

The Potential Impact of Entrepreneurial Skills on Chemistry Education Students' Achievement in the Sciences in Federal University, Oye Ekiti

Folasade Busayo Ojobola^{1*}, Femi Emmanuel Babalola² and Adekola Adenike Adedun³

¹Science Education Department Federal University Oye, Nigeria

²Science Education Department Federal University Oye, Nigeria

³Science Education Department Federal University Oye, Nigeria

ABSTRACT

The research investigated how entrepreneurial skills influence the academic achievements of chemistry education students in the field of chemical production at the Federal University Oye-Ekiti, Ekiti State, Nigeria. The study involved eighty (80) 300Level and 400Level Chemistry Education students, in which thirty (30) were males and fifty (50) were females. A quasi-experimental research design was utilized for this investigation. Entrepreneurship Chemistry Achievement Test (ECAT) was employed as the primary assessment tool. The examination items were formulated based on the concepts within chemical production, a sub-topic under polymer chemistry. Data obtained were analyzed using measures of central tendency such as mean and standard deviation. Hypotheses were tested through the application of t-test statistical analysis. Findings from the study revealed that students who participated in hands-on exercises related to chemical production exhibited superior performance compared to those who did not engage in practical activities, based on this finding, it was recommended that equipping chemistry education graduates with technical skills, wider and deeper knowledge of chemical analysis tools in addition to professional skills should be an integral part of the school curriculum not just for improved academic performance but also wealth creation, poverty reduction and youths' self-employment.

*Corresponding author

Folasade Busayo Ojobola, Science Education Department Federal University Oye, Nigeria. Tel: 08032565937.

Received: January 17, 2024; **Accepted:** January 24, 2024; **Published:** January 30, 2024

Keywords: Entrepreneurial, Skills, Chemical Production, Achievement

Background to the Problem

It was opined that students who received excellent entrepreneurial skills during their chemical production middle school years will be more likely successful in chemical production than those who do not. Studies have identified several key areas where entrepreneurial skills can support students in becoming successful chemical producers. One of the primary ways in which entrepreneurship education can support chemical production is by fostering a mindset of innovation and creativity. Chemical production is a complex and constantly evolving field, and successful producers must be able to adapt to new technologies and approaches in order to remain competitive. Chemistry education involves the instruction and learning of chemistry principles. It is one of the subsets of STEM education or disciplined-based education research (DBER) and it plays a key role in the future progress of humankind [1]. Science teaching in general particularly chemistry is very crucial for entrepreneurial skills development to students. However, the current output of educational institutions seems deficient in this proficiency. Contended that the effectiveness and lasting nature of skills gained through education, along

with their reinforcement and potential enhancement, rely on continuous practical application, testing, and reevaluation in real-life situations [2]. Hence, chemistry students graduating from the Nigerian education system should be able to transfer the knowledge and skills they have acquired in the classroom to novel situations and utilize them in solving problems daily. By developing entrepreneurial skills such as problem-solving, critical thinking, and creativity, students can become better-equipped to tackle complex issues and develop innovative solutions that allow them to stay ahead of the curve.

Entrepreneurial education will lead to increased employment, reduce poverty level, bring about entrepreneurs looking together for common good and consequently establishing a stronger economy than the present Nigeria economy. Entrepreneurs have the opportunity to utilize their country's resources to expand their businesses, generate employment opportunities, and address the need for specific skills within their societies, fostering growth. If students have skills in entrepreneurship, they are likely to see greater success in their chemical production studies. This certainly would be advantageous for students, as they would be able to learn more in a shorter amount of time, and would have a better understanding of how the process works. The hope of the

