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Assessment of Physics Material Resources in Stem and the Level of Acquisition of Entrepreneurial Skills among Senior Secondary Students in Akwa Ibom North East Senatorial District

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Abstract

The study investigated effective application of STEM education through assessment of physics material resources and the level of acquisition of entrepreneurial skills. A survey design was adopted for the study. Random sampling technique was used in drawing 250 SS3 physics students from 4 urban and 3 rural public secondary schools in Uyo Senatorial District of Akwa Ibom State. Four research questions were raised and two null hypotheses were formulated to guide the investigation. Two instruments, Physics Entrepreneurial Skills Acquisition Test (PESAT) with reliability coefficient of 0.72 and Physics Material Resources Assessment Checklist (PMRAC) with reliability coefficient of 0.81 were used in generating the data for the study. The reliability coefficients were determined using Pearson Product Moment Correlation Technique (PPMC). Mean and percentage were used in answering research questions while t-test was used in testing null hypotheses at significant level of 1.05. The findings revealed that physics students have low level of acquisition of entrepreneurial skills. There is no gender or location influence in the level of acquisition of entrepreneurial skills among physics students. The study also revealed that resource materials for teaching and learning of entrepreneurial skills were either rarely or non-available in secondary schools. Based on the findings, it was recommended that adequate resources should be provided by the State Ministry of Education for effective acquisition of entrepreneurial skills on STEM education.

Keywords: STEM Education, assessment, physics, material resources, acquisition and entrepreneurial skills.

Introduction

Globally, science and technology is recognised as a powerful tool for national development. It is in realisation of this that Nigeria had to adjust her education system and diversified her secondary school curriculum to integrate academic knowledge with technical and vocational skills aimed at empowering the graduates from secondary education system with relevant knowledge and skills (Njoku, 2008).

The Federal Government of Nigeria in the National Policy on Education stressed the need for functional education and school programmes to be relevant, practical and comprehensive (FRN, 2004). *[The present system of education in Nigeria is expected to*

equip the students on graduation with skills capable of making them entrepreneurs rather than job seekers. The acquisition of entrepreneurial skills by members of the society is a means of increasing the production power and employment in any nation]. This is because education is a vital instrument for national development. According to Eze (2009), education is the key that unlocks the economic potentials of people; it empowers and equips individuals in the society to participate in and benefit from their national economy. Education facilitates economic development and provides the basis for social transformation.

According to Enaiyeju (2010), STEM means Science, Technology, Engineering and Mathematics. The burden of evidence from the qualitative study reported here on STEM attributions, that is, what students perceived as the causes of their performance in STEM shows that students attribute underachievement or poor academic achievement in STEM to the ways STEM courses are taught. This measure of inadequacy on the part of STEM teachers calls for intervention methodologies especially in the area of teacher preparation. According to him, two of such interventions are contextualisation of STEM education and adoption of authentic formative assessment approaches. Many concepts in STEM are abstract by nature thereby making their learning relatively difficult when compared with some other non-STEM concepts, although the resourcefulness and effectiveness of the teacher is paramount in conquering the so-called “difficult barriers”.

In the objective of the National Policy on Education (FRN, 2004), it is stated that Science Education should emphasise the teaching and learning of science processes and principles. Science Education should be seen as a vital instrument for human capital development. Today’s workforce requires people who could think and have acquired the necessary content knowledge and skills in science and technology in order to provide solution to personal, social and economic problems (Ikwuanusi, 2011). It has become clear that the greatest challenge among others that will probably face Nigeria will be that of survival in the midst of numerous challenges in an intensive competitive world, which is completely dominated by the greatest might of science and technology (Oladipe, 2010).
Physics is the science that systematically studies various forms of energy and matter (Stephen, 2015). It is also an international enterprise, which plays a key role in the future progress of mankind (Sunday, 2012). According to the Nigerian Educational Research and Development Council (NERDC, 2009), physics is crucial for effective living in modern age of science and technology. Given its applications in industries, and in many other professions, the minimum standard embodied in physics education is designed to build confidence in students and enhance their abilities to adapt to the changing situations in scientific and technologically oriented society.

