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PRACTICAL APPROACHES AND SENIOR SECONDARY SCHOOL STUDENTS' ACQUISITION OF ENTREPRENEURIAL SKILLS IN SOAP PRODUCTION IN UYO LOCAL GOVERNMENT AREA OF AKWA IBOM STATE, NIGERIA.

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Abstract
The ability of students to acquire entrepreneurial skills will bring about growth, creativity and innovation. The study investigated the effects of practical approaches on acquisition of entrepreneurial skills in senior secondary school students in soap production in Uyo Local Government Area of Akwa Ibom State. The design was quasi-experimental design of pre-test, post-test non-randomized group. Population comprised all the senior secondary two (SS2) students. A sample of 129 students in three intact classes was selected by simple random sampling technique. Acquisition of Entrepreneurial skills (AES) check list in soap production was used to collect data. Reliability of the instrument was found to be 0.82. Descriptive statistics of mean and standard deviation was used to answer research questions, while hypotheses were tested using Analysis of Covariance (ANCOVA) at p≤0.05 level of significant. Findings of the study showed that students taught soap production using hands-on activity approach acquired skills better than those taught using virtual laboratory approach, followed by those taught using expository approach. There was a significant effect of practical approaches on students' acquisition of entrepreneurial skills. But there was no significant difference in male and female students' acquisition of entrepreneurial skills. Also there was no significant interaction effect of practical approaches, gender and acquisition of entrepreneurial skills in soap production. Based on the findings of this study, it was concluded that hands-on activity was most effective in producing students' acquisition of entrepreneurial skills. There was no significant effect of gender across treatment groups.

Key words: Practical approaches, Acquisition, Entrepreneurial skills, Secondary school, Soap production

Introduction

Chemistry is one of the science subjects studied in the secondary and tertiary institutions. It is the study of composition, structure, properties, interactions, transformations of organic and inorganic substances and various elementary forms of matter. It is often referred to as ―the central science‖ which enables students to better understand natural phenomena and the world they live in (Majid & Rohaeti, 2018). It is a foundational science and thus often a core requirement for the study of any science courses at the tertiary level of education. It is relevant to a number of manufacturing industries such as pharmaceuticals, food processing, agricultural, clothing and textiles, cosmetics, petrochemical as well as metallurgical industries (Gongden, 2016). It prepares students for the real world of work through career opportunities such as chemical engineering, medicine, pharmacy, cosmetics, food science, and environmental studies (Mahdi, 2014). These activities are planned to develop in students the needed self –reliance for future risk takingas noted by Wahyudiati & Rohaeti (2020), there is a need to promote

Chemistry education so that individuals are prepared to solve future scientific challenges and contribute to the collective development of society.

Difficulties in learning Chemistry are perceived to be lack of vision to be in the field of Chemistry in their future life; others find it to be difficult to learn and teach; and they feel that they are ineffective when engaged in it (Hanson, 2017). Some researchers have identified the reasons for poor performance in Chemistry to include: poor instructional approaches (Harkirat & David, 2014); abstract nature of Chemistry concepts (Adkins, 2020); students' attitude (Akubuiro, 2014); psychological factors such as anxiety and low self-esteem (Ajayi & Ogbeba, 2017); lack of qualified teachers (Okwuduba, 2018); poor infrastructure and inadequate laboratory facilities (Adeyegbe, 2015) and non-availability and utilization of instructional materials (Yusuf, 2014). These have led to teachers not exposing the students to adequate acquisition of entrepreneurial skills approaches. Ajayi & Ogbeba (2017) attributed the poor performance partly to the teachers' choice of instructional approaches that do not keep the students actively involved through hands-on and minds-on activities during lesson deliveries. Akpan & Babayemi (2022) noted that if effective knowledge transfer is to be achieved through science teaching in this era where entrepreneurial education is greatly emphasized, there should thereby be no separation between the community and the school. The use of community resources provides a shared memory for the class. Hence, the need to employ cutting edge teaching practical approaches that keep the students engaged in hands-on and minds-on to improve in knowledge and skills. Akpan (2017) maintained that traditional methods of instruction should give way to activity-based, mind-on, hands-on, students-centred strategy that enhances entire learning. By so doing, students from basic education level to senior secondary level in science will developed a more in-depth conceptual understanding of science and technology as well as procedures. Akpan (2019) opined that science curriculum should incorporate traditional knowledge, based on field test results. There should be bridge between traditional practices and the school science in the science classroom for easy understanding of science and to bring science to the understanding of all. To achieve this goal of education, Akpan (2016) advocated for a paradigm shift from the present time bound model of education to a lifelong model of education. This is the model of education that is aimed at developing in the learner the ability to effectively create, acquire, use and transmit knowledge for the promotion of human activities in a knowledge dominated society.