government providing white-collar jobs for the teeming youths graduate has become a mirage. This has posed a significant risk of joblessness. In this circumstance, it becomes imperative that a serious adjustment is required for out of school or graduate to plan for a life-long survival. This rethinking is embedded in the National policy on education (FRN, 2008), it states that an individual is to acquire appropriate skills, abilities and competencies both mental and physical as tools for individuals to thrive and contribute to societal progress [3]. This guideline was proactive enough as a signal that the government can no longer meet the aspiration of the graduate youths. It was a timely policy, hence the need to nurture a paradigm shift in the time of failure on the part of the government to meet its expectation. In view of this, the youth should be apprehensive of what is ahead of them. At this point, the need to seek a timely avenue for self-employment and self-fulfillment becomes necessary. In plain terms, the Nigerian youths can no longer rely on the nation's labour market for jobs after graduation. Students' academic achievement refers to the level at which students fulfill their educational objectives, whether short-term or long-term. This is typically determined through internal or external examinations; there are two primary types of evaluations to gauge academic performance: formative and summative evaluations. Continuous assessment, a type of formative evaluation, offers early insights into students' performance, aiming to provide additional support for those who struggle. Continuous assessment also provides students with information that can be used to improve their academic achievement (Wikipedia, 2019). For the past decades, these objectives were ignored, until in the recent time where graduates could no longer get employment immediately due to their unskilled potential [4]. This led to many ventures in entrepreneurial development; unfortunately, they are not properly equipped, nor prepared to face the challenges of the new survival. This informed the nature of the colonial inheritance that our curriculum was tailored to produce "job seekers" and not "job creators". The potential success of a country's economy may largely hinge on the resourcefulness of its youth. This largely untapped and potentially lucrative resource could be the cornerstone of the nation's prosperity. If it remains this way, it may lead to increased poverty, lack of employment, and a poor educational system. It is in realization of this, that Nigeria had to adjust her education system and diversified her curriculum to integrate academic knowledge with technical and vocational skills so as to empower the graduates from the education system with relevant knowledge and skills. The aim is to make them self-reliant and useful members of the society in which they live (Federal Republic of Nigeria (FRN), 2004). Entrepreneurial education integrates the process of initiating, operating, and sustaining a new business from a recognized opportunity into the student curriculum. While some believe entrepreneurship is innate, it's important to acknowledge that acquiring skills is crucial for becoming a successful entrepreneur, to this end, this study is poised to examine the potential impact of entrepreneurial skills on Chemistry Education students in Federal University Oye in other to establish a fact on its significance as well as contribute to the body of academic knowledge.

Statement of The Problem

Joseph (2015) argued that science education programs are structured to equip pre-service science teachers with necessary knowledge, ethics skills and attitude above the challenges in classroom. Also, the inclusion of courses such as chemistry laboratory techniques, metal and alloys, environmental and industrial chemistry, liquid state and colloids, organic and natural products chemistry and lot of practical leading to synthesis, tests and characterization

of organic and inorganic substances among others indicates a good design of the programme of entrepreneurship development skills. However, because of several problems that have plagued the study of science, products from schools are bereft of initiative and innovation of productive thinking that may lead to self-employment. Hassan (2018) posited that, what is being practiced today in science education is seen to be at level of memorizing facts, principles, theories and laws. Despite all efforts to produce graduates that could be self-sustained particularly, as it was emphasized and provided in the National Policy of Education (FGN, 2008), emphasizing that, graduates at all level should be self-reliant, it appears there is no remarkable impact that could lead to the skills required for self-employment [4]. Hence, this study tends to address the skill gaps by putting entrepreneurship at the fore front in the teaching and learning of chemical production among chemistry education students and subsequently examining the potential impact of entrepreneurship skills in the academic achievements of these undergraduate chemistry education students.

Objectives of the Study: The Objectives are:

1. To determine the extent of background knowledge exhibited by chemistry education students taught in polymer chemistry.
2. To determine the mean achievement scores of students exposed to chemistry entrepreneurship activities and those not exposed to entrepreneurial skills
3. To determine the mean achievement scores of chemistry education students before practical engagements and after hands-on experiences.
4. To determine the mean achievement scores of male and female students when exposed to entrepreneurship activities in chemistry.

Research Questions

1. What is the mean of pre-test scores of chemistry education students taught polymer chemistry?
2. What is the mean achievement scores of students exposed to chemistry entrepreneurship activities and those not exposed to entrepreneurship activities?
3. What is the main achievement scores of chemistry education students before engagement in practical activities and after hands-on experiences in chemical production?
4. What is the mean achievement scores of male and female students when exposed to entrepreneurship activities in chemistry?

Research Hypotheses

1. There is no significant difference in the mean achievement scores of chemistry education students expose to entrepreneurship activities and those without exposure.
2. There is no significant difference in the achievement scores of male and female chemistry education students exposed to practical activities on entrepreneurship.
3. There is no significant difference in the mean achievement scores of male and female chemistry education students not engaged in entrepreneurship activities.