Entrepreneurial skills are competencies that will enable an individual seek and run an enterprise successfully (Alkamu and Langkuk, 2017). They maintain that entrepreneurial skills are also the skills that are acquired through training that emphasise the acquisition and development of appropriate knowledge and skills that enable an individual to maximize the resources around him within the limits of his capability. According to Eniayeju (2010), entrepreneurial skills are occupational survival skills. These (observational, classification, computational, measurement, interpreting, communications and manipulative) skills are what are called process skills in Science, Technology and Mathematics (STM). The process skills are the path or ways and strategies followed by scientists in order to arrive at the product of science. These process skills include observing, classifying, predicting, measuring, counting, recording, calculating, manipulating, experimenting, hypothesizing and generalisation among others. The use of these process skills over a period of time will lead to an accumulation of STM knowledge in form of laws, principles and theories, of which when put together constitute the product of science (Eze, 2009).

Statement of the Problem

Research studies (Alkamu and Langkuk, 2012) indicated that in-spite of the priority which the National Policy on Education has conferred on STEM Education, the teaching and learning of STEM at both Secondary Schools and Technical Colleges is threatened by poor academic performance and lack of interest in the subject, especially Physics. According to them, the poor academic performance and lack of interest on the part of learners are attributed to poor teaching strategies and lack of resources, both material and personnel. The study therefore focuses on more prudent ways that could be fashioned for available material resources and for improving teaching strategies to engender students' interest and give room for the acquisition of entrepreneurial skills.

Purpose of the Study

Assessment of Physics Material Resources in STEM an the level of acquisition of Entrepreneurial skills among secondary school students in Akwa Ibom North East Senatorial District. Specifically, the study sought to:

1. Determine the availability of material resources for entrepreneurial skills acquisition in physics.
2. Determine the level to which physics students have acquired the entrepreneurial skills.
3. Determine the influence of gender on the level of acquisition of entrepreneurial skills in physics.
4. Determine the influence of location on the level of acquisition of entrepreneurial skills in physics.

Research Questions

The following research questions were raised to guide the study;

1. What are the levels of acquisition of entrepreneurial skills by physics students?
2. How available are the material resources for the acquisition of entrepreneurial skills in physics?
3. What is the influence of gender (male and female) on the level of acquisition of entrepreneurial skills as measured by Physics Entrepreneurial Skills Acquisition Test (PESAT)?
4. What is the influence of location (urban and rural) on the level of acquisition of entrepreneurial skills as measured by Physics Entrepreneurial Skills Acquisition Test (PESAT)?

Null Hypotheses

1. There is no significant influence of gender on the level of acquisition of entrepreneurial skills as measured by PESAT.
2. There is no significant influence of location on the level of acquisition of entrepreneurial skills as measured by PESAT.

Research Design

Survey design was adopted for the study. The population comprised all the 86 Senior Secondary Schools in both urban and rural areas of Uyo Senatorial District of Akwa Ibom State. This gave the population size of about 1520 Senior Secondary Three (SS3) physics students as at March, 2017. Criterion sampling technique was used in selecting 62 coeducational Senior Secondary Schools out of the 86 existing secondary schools. The criteria used were

1. The school must be coeducational; and
2. It must have a functional Physics Laboratory.
3. It must have two or three professional physics teachers.

Sixty-two (62) Senior Secondary Schools from both urban and rural areas of Uyo Senatorial District of Akwa Ibom State met the criteria. Random sampling technique was then used to select 10% of the 62 Senior Secondary Schools to form the sample for the study. In all seven (7) coeducational Senior Secondary Schools (4 from urban and 3 from rural) were selected to form the sample. This gave the sample size of 250 SS3 physics students. Two instruments were used: the Physics Entrepreneurial Skill Acquisition Test (PESAT) and Physics Material Resources Assessment Checklist (PMRAC). The instruments were given face validation and their reliability coefficients were determined using Pearson Product Moment Correlation technique. Results obtained were 0.72 for PESAT and 0.81 for PMRAC. PESAT was a 20 item multiple test items that measured the respondents' level (Very Low, Low, Moderate, High and Very High) of skill acquisition in physics. Each item was scored 5 marks and for a respondent or school to be said to have acquired an acceptable level of entrepreneurial skills in physics, such a respondent or school must have scored up to the weighted mean of 50% and above. Below this was regarded as acquiring low entrepreneurial skills through physics.