Practical approaches are teaching approaches where teachers teach the students by combining theory and practical exercises. They are investigations that are carried out in the laboratory or field which provide students the opportunity of becoming more knowledgeable with scientific concepts. Enohuean (2015) stated that practical approaches are approaches that make the task of teaching more real to the students as opposed to theoretical presentation of facts, principles and concepts of a subject matter. Akpan (2018) observed that the success in the 21st century education depends upon acquiring competencies rather than simply learning facts. Innovation is linked directly or indirectly to human experience, needs and problems. These approaches provide opportunities to collect, analyze data, apply mathematical knowledge to illustrate concepts, facts and principles.

Eden (2019) stated that practical approaches enable the development of students' observation, manipulative and communication skills in chemistry. Akpan (2013) noted that it has become imperative that science curriculum should not only be functional and relevant to the learners and the society, but also should be responsive so as to equip the learners with the current and necessary training, knowledge, values and basic skills needed in the current age. Some of these practical approaches include: co-operative learning, collaborative learning, guided discovery, think- pair- share, use of analogy, inquiry-based learning, problem-based learning, concept mapping, virtual laboratory, hands-on activity, computer simulation and so on. In this study we shall consider the virtual laboratory and hands-on activity approaches. The reason

being that the interest of the learners in the classroom is very paramount and should be sought after and encouraged.

A virtual laboratory approach is an approach that uses computer programme to simulate series of experiments without physically doing them. It helps to transform the object properties, to revolutionize sciences both in practical and theory. A virtual laboratory approach consumes less instructional time, reduces reliance on complex, hazardous, and costly equipment, and allow students to experience high-level investigations that might not otherwise be possible in a real school classroom setting. It enhances the learning process in traditional, face-to-face environments (Rutten, Wouter, Van & Van, 2014). The use of virtual laboratory approach in schools is said to offer access to more students than in a brick-and-mortar school. It is learner- centered and it renews the students' interest (Nwagbo & Ugwuanyi, 2015).

Hands-on activity approach is a practical approach that involves activity and direct interaction with material or nature. It is a practical approach where learners are guided to gain knowledge and skills through experience (Hirça, 2013). These experiences enable students' manipulation of objects to gain knowledge or understanding. According to Fuad, Deb, Etim & Gloster (2018), hands-on activity approach encourages the liking of lifelong learning; motivate learners to explore and discover new facts. Alkan (2016) pointed out that when learners are fully engaged with activities, they are likely to appreciate and learn what they are being taught. Akpan & Ekanem (2017) maintained that the quality of an education system is judged by how relevant its programmes and training are to the labour market. Content should include transferable knowledge in terms of content and on how to apply this knowledge to solve problems. Thus the need for acquisition of entrepreneurial skills in soap production to be independent and contribute to the economic development of the nation.

Acquisition of entrepreneurial skills in soap production is the ability of students to carry out certain practical activities that lead to the production of soap and ultimately selling it. It is the ability of the learner to create soap with value by devoting the necessary time and effort. These activities add value not only to the individual but also to the society. Entrepreneurial skills can be developed at school, during class work, assignments and projects. Obijiofor & Obiadazie (2015) describe acquisition of entrepreneurial skills as a process whereby individuals or groups of individuals use organized effort to pursue opportunities, create value and grow by fulfilling wants and needs through innovation and uniqueness. This is assuming the accompanying financial, mental and social risks and receiving the resulting rewards of financial and personal satisfaction and independence are envisaged.

Muzio, Fisher, Thomas & Peters (2017) describe entrepreneurship as competencies and skills that are acquired through training which emphasize the acquisition and development of appropriate knowledge and skills that enable an individual to maximize the resources available to him and within the limits of his capability. It can lead to the making of leaders who possess skills and attitudes to be entrepreneurs. It will produce youths that are responsible, can take risk, can manage a soap production business and learn from the outcomes by immersing in real life learning experiences. The conditions of modern-day living characterized by complexity and interdependence, technological and communication advances, as well as rising expectations call for increased acquisition of entrepreneurial skills (Khuong & An, 2016). As the society becomes more complex, there is a gradual increase in the awareness that methods used yesterday do not effectively solve contemporary problems of the society (Khuong & An, 2016). This is why entrepreneurial skills are needed in nearly all the facets of the society.

A study by Onyebu (2015) showed a significant relationship between entrepreneurial skills and academic performance of students and that gender does not significantly influence academic behaviour among the students. It was also found that training students on essential and valuable entrepreneurial skills could improve moral education among the students in tertiary institution. Osakede, Lawanson & Sobowal (2017) found that engagement in entrepreneurial activity has no significant effect on students' academic performance.

