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A Comparative Study of Federal and State University Undergraduate Chemistry Students' Performance on Paint Production Using a Developed Module in North Central Zone Nigeria

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Abstract:
The study compared undergraduate chemistry students' performance in paint production using a developed entrepreneurial skill training module. It specifically compared the entire undergraduate chemistry students of Federal and State Universities in the North Central region of Nigeria on one hand and the male and female students on another hand. The objective was to assess the students' ability to use the module successfully to produce paint and to assess their entrepreneurial skills. Non-randomized post-test only quasi experimental design was employed to carry out the study. Two hundred and thirty-six (236) students were randomly selected for the study. Two instruments – chemistry lecturers' rating scale (CLRS) and chemistry lecturers' questionnaire (CLQ) were developed and used. Data were analyzed using t – test statistical tool. The results showed a significant difference (p = 0.016) between the mean scores of State and Federal University undergraduate chemistry students who were trained using the entrepreneurial skill training module for paint production in favor of the State Universities. There was also a significant difference (p = 0.000) between the mean scores of the male and female undergraduate chemistry students in both federal and state universities trained using the draft entrepreneurial skill training module on paint production. The study recommended the use of the developed entrepreneurial skill training module for the teaching of undergraduate chemistry students in Universities to enable them acquire entrepreneurial skills.

Keywords: *Undergraduate, module, entrepreneurial, paint, north central Nigeria*

1. Introduction

Chemistry is an important course taught in the Nigerian universities. Of the science subjects, chemistry is a key subject upon which the bulk of the present technological break-through is built (Gongden, 1998). It also occupies a unique position in science education. According to Uwague and Ojebah (2010), chemistry is typically an investigative and experimental science involving the study of nature and properties of all forms of matter coupled with the changes these matters undergo under different conditions. The concept of chemistry as a science is centered on life and this encompasses the three states of matter-solid, liquid and gas in a give and take processes. Students offering courses such as medicine, biology, pharmacy, physics, biochemistry, microbiology, home economics, etc. are required to take chemistry. In Nigeria, chemistry is offered at the senior secondary level of education alongside other subjects like physics, biology, and mathematics (as science subjects). It is taken either as a single or combined course for the award of Nigeria Certificate in Education by colleges of Education. In the University, various degrees are awarded such as Bachelor of Science, Bachelor of Science Education, Masters of Science, Post Graduate degrees and Doctor of Philosophy in different branches or disciplines of chemistry. Essentially, chemistry forms the bed rock subject for all science and science related courses in the tertiary institution as any student wishing to study engineering, agriculture, medicine, pharmacy, nursing, optometry, medical laboratory, etc. and even social sciences requires a credit pass in chemistry at the ordinary level.

A lot of activities centered on the study of chemistry such as the management of natural resources, manufacturing, processing and storage of food and health facilities and a favorable living environment draw their basis from chemistry as Ezeudu (2000) remarked. Chemistry students to understand what happens in the world they live in and how they can apply its knowledge to improve the quality of life and create self-employment on this planet. Chemical knowledge and chemical principles are also applied in the manufacture of products that improves man's luxury such as herbicides, insecticides, plastic products, foams, drugs, clothing materials etc. (Oak, 2011). Most products such as drugs, plastics, polymers, etc. are products of chemical research. Through the study of chemistry, it is hoped that students will be helped to acquire entrepreneurial skills in various areas of chemistry endeavors especially at the higher institutions of learning.

Uwague and Ojebah (2008) observed that chemistry is one of the naturally and well-established means through which the nation's abundant natural resources can be harnessed into useful ventures for the overall economic and socio-political wellbeing of its

citizenry. Writing on similar issue, Okieimen (2007) asserted that chemistry is all about everything in the world. He added that chemistry is the nucleus of science which ultimately is the foundation upon which the development of any nation is hinged. Chemistry certainly cannot be divorced from any today human activities. The N.P.E (2004) stated categorically that science, including chemistry education shall emphasize teaching and learning of science processes and principles leading to fundamental and applied research in the sciences at all levels of education.

The rate at which unemployment rate is increasing especially in Nigeria, has become a source of concern to well-meaning citizens. It is a cankerworm that is affecting the development and the growth of the nation such that there is the need to look for an alternative ways or methods to reduce the rate of unemployment as a way of transformation that would bring about self-reliance and economic development.