Methodology

This study involved the use of quasi experimental pre-test post-test control group design in which undergraduate students were randomly assigned into experimental and control group. The two groups were pre-tested on the dependent variables before the implementation of the study and then post-tested after the treatment has been administered. The instruments used for this study are researcher designed pre-test and post-test Entrepreneurship

Chemistry Achievement Test (ECAT). Twenty items questions were used in which four options were given; the students were to underline the correct options from the list of options given. The test items were drawn from various concepts taught in CHM311 (Polymer chemistry) which include nature, classification and composition of crude oil, characteristics and scope of petroleum industry, oil refining, chemical conversion, alkylation, halogenation, petrochemicals and catalytic cracking among others. The pre-test was designed to test the homogeneity of the two groups (experimental and control groups) and it was administered to all the students before treatment. The research involved two main stages which were the administration of pre-test and post-test that contained the same questions arranged in different order. The course was done over a period of three months in which various concepts in polymer chemistry were covered. Students in year 3 and year 4 were randomly assigned to treatment groups. The pre-test was administered to the whole students before the experimental groups were subjected to treatment. After the administration of the pre-test, students in the experimental group (400level) were exposed to various practical activities in chemical production, production of liquid wash, paint production, air freshener production, and production of detergent where they acquired various entrepreneurship skills. Also students in the control group were taught polymer chemistry without exposure to any practical activities that can enhance their entrepreneurial skills. The teaching and learning process lasted for 12 weeks and a post-test was administered to all students. The Entrepreneurship Chemistry Achievement Test was designed as two equivalent tests that contain the same questions arranged in different order. In other words, they are equal in content difficulty level and psychometric properties.

Results and Discussion

Research Question 1: what is the mean of pre-test scores of chemistry education students taught polymer chemistry?

Pre-test scores of students obtained from Entrepreneurship Chemistry Achievement Test (ECAT1) were analyzed using mean and standard deviation as shown in table 2 below.

Table 3: Mean of Pre-Test Scores of Students Taught Polymer Chemistry in Both Groups

	Male		Female		Total	
	N	Mean X	N	Mean X	N	Mean X
Experimental group	15	10.89	25	13.80	40	12.34
Control group	15	11.89	25	14.33	40	13.11

Source: Field Survey, 2023

The data presented in table 1 shows the mean of the scores of students in both experimental and control group in the pre-test. The mean (X) of the experiment group is 12.34 while that of the control group is 13.11. The difference is 0.77, this shows that the difference in the performance level of both groups is insignificant. This is because both groups were possessed residual knowledge before the test was administered. As a result of this, the performance of both group are almost at the same level.

Research Question 2: what is the mean achievement scores of students exposed to chemistry entrepreneurship activities and those not engaged in entrepreneurship activities?

Post test scores of students obtained from the Entrepreneurship in Chemistry Achievement Test (ECAT2) were analyzed as shown in table 2 below

Table 2: Mean of Post-test Scores of Experimental and Control Groups

	Male		Female		Total	
	N	Mean	N	Mean	N	Mean
Experimental group	15	27.67	25	40.50	40	34.09
Control group	15	21.44	25	21.17	40	21.31

Source: Field Survey, 2023

Table 2 shows the mean of students' scores in the post-test both for experimental and control groups. The mean of the experimental group is 34.09 which is higher than the mean of the control group of 21.31. The difference is 12.78 which is very significant. The high mean score in the experimental group is due to the engagement of the students in entrepreneurship activities during the teaching and learning process whereas, the mean score is low in the control group due to the absence of hand-on activities.

Research Question 3: what is the mean achievement scores of chemistry education students before engagement in practical activities and after hands-on experiences?

The pre-test and post-test scores of students were compared as shown in table 3 below

Table 3: Comparison of the Pre-Test and Post-Test Mean Scores

Group	Male		Female		Total	
	Pre-test	Post-test	Pre-test	Post-test	N	Mean
Experimental	15	15	25	25	40	41.43
Control	15	15	25	25	40	34.42

Source: Field Survey, 2023

The data presented in table 3 showed the performance of the groups in the pre-test and post-test. The experimental group had a mean score of 41.43 and the control group had a 34.42 mean score. On closer examination of the above table, there was an increase in the performance of students across the group after treatment. From table 1 and 2, the pre-test and post-test mean score for the experimental group is 12.34 and 29.09 respectively, which gives the difference of 16.75; the high mean score of the post-test experimental group is due to the exposure to hands-on activities in polymer chemistry. On the other hand, the pre-test mean score and post-test mean score for the control group is 13.11 and 21.32 respectively which gives the difference of 7.2, the difference is due to lack of exposure to hands-on practical activities in the control group. However, it can be observed that students in the experimental group performed better than those of the control group due to their engagement in entrepreneurship activities embedded in polymer chemistry.