Soap is an item of daily necessity as a cleaning agent. It is one of the cleaning materials needed by every family (Anyakoha, 2014). Soap is so important that there is hardly any family that does not use it in their daily activities either in the solid bars, liquid and detergent forms. Soap production is one of the large chemical industries because it has a high demand in every part of the world. It is also one of the concepts in the secondary school chemistry curriculum that students are expected to learn. Students can engage in soap production for effective knowledge, comprehension and application of its usefulness in school and after school. Students can engage in soap production, acquire cognitive knowledge and entrepreneurial skills to be independent and contribute to the economic growth of the nation.

Gender is one of the factors affecting performance of students in science. It is a socio-cultural construct that connotes the differentiated roles and responsibilities of men and women in a particular society. This definition implies that gender determines the role, which one plays in relation to cultural, social and economic system of the society. According to Nnamani & Oyibe (2016) gender is a specially constructed phenomenon that is brought about as society ascribes different roles, duties, behaviours and mannerisms to the two sexes. Eden & Mbuk (2019) describes gender as term used to describe a person either as a man/boy or a woman/girl, adding that gender is an important factor that contributes to academic performance in Chemistry.

Osakede, Lawanson & Sobowal, (2017) contend that the societal emphasis on sex role differences tends to favour males in entrepreneurial skills acquisition. Agomuoh (2015) and Ejem & Fab-Ukozor (2015) have demonstrated that males exhibit greater proficiency than females in science and technology concepts. It has been observed that males outperform females in Chemistry (Goni, Yagana, Hajja & Mohammed, 2015); while Eden, *et al.,* (2023) reported that female students exhibit greater aptitude in learning concepts in chemistry. Umanah & Sunday (2022) observed no discernible gender differences in studens‘ academic performance and Onyebu (2015) reported that there was no difference between male and female students on general entrepreneurial tests. They recommended that neither men nor women should be discriminated against in tasks that require demonstration of entrepreneurial skills. It is clear from literature that studies which investigated gender differences in entrepreneurial skills, seem to be characterized by contradictory results.

Statement of the Problem

Entrepreneurial skills are life-long skills that can be taught as early as the elementary school and progress through all levels of education including adult education. When students are exposed to entrepreneurial skills when studying chemistry, they are more likely to choose entrepreneurship careers in future. The problem with our educational system is that students are not taught in a way that enhances entrepreneurial thinking and the assessment procedures do not reward entrepreneurship. This is a serious challenge to our educational system especially the secondary education that should encourage acquisition of entrepreneurial skills like in soap production which can be enhanced through entrepreneurial thinking. There is a dearth in the literature for studies that provide findings for determinants of entrepreneurial engagement particularly among students and whether it has any effect on academic performance. Therefore, the need for this study on acquisition of entrepreneurial skills in soap production.

It is from this backdrop that this study is conducted to investigate the effect of practical approaches and senior secondary school students‘ acquisition of entrepreneurial skills in soap production in Uyo Local Government Area of Akwa Ibom State, Nigeria.

Purpose of the Study

The purpose of this study is to investigate the effect of practical approaches (virtual laboratory, hand-on activity and expository) on the acquisition of entrepreneurial skills and senior secondary school students‘ academic performance in soap production in Uyo Local Government Area of Akwa Ibom.

Research Questions

1. What is the difference in students‘ acquisition of entrepreneurial skills scores in soap production when taught using practical approaches (virtual laboratory, hand-on activity and expository)?
2. What is the difference in male and female students‘ acquisition of entrepreneurial skills scores in soap production when taught using practical approaches?
3. What is the interaction effect of practical approaches and gender on acquisition of entrepreneurial skills in soap production?

Research Hypotheses

1. There is no significant difference in students‘ acquisition of entrepreneurial skills scores in soap production when taught using practical approaches
2. There is no significant difference in male and female students‘ acquisition of entrepreneurial skills scores in soap production when taught using practical approaches
3. There is no significant interaction effect of practical approaches and gender on acquisition of entrepreneurial skills in soap production