PMRAC was a 20 item structured questionnaire. It provided the information on the minimum basic resource materials that an average physics laboratory should have for students' acquisition of entrepreneurial skills. The scoring of the items was on 4 point scale; Highly Available, Available, Rarely Available and Not Available. Highly Available was scored 4 points, Available was scored 3 points, Rarely Available was scored 2 points and Not Available was scored 1 point. The instrument had a weighted mean of 2.5. Hence any item with 2.5 and above indicated a positive response while any item from below 2.5 indicated a negative response. This weighted mean was converted to percentage, that is, 50% and above indicated positive response while any item from below 50% was regarded as negative

response. Mean was used in answering research questions while t-test was used in testing the null hypotheses.

Analysis and Presentation of Results

Research Question 1: What are the levels (Very Low, Low, Moderate, High and Very High) of acquisition of entrepreneurial skills by physics students?
Table 1: Entrepreneurial Skills Acquisition Score of Physics Students

Entrepreneurial Skills	No. of physics students	Mean score in percentage
Observational	45	41.22
Classification	47	37.18
Computational	38	38.21
Measurement	32	42.18
Interpreting	29	26.27
Communications	30	28.82
Manipulative	29	25.28
Average		34.17

The result in Table 1 shows that students average mean score is 34.17%. This shows a low performance when compared with the weighted mean score, 50% in Physics Entrepreneurial Skills Acquisition Test (PESAT).

Research Question 2: How available are the material resources for the acquiring of entrepreneurial skills in physics?

Table 2: Availability of Material Resources for the Acquisition of Entrepreneurial Skills through Physics

S/no.	Resources available in schools	Frequency	Percentage	Decision
1	Potentiometer	1.26	12.6	Rarely available
2	Meter bridge	3.10	77.5	Available
3	Galvanometer	2.14	21.4	Rarely available

4	Stop watch	2.82	70.5	Rarely available
5	Stop catch	2.96	74.0	Available
6	Rheostat	2.20	22.0	Available
7	Computer and its peripheral for physics research	2.05	20.5	Rarely available
8	Well ventilated laboratory	2.12	21.2	Rarely available
9	Constant electricity for practical	1.86	18.6	Rarely available
10	Measuring cylinder	1.74	17.4	Rarely available
11	Essential amenities like pipe borne water	1.20	12.0	Rarely available
12	Well-equipped library	1.96	19.6	Rarely available
13	Internet facility	1.08	10.8	Rarely available
14	Smart board	0.24	2.4	Not available
15	Power point design and usage	0.21	2.1	Not available
16	Widget software training for writing symbols	0.18	1.8	Not available
17	Electronic books	1.10	11.0	Rarely available
18	Pendulum with accessories	3.35	83.6	Available
19	Reagents for practical	1.29	12.9	Rarely available
20	Weight box	2.25	22.5	Not available

From Table 2, items 2, 4, 5 and 18 have the percentage score ranging between 70.5 and 83.6 which is above the weighted mean of 50% for available resource questionnaire and this shows that the resources are available in schools for acquisition of entrepreneurial skills by physics students. Items 1, 3, 7, 8, 9, 11, 12, 13, 17 and 19 have their percentage score between 10.8 and 22.5 which is not up to 50% and above the weighted percentage score for available resource questionnaire and this shows the resources are rarely available in schools for acquisition of entrepreneurial skills in physics. Finally, items 14, 15 and 16 show their percentage scores ranging from 1.80 to 2.40 which are below the weighted percentage score of 50% for available resource questionnaire, and this indicates that these resources are not available in schools for physics students to acquire entrepreneurial skills.