Chemistry has played a major role in science, technology and society, and it still does so today. The emphasis by the Nigerian government on science and technology as a necessary ingredient for national development as clearly spelt out in the National Policy on Education (FME, 2008) and vividly portrayed in the increasing number of new Science and Technical Colleges, Polytechnics and Universities of Technology is commendable. The change in the structure of the educational system (in Nigeria) to the 6-3-3-4 and now 9-3-4 was geared toward ensuring that sufficient opportunities are opened to citizens to get the best scientific education possible. The need for a global awareness on the need to improve the quality of science and technology at all levels of education therefore becomes important. Chemistry topics are generally related or based on the structure of matter and proved to be a difficult subject for many students. Science Education is designed to guide the world towards a development of self-reliant nation. The goals of science education in Nigeria include among others; cultivating, knowing, inquiring and 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 (FRN 2004:29). Regrettably, chemistry and its education is yet to make any noticeable impact in the nation due to lack of commitment on the part of the government and all stake holders.

1.1. Statement of the Problem

At the university level of education, the 400 level undergraduate chemistry students are required to display a high level of chemical knowledge prowess, be able to effectively apply what they have learned theoretically in the class for self- reliance as a cardinal objective of university education. However, research evidences have shown that formal education in Nigeria has not provided school learners with functional education (i.e. education for self-reliance) rather, it has continued to turn out half-baked graduates with mere certificates which are not justified by such graduates in most labor markets and industries.

Chemistry which should be taught using hands-on and minds-on (practical) approach is basically taught theoretically which makes the learner not to benefit maximally from their education. It was also revealed that understanding of the principles and applications of knowledge gained for cognitive growth as well as technological advancement, hence development of useful skill necessary for self-reliant living is lacking. Beside this, teaching of chemistry theoretically to students is difficult because they are likely to complain that "theory is boring! Lectures are boring! School is boring! And so, everything in the chemistry lecture becomes irrelevant. The purpose of teaching chemistry should be to assist the students to become skilled and be self-employed.

The present trend of mass unemployment in Nigeria shows that the science education including chemistry education being taught in schools do not prepare Nigerian graduates to function well in the nation undergoing transition from rural economy to modern economy. He researcher further observed that the lack of entrepreneurship ability among chemistry graduate could be attributed to the lack of skills occasioned by absence of training modules by teachers. Therefore, the concern of this 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 the graduates or youth so that they can acquire the right entrepreneurial habits, attitudes and saleable skills with which they can explore their environments as well as means of surviving the face of unemployment.

1.2. Objective of the study

The objective of the study was to assess undergraduate chemistry students' ability to use a module to produce paint successfully. It also aimed at assessing their entrepreneurial skills. Specifically, the study was carried out to:

i. Compare Federal and State Universities undergraduate chemistry students' performance in paint production using a developed entrepreneurial skill training module
ii. Compare male and female undergraduate chemistry students' performance in paint production using a developed entrepreneurial skill training module

1.3. Research Hypotheses

i. There is no significant difference between the mean scores of State and Federal University undergraduate chemistry students who were trained using the entrepreneurial skill training module for paint production.
ii. There is no significant difference between the mean scores of the male and female undergraduate chemistry students in both federal and state universities trained using the draft entrepreneurial skill training module on paint production.

2. Materials and Methods

The study employed the non-randomized posttest only quasi experimental design. A sample of two hundred and ninety-six (296) respondents made up of two hundred and thirty-six (236) undergraduate chemistry students and sixty (60) chemistry lecturers from four north central Nigerian universities was drawn from the lecturers and students' population of one thousand six hundred and forty

(1640). The researchers developed two instruments – the chemistry lecturers' questionnaire (CLQ) and the chemistry lecturers' rating scale (CLRS) were used for data collection. The instruments were validated by five experts from the department of chemistry and science education, University of Jos and University of Agriculture Makurdi. The instruments were pilot tested using Cronbach Alpha formula which yielded coefficients of 0.83 and 0.86. The developed entrepreneurial skills training module was developed by the researchers on paint production. The treatment lasted two days during which data collected were also collected at various intervals using the CLQ and CLRS. The data collected were analyzed using mean and standard deviation to test the hypotheses at 0.05 level of significance.

3. Results

- Hypotheses 1: There is no significant difference between the mean scores of State and Federal University undergraduate chemistry students who were trained using the entrepreneurial skill training module for paint production.

Ind. Variables	N	Mean	SD	df	t-cal	P-value
Fed. Univ	167	50.52	8.17	224	-2.418	0.016
State Univ	69	53.38	8.49	122	-2.38	
Total	236					

Table 1: Independent sample t-test analysis for Federal University and State University on paint production module

From the table, P (0.016) < 0.05. This means that there is significant difference between the skills and competences required by Federal University Undergraduate chemistry students in Paint production and those of State University undergraduate chemistry students in favor of the State Universities. Based on the result the null hypothesis was rejected.