Method

The design of the study was a pretest posttest, quasi- experimental, non-randomized design. Quasi-experimental design was considered appropriate for the study because intact classes were used to avoid disruption of normal class lessons. The study was conducted in Uyo Local Government Area of Akwa Ibom State, Nigeria. The population of the study was all public co- educational Senior Secondary School two (SS2) students offering Chemistry in the thirteen (13) public coeducational secondary schools in Uyo Local Government Area of Akwa Ibom State, Nigeria; with a total enrolment of two thousand eight hundred and ninety (2890) students. (Source: Akwa Ibom State Secondary Education Board, 2023/2024 academic session). A sample of one hundred and twenty- nine (129) Senior Secondary two (SS2) Chemistry students were selected from three co-educational schools in the sample area by stratified random sampling technique. A researcher made instruments titled Acquisition of Entrepreneurial Skills (AES) Check list was used. The AES check list comprises of two Sections A and B. Section A was Students‘ Biodata on school name, gender and class. Section B was items on AES. It consisted of 30-items on entrepreneurial skills with a 5-point type scale: 5= Excellent, 4= Very good, 3= Good, 2= Fair, 1= Poor. The instrument was face and content validated by two experienced Chemistry lecturers and a specialist in Test, Measurement and Evaluation in the Department of Science Education. The validators scrutinize the instrument in terms of: clarity of instrument to the subjects, proper wording of items, appropriateness and adequacy of the items for the study. The recommendations by the validators were used to modify the items in the instrument.

In ascertaining the reliability index of the instrument, copies of the instrument were administered to a trial test group of thirty (30) Chemistry students in a school not selected in the main study but found to be equivalent in all respects to the study area. The result obtained after administration was subjected to Cronbach alpha statistics and found to be. 0.82.

The researcher obtained permission from the principals of the selected schools to carry out the research in the schools. The experimental procedure was done with the help of the chemistry teachers as research assistants. The teachers were trained for one week on the use of the lesson packages and how to present lessons effectively using the virtual laboratory, hands-on activity and expository approaches. To ensure uniformity, the Chemistry teachers were taught how to use the lesson packages designed and prepared by the researcher to be used in the selected schools. A training module which consisted of sample lesson packages to be followed when teaching the chosen Senior Secondary Two (SS2) Chemistry students was used. To ensure

uniformity, the researcher designed, prepared and discussed with the Chemistry teachers the sample lesson packages to be used by the selected schools. Before the experimental activities the pre-test AES check list was used to record students‘ base line entrepreneurial skills in the three groups. Thereafter, students in the Experimental group 1, 2 and control groups were taught the concept of soap production using virtual laboratory, hands-on activity and expository approaches respectively. The teaching lasted for 3 weeks under the following headings: Nature and chemical composition of soaps and Laboratory preparation of soaps, production of local soaps and cleansing action of soap, hard water and soap, detergents (soapless), Soap versus soapless detergents. After the teaching, the students were made to produce soap during which the AES Check List was used by the researcher to record students‘ level of acquisition of entrepreneurial skills of measuring, creativity, motivation, originality and finishing. The inter- rater transparency clause was considered in the study. To control the error that might arise as a result of teacher difference on the scoring of acquisition of entrepreneurial skills, the researcher trained the Chemistry teachers of the schools that were chosen for the study using the lesson notes prepared by the researchers. The researchers assessed the research assistants by allowing them to demonstrate what they have been taught at the training. This was done to control the differences that may arise as a result of teacher variable.

The data collected was analyzed using descriptive statistics of mean and standard deviation to answer the research questions, while the hypotheses were tested using Analysis of Covariance (ANCOVA) at $p \leq 0.05$ level of significance. Statistical Package for Social Sciences (SPSS) was used for analysis of collected data.

Presentation of Results

The results were based on the research questions and hypotheses.

Research Question One: What is the difference in students‘ acquisition of entrepreneurial skills scores in soap production when taught using practical approaches?
The result of this analysis is presented in Table 1

Table 1

Mean and standard deviation of students‘ pre-test and post-test mean acquisition of entrepreneurial skills score in soap production

		Pre-test		Post-test		
Groups	N	Mean	SD	Mean	SD	Mean Gain
Virtual Laboratory	37	60.46	15.72	128.73	12.33	68.27
Hands-on Activity	44	52.27	16.38	134.36	11.29	81.09
Expository	48	55.88	19.13	97.58	12.02	23.70

Results in Table 1 shows the mean difference (post-test and pre-test) of students‘ acquisition of entrepreneurial skills when taught using virtual laboratory, hands-on activities and expository approach to be 68.27, 81.09 and 23.70 respectively. This result indicates that students taught soap production using hands-on activity approach acquired skills better than those taught using virtual laboratory approach, followed by those taught using expository approach.

Research Question 2: What is the difference in male and female students‘ acquisition of entrepreneurial skills scores in soap production?
The result of this analysis is presented in Table 2.