Research Question 3: What is the influence of gender on the acquisition of entrepreneurial skills as measured by Physics Entrepreneurial Skills Acquisition Test (PESAT)?

Table 3: Mean Score of Acquisition of Entrepreneurial Skills based on gender

Gender	No. of students	Mean score in percentage
Male	160	37.19

Female	90	31.15
Total	250	

The mean scores of both male and female physics students on entrepreneurial skills test from Table 3 stand at 37.19% and 31.15% respectively. Even though male physics students scored higher than their female counterparts, both scores were below the weighted mean score of 50%. Their levels of acquisition of entrepreneurial skills are said to be low and hence showed no difference in the entrepreneurial skill acquisition in physics.

Research Question 4: What is the influence of location on the acquisition of entrepreneurial skills as measured by Physics Entrepreneurial Skills Acquisition Test (PESAT)?

Table 4: Mean Score of Acquisition of Entrepreneurial Skills based on Location

School location	No. of students	Mean score in percentage
Urban	170	36.18
Rural	80	32.16
Total	250	

The result analysis from Table 4 showed the mean score of urban physics students to be 36.18% while that of their rural counterparts stood at 32.16% in entrepreneurial skill acquisition test. Although 36.18% is higher than 32.16% but when compared with the weighted mean score of 50%, both scores were below the weighted mean score upon which decision was based. Hence, urban and rural physics students showed no difference in entrepreneurial skills acquisition through physics.

Testing of Null Hypotheses

Null Hypothesis 1: There is no significant influence of gender on the level of acquisition of entrepreneurial skills as measured by PESAT.

Table 5: **t-test Analysis of the Difference in Acquisition of Entrepreneurial Skills in Physics Based on Gender**

Source of variation	N	Mean	SD	df	t-cal	t-crit	Decision at p< .05
Male	160	37.17	1.83				
vs				248	0.72	1.96	NS
Female	90	31.15	1.74				

NS = Not significant at p < .05

Table 5 shows that t-cal (0.72) to be less than the t-crit (1.96), hence hypothesis 1 is retained. This means there is no significant difference in entrepreneurial skills acquisition in physics based on gender.

Null Hypothesis 2: There is no significant difference in the level of acquisition of entrepreneurial skills between urban and rural physics students as measured by PESAT.

Table 6: t-test Analysis of the Difference in Acquisition of Entrepreneurial Skills of Physics Students Based on School Location

Source of variation	N	Mean	SD	df	t-cal	t-crit	Decision at p < .05
Urban	170	36.18					
vs			1.76	248	0.70	1.96	NS
Rural	80	32.16					

NS = Not significant at p < .05

The result from Table 6 shows that the calculated-t (0.70) is less than critical-t (1.96), hence hypothesis 2 is retained. This implies there is no significant difference in the acquisition of entrepreneurial skills based on school location as measured by PESAT.

Discussion of Findings

The results obtained from the investigation showed that Senior Secondary physics students have low level of acquisition of entrepreneurial skills. The investigation further showed that gender and school location have no influence on the level of acquisition of entrepreneurial

skills among physics students. These results are caused by inadequate or in some cases non availability of material resources for teaching and learning of entrepreneurial skills. This scarcity or non-availability of material resources for teaching and learning of physics is a hindrance towards practical exposure for skills acquisition which is necessary for completing the process of learning. The findings of this study are in line with the submissions of Ikwuanusi (2011) and Nnoli (2011).

Conclusion

The conclusion from this study is that although there is reasonable provision of entrepreneurial skills in the secondary school Physics curriculum there are no corresponding infrastructural and resource materials for acquisition of entrepreneurial skills by physics students in secondary schools. This can be seen on the level of acquisition of entrepreneurial skills by Physics students.

Recommendations

From the findings of this study, it is recommended that:

1. Provision of sufficient resource materials by the agency in charge of the development and implementation of Secondary School curriculum for teaching and learning of Physics will provide enabling environment for acquisition of entrepreneurial skills by students.
2. Students should be encouraged to have interest in Physics Education through enlightenment programme on career prospect and opportunities in Physics Education. This will give a mind-set to students to see self-employment as a better option.

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