- Hypothesis 2: There is no significant difference between the mean scores of the male and female undergraduate chemistry students in both federal and state universities trained using the draft entrepreneurial skill training module on paint production.

To test hypothesis 2, the related data were tested using t- test statistics at 0.05 level of significance. The result obtained is presented in Table 2.

Ind. Variables	Means	Std Dev	df	t – cal	P – value
Female	49.61	8.98	234	-5.86	0.000
Male	67.17	9.93	125.3	-5.94	

Table 2: Independent sample t-test analysis for male and female undergraduate chemistry students in federal and state universities on paint production module

P (0.000) <0.05. From Table 2, 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 is significant difference between the skills and competences acquired by male and female students in both federal state universities. Table 2 also reveals that male students performed better than the female students – an indication that learning took place and male undergraduate chemistry students learned more than their female counterparts in both universities. This reveals that if male undergraduate students in federal and state universities are engaged with the right equipment, positive results could be achieved than the females. The null hypothesis was rejected. Therefore, there is a statistically significant difference between the mean scores of the male and female undergraduate chemistry students in both federal and state universities trained using the draft entrepreneurial skill training module on paint production.

4. Discussion of Results

The research investigated the skills required by undergraduate chemistry students for the development and determining the effects of entrepreneurial skill training module for paint production. The results showed a significant difference between the mean scores of State and Federal University undergraduate chemistry students who were trained using the entrepreneurial skill training module for paint production in favor of the State Universities. The finding here is consistent with that of Olasehinde and Olatoye (2014) who concluded that there is a significant difference between public and private schools (in this case, state and federal) in science achievement. One possible reason here is the fact that most state universities are not only well equipped for teaching but are closely monitored by the proprietors (the state governments) than the poorly funded (equipped) federal universities. The political will to fund state universities is mostly present than in federal universities. Therefore, the resources or facilities for implementation of the modules are readily available in state schools than public universities. Nbioho and Daodu (2014) had earlier found out that skills are required for the development of entrepreneurial skill training module for planning fish breeding and hatching. Similarly, Obiyai, Ekpedu and Ekubo (2011) also found out that skills are required for the development of entrepreneurial skill training module for farmers in fish production and marketing occupation.

There was also a significant difference between the mean scores of the male and female undergraduate chemistry students in both federal and state universities trained using the draft entrepreneurial skill training module for paint production. The male undergraduate chemistry students performed better than their female counterparts. This finding is consistent with those of Eribe and Ande (2006) who had earlier found out that there exists gender difference or inequality in science achievement among science students all over the

world. Dhindsa and Emran (2011) observed that most studies on gender difference report male dominance. Ezeudu, Gertrude, Chiaha, Anazor, Eze and Omeke (2015) reported that male students performed better than female students in chemistry tasks. Casey (2001) reported higher problem solving among males than female students. Onekutu (2002) had also found that male students performed better than females with an increasing gap in chemistry examination. This is due to the fact that female students encountered problem solving difficulties more frequently than their male counterparts (Adesoji and Babatunde, 2008). Gongden (2015) reported that male chemistry students have better reasoning ability than females. The life-world experience and interaction of male students with the environment helped them visualize abstract ideas than females. They therefore learn and do better in tasks that require high level of abstract thinking. Another reason is the fact that males are generally more enterprising and business oriented than females. The society places much responsibility on males than females such that anything that will lead a man to succeed financially will have his interest and attention.

The finding however, is contrary to that of Olorundare and Aderogba (2009) who found out that no significant difference occurred between male and female students' performance in chemistry. Kumar and Helgeson (2000) in a study on the effects of gender on computer-based chemistry problem solving using hyper equation on the Macintosh computer platform reported no significant difference between male and female students.

5. Conclusion

The study set out to assess undergraduate chemistry students' ability to use a module to produce paint successfully. It also aimed at assessing their entrepreneurial skills. Undergraduate chemistry students from Federal and State Universities in north central Nigeria were compared. The result showed that undergraduate chemistry students in state universities performed better in paint production using the developed module than their counterparts from federal universities. It also showed that male students generally performed better than female undergraduate students. The study recommended the use of the developed entrepreneurial skill training module for the teaching of undergraduate chemistry students in Universities to enable them acquire entrepreneurial skills. It also recommended that graduates of chemistry from universities be given low interest loans by government to embark on production of paints and other chemicals that are useful and economically empowering. Female undergraduate students should be encouraged to learn to use the developed entrepreneurial skill training module for paint and other productions so as to be self-reliant.

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