Table 2
Mean and standard deviation of male and female students' pre-test and post-test acquisition of entrepreneurial skills scores in soap production

		Pre-test		Post-test		
Groups	N	Mean	SD	Mean	SD	Mean gain
Male	55	58.62	16.74	120.11	18.82	61.49
Female	74	53.99	17.68	118.28	21.99	64.29

Source: Field work 2023

Results in Table 2 show the mean difference (post-test and pre-test scores) for male and female students acquisition of entrepreneurial skills to be 61.49 and 64.29, respectively. This result indicates that female students acquired entrepreneurial skills better than female students in soap production.

Research question Three: What is the interaction effect of practical approaches and gender on acquisition of entrepreneurial skills in soap production?
The result of this analysis is presented in Table 3

Table 3
Interaction effect of practical approaches and gender on acquisition of Entrepreneurial skills scores in soap production

		Pre-test		Post-test		
Groups	N	Mean	SD	Mean	SD	Mean Gain
Virtual Laboratory						
Male	18	60.11	16.11	129.06	9.00	69.49
Female	19	60.79	15.79	128.42	15.08	67.63
Hands-on Activity						
Male	16	51.88	15.79	135.56	11.66	83.68
Female	28	52.50	16.99	133.68	11.24	81.18
Expository						
Male	21	62.48	17.70	100.67	11.20	38.19
Female	27	50.74	18.93	95.19	13.57	44.45

Result on Table 3 shows the pre-test and post-test mean score of the interaction effect of gender and practical approaches on acquisition of entrepreneurial skills in soap production. The result showed that the male students exposed to virtual laboratory had a higher mean gain of 69.49 as compared to the female students who had 67.63. This indicates that virtual laboratory approach proved to be more effective in increasing the mean acquisition of entrepreneurial skills scores of male students in soap production more than their female counterparts. In like manner, male students exposed to hands-on activity approach had a higher mean gain of 83.68 as against 81.18 for the female students. This means that hands-on activity approach proved to be more effective in improving the acquisition of entrepreneurial skills score of male students in soap production more than the female students. Furthermore, the result shows that female students under expository had a higher mean gain of 44.45 when compared to their male counterparts with a mean gain of 38.19.

Research Hypotheses

Hypothesis One

There is no significant difference in students‘ acquisition of entrepreneurial skills scores in soap production when taught using practical approaches.

Table 4

Analysis of Covariance (ANCOVA) of students‘ post-test acquisition of entrepreneurial skills classified by practical approaches (virtual laboratory, hands-on activities and expository) with pre-test as covariate

Source of Variance	Sum ofsquares	Df	Mean	F	Sig
Corrected model	36322.43 [a]	6	6053.74	40.60	.00
Pre-test (Covariate)	23.29	1	23.29	.16	.69
Main effect: Practical Approaches	3444.30	2	17222.28	115.4	.00
Error	18193.08	122	149.12		
Corrected total	54515.54	128			

*significant at p<.05

The result on Table 4 shows the analysis of Variance (ANCOVA) of the effect of practical approaches (virtual laboratory, hands-on activity and expository) on acquisition of entrepreneurial skills. The results show that there is a significant effect of practical approaches on acquisition of entrepreneurial skills (F=115.49; 0= 0.00). Hence the null hypothesis that there is no significant effect of practical approaches on acquisition of entrepreneurial skills in soap production was rejected at the 0.05 level of significance.

To show which of the practical approaches was better in producing acquisition of entrepreneurial skills, a Post Hoc using LCD was performed as reported in Table 5.

Table 5

Summary of LCD Posthoc pair wise comparison of students‘ post- test performance classified by practical approaches

Treatment groups (I)	(J)	Mean Diff (I-J)	Std. Error	Level of sig.
Virtual Laboratory	Hands-activity	-6.09	2.82	.099
	Expository	30.72*	2.69	.000
Hands-activity	Virtual Laboratory	6.09	2.82	.099
Expository		36.81*	2.63	.000
Expository	Virtual Laboratory	-30.72*	2.69	.000
Hands-activity		-36.81*	2.62	.000

*significant at p<0.05

Table 5 shows the Post-Hoc result of the significant effect of practical approaches on acquisition of entrepreneurial skills. Results show that virtual laboratory and hands-on activity do not significantly differ, but virtual laboratory and expository approach differ significantly, hands-on activity and expository differ with virtual laboratory showing more promise in enhancing acquisition of entrepreneurial skills.