Research Question 4: what is the mean achievement scores of male and female students when exposed to entrepreneurship activities in Chemistry?

Post-test scores of students obtained from the Entrepreneurship Chemistry Achievement Test (ECAT) for both male and female students involved for the experimental group were analyzed using mean and standard deviation as shown in table 4 below

Table 4: Mean of Post-Test Scores of Male and Female Students in the Experimental Group

Gender	N	Mean	S.D
Male	15	27.67	3.51
Female	25	40.50	8.02
Mean & SD difference		12.83	4.51

Source: Field Survey, 2023

The data presented in table 4 showed that male and female students taught using practical work in chemistry had a mean score of 27.67 and S.D of 3.51 (mean=27.67; S.D=3.51) for male students and mean score of 40.50 and S.D of 8.02 (mean=40.50; S.D=8.02) for female students, giving a mean gain to be 12.83 with an S.D difference of 4.5. The mean score of female students in the experimental group is significantly higher than that of their male counterparts. This result indicated that female chemistry education students gain more from various entrepreneurship skills than their male counterparts.

Hypotheses Testing

Hypothesis One

There is no Significant Difference in the mean Achievement Scores of Chemistry Education Students Exposed to Entrepreneurship Activities and Those Without Exposure.

This hypothesis was tested by carrying out a t-test analysis on the scores of both experimental and control group. To do this, the scores from the post-test were gathered together and the mean

and standard deviation were computed and subjected to a t-test analysis as shown in table 5

Table 5: A t-Test Analysis of Post-Test Scores of Students in Both Control and Experimental Group

Categories	N	Mean	S.D	Df	t_{c}	t_{t}	Decision
Control	40	21.31	4.17				
Experimental	40	34.09	5.65				
		78	6.42	1.78	Rejected		

Source: Field Survey, 2023

From table 5, the students exposed to entrepreneurship activities performed better than those without exposure ($t_c=6.42 > t_t=1.78$, $d_f=78$, $P > 0.05$). The null hypothesis which states that there is no significant difference in the mean achievement scores of chemistry education students exposed to practical activities and those without exposure is rejected. Therefore, the alternative which says there is significant difference between the students engaged in the experimental group and their counterpart in the control group is accepted.

Hypothesis Two

There is no Significant Difference in the Achievement Scores of Male and Female Chemistry Education Students Exposed to Practical Activities on Entrepreneurship.

This hypothesis was tested by carrying out a t-test analysis on the scores of both male and female students in the experimental group. To do this, the scores from the post-test were gathered together and the mean and standard deviation were computed and subjected to a t-test analysis as shown in table 6

Table 6: A T-Test Analysis of Post-Test Scores of Male and Female Students Exposed to Entrepreneurship Activities

Categories	N	Mean	S.D	DF	t_{cal}	t_t	Decision
Male	15	27.67	3.51				
Female	25	40.50	8.02				
		38	1.98	1.43	Rejected		

Source: Field Survey, 2023

From table 8, $t_c=1.98 > t_t=1.43$, $df=38$, $P > 0.05$. The null hypothesis which states that there is no significant difference in the achievement of male and female chemistry education students exposed to practical activities in entrepreneurship is rejected. Thus, practical activities in entrepreneurship had significant effect on gender performance among chemistry education students.

Hypothesis Three

There is no Significant Difference in the Mean Achievement Scores of Male and Female Chemistry Education Students not Engaged in Entrepreneurship Activities.

This hypothesis was tested by carrying out a t-test analysis of the scores of both male and female students in the control group. To do this, the scores from the post-test were gathered together and

the mean and standard deviation were computed and subjected to a t-test analysis as shown in table 7.

Table 7: A T-Test Analysis of Post-Test Scores of Male and Female Students Not Exposed to Entrepreneurship Activities

Categories	N	Mean	S.D	df	t_{cal}	t_c	Decision
Male	15	27.67	3.51				
Female	25	40.50	8.02				
	38	1.98	1.43				Rejected

Source: Field Survey, 2023

From table 7, $t_c = 1.45 < t_{cal} = 1.72$, $df = 38$, $P > 0.05$. The null hypothesis which states that there is no significant difference in the achievement of male and female chemistry education students not engaged in entrepreneurship activities is accepted. Thus, male and female chemistry education students do not differ in their performance when not exposed to entrepreneurship activities.

