesis four, data presented in Table 4 were used.

Table 4: Independent sample t-Test Analysis for B.Sc male and B.Sc(Ed) Female Degree Undergraduate Chemistry Students on Paint Production.

Independent variables		N	Mean	SD	Df	T – cal	P-value
Chemistry (Ed) Male	**B.Sc**	153	49.61	8.96	231	-1.43	0.152
Chemistry (Ed) Female	**B.Sc**	83	53.31	4.86	13.132	-1.52	
Total		236					

From Table 4, the result shows a p-value 0.152 which is greater than 0.05 level of significance. Based on the result, the null hypothesis was not rejected. It was revealed that there was no significant difference between the skills and competences acquired by B.Sc male and B.Sc(Ed) female undergraduate Chemistry students.

DISCUSSION OF FINDINGS MALE

The purpose of the study was to determine whether there was difference in the learning outcome of male and female undergraduate Chemistry students. The findings revealed that there was no statistically significant difference between the mean scores of male and female undergraduate Chemistry students. This shows that there was no significant difference between the skills and competencies acquired by male and female undergraduate Chemistry students in paint production.

CONCLUSION AND RECOMMENDATIONS

Based on the findings, the researcher has concluded that gender disparity reported in many studies is the same case here. There is significant difference between the mean scores of male and female undergraduate Chemistry students who were trained using the entrepreneurial skill training package on paint production for skill acquisition in North Central Zone, Nigeria. From the findings of the study, the following recommendations were made:

1. Chemistry lecturers should evoke strategies that will sustain gender equality.
2. The number of female undergraduate Chemistry students is lower than male undergraduate Chemistry students in both B.Sc. and B.Sc. (Ed) Chemistry. Hence more female friendly Chemistry topics and concepts should be organized and taught entrepreneurially.
3. Developed entrepreneurial skill training package on chemical products production should be made available to both genders.

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