Hypothesis two: There is no significant difference in male and female students‘ acquisition of entrepreneurial skills scores in soap production

Table 6

Analysis of Covariance (ANCOVA) of male and female students‘ post-test acquisition of entrepreneurial skills with pre-test as covariate

Source of Variance	Sum of squares	Df	Mean	F	Sig
Corrected model	36322.43 [a]	6	6053.74	40.60	.00
Pre-test (Covariate)	23.29	1	23.29	.16	.69
Main effect:					
Practical Approaches	3444.30	2	17222.28	115.49*	.00
Gender	203.43	2	203.43	1.36	.25
Error	18193.08	122	149.12		
Corrected total	54515.54	128			

*significant at p<.05

The result on Table 6 shows the Analysis of Variance (ANCOVA) of the difference in male and female students‘ acquisition of entrepreneurial skills. The result showed that there is no significant difference in male and female students‘ acquisition of entrepreneurial skills (F= 1.36; P = 0.25). Since the associated probability value of 0.25 obtained was greater than 0.05 level of significance set for decision making, the null hypothesis which states that there is no significant difference in male and female students‘acquisition of entrepreneurial skills scores in soap production was retained.

Hypothesis Three

There is no significant interaction effect of practical approaches and gender on acquisition of entrepreneurial skills in soap production

Table 7

Analysis of Covariance (ANCOVA) of the interaction effect of practical approaches, gender on acquisition of entrepreneurial skills in soap production with pre-test as covariate

Source of Variance	Sum ofsquares	Df	Mean	F	Sig
Corrected model	36322.43 [a]	6	6053.74	40.60	.00
Pre-test (Covariate)	23.29	1	23.29	.16	.69
Main effect:					
Practical Approaches	3444.30	2	17222.28	115.49*	.00
Gender	203.43	2	203.43	1.36	.25
Two-way Interaction: Practical Approaches* Gender	114.61	2	57.31	.38	.68
Error	18193.08	122	149.12		
Corrected total	54515.54	128			

*significant at p<.05

The result on Table 4.26 shows the Analysis of Variance (ANCOVA) of the interaction effect of practical approaches, gender on acquisition of entrepreneurial skills in soap production. The result showed that there is no significant interaction effect of practical approaches, gender on acquisition of entrepreneurial skills (F= .38; P = 0.68). Since the associated probability value of 0.68 obtained is greater than 0.05 level of significance set for decision making, the null hypothesis which states that there is no significant interaction effect of practical approaches, gender on acquisition of entrepreneurial skills in soap production was retained.

Discussion of findings

Findings on the effect of practical approaches on acquisition of entrepreneurial skills in soap production showed that students taught soap production using hands-on activity approach acquired better skills than those taught using virtual laboratory approach, followed by those taught using expository approach. This could be attributed to the fact that students in hands-on activity appreciated the practical activities better than those in the other groups. Hence, there was a statistically significant effect of practical approaches on acquisition of entrepreneurial skills.

Findings on the difference in male and female students‘ acquisition of entrepreneurial skills scores in soap production indicates that female students acquired entrepreneurial skills better than female students in soap production. This could be due to the fact that the female students were more captivated by the practical approaches than their male counterparts since it has to do with mixtures which is typical of kitchen Chemistry that the female students are conversant with. However, the difference was not significant. This is in contrast to Osakede, Lawanson & Sobowal (2017) who contend that the societal emphasis on sex role differences tends to favour males in entrepreneurial skills acquisition.

The non-significant difference in male and female students‘ acquisition of entrepreneurial skills agrees with the findings of Onyebu (2015) on the relationship between entrepreneurial skills and academic performance among the students in tertiary institution. The result indicated that gender does not significantly influence academic behaviour among the students. The findings of this study is in contrast with Osakede, Lawanson & Sobowa (2017) who noted that sex role differences tends to favour males in entrepreneurial skills acquisition.

Findings on the interaction effect of practical approaches and gender on acquisition of entrepreneurial skills in soap production showed that the male students exposed to both virtual laboratory and hands-on activity approach had a higher mean gain as compared to the female students which indicates that virtual laboratory and hands-on activity approaches proved to be more effective in increasing the mean acquisition of entrepreneurial skills scores of male students in soap production more than their female counterparts. This could be attributed to the fact that both strategies were able to develop entrepreneurial skills attributes in students such as technical skills. Students were able to follow the procedure so learned to produce soap with much interest. This agrees with Muzio, Fisher, Thomas & Peters (2017) who described entrepreneurship as competencies and skills that are acquired through training which emphasize the acquisition and development of appropriate knowledge and skills that enable an individual to maximize the resources available to him and within the limits of his capability. However, the interaction effect of practical approaches and gender on acquisition of entrepreneurial skills in soap production was not significant.

Conclusions

The result of this study highlighted the effect of practical approaches in fostering positive acquisition of entrepreneurial skills of Chemistry students in soap production. The hands-on activity approach helped the students to overcome the difficulties inherent in learning the concept of soap production which is a practical based concept and is difficult to understand theoretically by both students and teachers. Based on the findings of this study, it was concluded

that hands-on activity was most effective in producing students' acquisition of entrepreneurial skills. There was no significant effect of gender across treatment groups.