Discussions of Findings

Based on the result of performance obtained from the analysis presented in tables 2 to 7, the following discussions are made:

The result of the mean scores of the pre-test showed that there is not much difference between the experimental group and the control group performance implying that both have the same background knowledge of CHM311 (Polymer Chemistry concept). However, from the post test scores of the students in both groups, it was observed that those engaged in entrepreneurship activities had a marginal gain in their post-test scores than those that lacked entrepreneurship skills. Female students performed better than their male counterparts when engaged in practical activities on chemical production. However, there is no difference in the performance of male and female students that were not exposed to the practical. This shows that entrepreneurship skills exert a great influence on the gender of chemistry education students. This is in agreement with Ferk, et al., who asserts that gender has a crucial role in determining different attitudes and learning styles and consequently different impacts of educational activities on different individuals. The sex role stereotype students are attached to could influence how they performed in both practical and theoretical aspects of chemistry examination [5].

Engaging students in practical activities embedded in entrepreneurship (chemical production) made the chemistry education students understand the concepts taught in polymer chemistry the most and consequently made them to score higher marks. The results of hypotheses showed that students in the experimental group performed better than students in the control group. It can therefore be concluded that practical activities embedded in entrepreneurship makes the teaching and learning of chemistry meaningful. This is in line with who argued that entrepreneurship education will provide opportunities for students to have access to the attitudes, knowledge and skills in relation to those necessary for the development and management of business [6]. Entrepreneurship education equips the students with entrepreneurship skills, abilities and competencies which can help them become self-reliant citizens and live a successful life.

Promoting entrepreneurship skills in chemistry education is designed to give chemists from developing countries the attitudes and skills that they need to bring their innovations to the marketplace. It is therefore very imperative for undergraduate chemistry students to acquire entrepreneurship skills to bring out in them the creativity and innovations with which they are

endowed. It is very necessary for University graduates to be self-employed. Entrepreneurship skills are skills that can make chemistry graduates become self-reliant, creative and generate employment for themselves and others. Chemistry undergraduate students should be taught how to be self-reliant and generate income for themselves without waiting to be employed by the government after graduation. The study concludes that engagement of undergraduate students in practical activities in the teaching and learning of chemical production leads to improved performance among the students compared to when the practical activities are not employed. Acquiring entrepreneurship skills by chemistry students can be used to address the challenges of unemployment. The knowledge and skills chemistry students acquire while learning chemistry could be very useful to them in the development of entrepreneurial skills for wealth creation. Equally, findings revealed the existence of gender parity among chemistry education students when exposed to practical activities in chemical production in the entrepreneurship in chemistry education achievement test. The study therefore concludes that the female gender performed better than their male counterparts in the experimental group. The following recommendations were made based on the findings of the study. Chemistry teachers/lecturers should teach chemistry with the aim of equipping chemistry education graduates to acquire technical skills, wider and deeper knowledge of chemical analysis tools, professional skills such as teamwork, communications, and basics business skills that will make them successful and effective entrepreneurs. Appropriate teaching strategies such as field trips demonstration and inquiry in teaching entrepreneurship education should be encouraged so that chemistry students will grasp the basic knowledge very well.

References

1. Jones A Z (2008) Physics. Received 20th June, 2009 from <http://physicsciabout.com>
2. Nwosu EJ, Nwaocha C (2004) Towards a meaningful educational reform in developing countries. The Nigerian journal of development studies 1: 1-21.
3. Federal Government of Nigeria (FGN,2008) National Policy on Education. NERDRC Press, 3 Jibowu street, Yaba Lagos, Nigeria. http://wbfiles.worldbank.org/documents/hdn/ed/saber/supporting_doc/AFR/Nigeria/TCH/National%20Policy%20on%20Education.pdf
4. Millennium Development Goals (2015) University training for entrepreneurial competencies: Its impact on intention of venture creation. International Entrepreneurship and Management Journal 7: 239-254.
5. Ferk M, Maja Q, Zvezdana P (2013) Female vs. Male Entrepreneurship is there a difference? Studies of Organizational Management & Sustainability 1: 67-77.
6. Alabi EO (2014) The new 9-year basic science and Technology curriculum and challenges of its implementation. Journal of Curriculum and Instruction 6:1-6.

Copyright: ©2024 Folasade Busayo Ojobola, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.