Recommendation

Based on the findings, it was recommended that;

i. The use of virtual laboratory and hands-on approaches should be encouraged for teaching students who will acquire knowledge and entrepreneurial skills that will enable them seek and run an enterprise for socioeconomic empowerment
ii. Teachers of Chemistry in secondary schools should be trained on the use of practical approaches of virtual laboratory and hands-on activity as it will re-emphasize the need for teachers to always enrich the teaching and learning process with good practical approaches that will foster skill acquisition. It will also give direction and confidence to the teacher whose job it is to put the curriculum into use and ensure the attainment of specific objectives of learning science such as knowledge, skills, acquisition and building youths that are economically independent.
iii. Curriculum developers should be able to recommend and incorporate use of practical approaches into the school curriculum which will aid students in understanding the subject better, thereby making the subject or course interesting.

References

Adeyegbe, S. A. (2015). ―A review of chief examiners reports on SSCE May/June Chemistry examination papers‖. In: proceeding of the 45th Science teachers association of Nigeria annual national Chemistry workshop held at Minna, Niger state, Nigeria.

Adkins, D. G. (2020). Effects of hands-on experiences on student performance, interest, and attitude in Chemistry. Electronic Theses and Dissertations. Available at https://scholarworks.sfasu.edu/etds/343. Retrieved on 8th October, 2022.

Agomuoh, P. C. (2015). Effect of prior knowledge exploration, discussion, dissatisfaction with prior knowledge and application (PEDDA) and the leaving circle (TLC) Instructivitst. Instructional model on students' conceptual change and retention, PhD Thesis, University of Nigeria Nsukka.

Ajayi, O. V. &Ogbeba, J. (2017). Effect of Gender on Senior Secondary Chemistry Students' Performance in Stoichiometry Using Hands-on activity. *American Journal of Educational Research*, 5 (8), 839-842

Akpan, I. F. & Babayemi, J. O. (2022). The availability, utilization and efficacy of community resources in the teaching and learning of science for knowledge transfer in senior secondary schools in Akwa Ibom state, Nigeria. *KIU Journal of Social Sciences,* 8(2), 257-265

Akpan, I. F. (2013). Re-packaging primary science curriculum to meet the challenges of globalization and climate change in Nigeria. *Nigerian Journal of Curriculum Studies,* 20 (1), 17-23.

Akpan, I. F. (2016). New trends in science education curriculum for knowledge based economic development in Nigeria. *African Journal of Theory and Practice of Educational Research,* 3, 106-116

Akpan, I. F. (2017).. Reform and quality science education in Nigeria: The needed benchmark for sustainable national development. *African Journal Of Educational Assessors*, 4(1), 91-97

Akpan, I. F. (2018). Innovative science education curriculum; the needed skills for competitiveness in the global economy. *Card International Journal of Educational Research & Management Technology,* 3 (1), 18-25.

Akpan, I. F. (2019). Global challenges in science education in higher education and the way forward. *An International Journal of Academic Discourse*, 11(1), 200-207.

Akpan, I. F. & Ekanem, T. F. (2017). Desired curriculum change in science education basic education level for national development. *Nigerian Journal of Curriculum Studies,* 24 (3), 184-192.

Akubuiro, E. J., (2014). Students' attitude towards science and academic self-concept. *University of Calabar Publication*, 1 (3), 22-34

Anyakoha, E. U. (2011). Home Economics for Junior Secondary Schools. African-first Publishers Plc.

Eden, M. I. (2019). Effects of instructional materials and learning styles on senior secondary students' acquisition of practical skills in Chemistry in Ibiono Ibom Local Government Area. Unpublished master dissertation, University of Uyo, Akwa Ibom State.

Eden, M. I., Etiubon, R. U., Ekong, A. M., Sampson, E. M. &Umoetuk, E. U. (2023). Digital tools utilization and Chemistry students' academic achievement in the teaching of soap production in secondary schools. *Unizik Journal of STM Education*, 6(1), 73-81.

Eden, M. I. &Mbuk, W. (2019). Students' attitude towards Chemistry and their academic performance in selected concepts in Chemistry among secondary school students in Ibiono Ibom Local Government Area, Nigeria. *International Journal of Innovative Research and Advanced Studies*, 6 (12), 19-26.

Ejem, A. A. & Fab-Ukozor, N. (2015). Lookism as a gender-specific concern: Assessment of male and female attitudes towards the appearance of TV programme presenters in Owerri, Imo State, Nigeria. *International Journal of Leadership, Education and Business Studies*, 1 (1), 39-54

Ekenobi, T. N. &Mumuni, A.A.O (2015). Efficacy of advance organizers strategies on Chemistry Student's cognitive achievements in redox reaction concept. *British Journal of Psychology Research*, 3 (5): 16-27.

Enohuean, V. O. (2015). Effects of instructional materials on performance and retention of Biology concepts among secondary school students in Delta State Nigeria, Department of science education Ahmadu Bello University, Zaria, Kaduna- Nigeria.

Fuad, M., Deb, D., Etim, J. &Gloster, C. (2018). Mobile response system: A novel approach to interactive and hands-on activity in the classroom. *Educational Technology Research and Development*, 66 (2), 493–514.

Gongden, E. J. (2016). The Effects of analogy on male and female chemistry students'. problem-solving ability in electrolysis. *International Journal of Scientific Research in Education*, 9 (1), 1-6.

Goni, U., Yagana, S. B., Hajja K. A. & Mohammed W. B. (2015). Gender difference in students' academic performance in colleges of education in Borno State, Nigeria: Implications for counselling. *Journal of Education and Practice,* 6 (32), 107- 117.

Hanson, R. (2017). Enhancing students' performance in organic chemistry through context- based learning and micro activities: A case study. *European Journal of Research and Reflection in Educational Sciences,* 5 (6), 234-245

Hirça, N. (2013). The influence of hands-on Physics experiments on scientific process skills according to prospective teachers' experiences. *European Journal of Physics Education*, 4 (1), 52-61

Khuong, M. N. &An, N. H. (2016). The factors affecting entrepreneurial intention of the students of Vietnam national University—A mediation analysis of perception toward entrepreneurship. *Journal of Economics, Business and Management,* 4 (2), 104- 375.

Majid, A. N. &Rohaeti, E. (2018). The effect of context-based chemistry learning on student performance and attitude. *American Journal of Educational Research*, 6(6), 836-839

Mahdi, G. J. (2014). Students' attitudes towards chemistry: an examination of choices and preferences. *American Journal of Educational Research*, 2(6), 351–356.

Muzio, E., Fisher, D., Thomas, E. R. & Peters, V. (2017). Soft skills quantification for project manager competencies. *Project Management Journal*. 38(2), 30–38

Nnamani, S. C. &Oyibe, O. A. (2016). Gender and academic performance of secondary school students in social studies in Abakaliki urban of Ebonyi State. *British Journal of Education,* 4 (8), 72-83

Nwagbo, C. R. &Ugwuanyi, C. S. (2015). Assessment of science teachers' pedagogical beliefs and information and communication technology (ICT) classroom practices in secondary schools in Enugu State Nigeria. *Journal of Science Teachers Association of Nigeria,* 50 (1), 24-39.

Obijiofor, E. &Obiadazie, R. E. (2015). Improving the teaching of entrepreneurship education through the use of information and communication technology (ICT) in secondary schools. *International Journal of Educational Leadership,* 3(5), 303-309.

Okwuduba, E. (2018). Effect of teaching methods on students' academic effect of teaching methods on students' academic performance in Chemistry in Nigeria: Meta-Analytic review. *Bulgarian Journal of Science and Education Policy,* 12 (2), 2–18.

Onyebu, C. M. (2015). The role of entrepreneurial skills in academic Performance: A case study of selected universities in Abia state, Nigeria. *Review of Public Administration and Management,* 4 (8), 121-130

Osakede, U. A., Lawanson, A. O. &Sobowale, D. A. (2017). Entrepreneurial interest and academic performance in Nigeria: Evidence from undergraduate students in the University of Ibadan. *Journal of Innovation and Entrepreneurship,* 6(19), 1-15

Rutten, N., Wouter, R., Van, J. T. & Van, D. V. (2014). Computers & Education 58 (1), J ISSN 0360-1315 Publisher: Elsevier Ltd. Pp 1-25

Umanah, F. I. & Sunday, E. S. (2022).Crosswords Puzzle, Flashcards Teaching Strategies and Senior Secondary School Students' Academic Performance in Chemistry. *International Journal of Educational Benchmark,* 22(2), 1-12

Wahyudiati, D. & Rohaeti, E. (2020). Attitudes toward Chemistry, self-efficacy, and learning experiences of pre-service Chemistry teachers: Grade level and gender differences. *International Journal of Instruction,* 13, 235–254.

Yusuf, S. D. (2014). Effects of collaborative learning on chemistry students' academic performance and anxiety level in balancing chemical equations in secondary school in Katsina Metropolis, Nigeria. *Journal of Education and Vocational Research,* 5(2), 43–48.