IDENTIFICATION OF PHYSICS CONTENTS THAT CAN PROMOTE ENTREPRENEURIAL SKILLS AMONG SENIOR SECONDARY PHYSICS STUDENTS

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Abstract

One of the major crises facing Nigeria today is the high rate of unemployment and drop out of its youths from secondary schools. This has been found to be one of the reasons for the current high rate of extreme poverty and hunger in the society. Entrepreneurial Education is the process of providing individuals with concepts and skills to recognize opportunities that others have overlooked and to have the insight, self-esteem and knowledge to act where others have hesitated. Entrepreneurial Education helps to develop in youths, the entrepreneurial spirit to make many drop outs of school youths who are jobless roaming the streets to embark on their own self-employment. In this paper, the contents of the Senior Secondary School Physics curriculum which promote the acquisition of entrepreneurial skills were identified. Also the different approaches that should be used in teaching Physics to promote the inculcation of these skills were also identified. A total of forty Physics teachers were drawn from thirty out of sixty-five government owned secondary schools and also ten industrialists in Nnewi Education Zone. The instrument was self-structured questionnaire. The results were presented on tables. Two research questions and one hypothesis were stated. Mean and standard deviation were used in answering the research questions while t-test statistics was employed in testing the sole hypothesis. The findings revealed that thirty-one out of forty-eight major topics in the Senior Secondary School Physics curriculum promote the acquisition of entrepreneurial skills. Also the use of such approaches like field trip/excursion, laboratory work, inquiry, discovery approach, concept mapping and practical activities in teaching the contents will highly promote the inculcation of entrepreneurial skill among the Physics students. However, there is no significant difference between scores from Physics teachers and industrialists in the contents that can promote entrepreneurial skills by the Physics students.

Key words: *Identification, physics contents, entrepreneurial skills.*

Introduction

The educational system of every country must have a set goal relevant to the citizen's needs and national aspirations. Its major task lies in the process of how to ignite the latent talents in its citizens, prepare and thoroughly equip them with relevant knowledge and skills for viable functionality and ability to cope with any intellectual or cultural challenges which the rapidly changing environment may demand in future (Federal Republic of Nigeria, FRN, 2004).

The perennial unemployment problem of school leavers in Nigeria is one of the variables that is rendering the education of our youths hopeless and thus, dampens the interest of the youths in academic pursuit (Eya, 2009). This is because it lacks functionality and focus. This is why we have so many physics graduates that are roaming the streets of the nation seeking employment with certificates which most of them cannot defend. The only therapy to such education is entrepreneurship skills in physics education. The mentioned national aspirations can only be achieved through a self-reliant type entrepreneurship incorporated into professional skills in physics education. Such education according to UNESCO (2009) in Shelm, Yohanna & Ayodele (2017) is essential for social economic and industrial development. A physics graduate's access to it would spur him/her into becoming in the nearest future, creative, innovative and free from economic stagnation evidenced in poverty and in total lack in harmony in today's community.

Physics as a core component is concerned with understanding and exploration of the physical world that encompasses energy transformation and the general properties of materials. Physics knowledge has led to tremendous advancement in modern technology (Obafemi & Ogunkunle, 2013). Also, in the area of capacity building, an admission into university for a career in Engineering, Medicine, Pharmacy, Agriculture and Physical Sciences requires a credit pass in physics at Senior School Certificate Examination. Additionally, good practices in physics teaching, realize the objective of soundness in critical thinking (Velmovska & Bartosovie, 2017), problem-solving abilities and proficiency in data interpretations with good communication skills (Apata, 2017), these qualities are germane to professional competence and self-employability.

A nation that is not sensitive to the growth and happenings in science sector is already a dead nation. The level of science in the nation determines the level of economic/technological growth of the nation. Physics serves as the pivot around which the economy of the nation revolves. It is very vital in transportation, aviation, medicine, industry, ware-fare, peace and communication among others (Ogunleye, 1996 in Uko & Utibe, 2009). The FME, (2014) has this about science (Physics) education. Science (Physics) education shall emphasize the teaching/learning of science (physics) processes and principles (entrepreneurial skills). This will lead to fundamental and applied research in the sciences at all levels of education.
The goals are to:

(a) Cultivate inquiring knowledge and rational mind (entrepreneurial skills) for the conduct of a good life and democracy;
(b) Produce scientists for national development
(c) Service studies in technology and the cause of technological development
(d) Provide knowledge and understanding of the complexity of the physical world, the forms and the conduct of life (entrepreneurial skills)

Entrepreneurship according to Nwokolo, (2004) involves the ability to set up a business enterprise as different from being employed. Nwokolo observes that this ability should be acquired and should differ in some respect from the abilities acquired to enable a person obtain paid employment. Entrepreneurship is the effective manipulation of human intelligence as demonstrated in a creative performance, choosing to assume risk, identifying business opportunities, gathering resources, initiating action and maximizing opportunities (Ikem & Onuh, 2006). Stinhoff and Burgas (1993) said that entrepreneurship occurs when an individual develops a new ventures, a new approach to an old business or idea, a unique way of giving the market place a product or service by using resources in a new way, under conditions of risk. Lemechi and Anyakoha (2002) as in Eya (2009) defined entrepreneurship education as a carefully planned process leading to the acquisition of entrepreneurship skills for efficient and effective living. Entrepreneurship education is the key that opens the way to economic growth and development. It is the instrument that empowers youths to be in control of their future.

The aims and objective of entrepreneurship education as outlined in the National Policy on education (NPE), 2014 centres on producing individuals who are not job seekers but job creators in line with the attainment of the broad goal of Secondary Education which is to prepare the individual for useful living within the society. Physics as a branch of science has attained a unique position in the school curriculum as an essential part of general education for life (Okafor, 1998). The objectives of physics curriculum among others include to link physics with industry, everyday life benefits and hazards; to provide a course which is complete for students not proceeding to higher education while at the same time a reasonably adequate foundation for a post-secondary Physics course. The physics curriculum planners recommend that the guided discovery approach, field trip/excursions, discussion, cooperative learning, demonstration, Assignment/Home work, conventional lectures, laboratory work etc approaches should be used in teaching the contents. An effective physics teacher should be selective in the use of different approaches in Physics teaching depending on the subject matter and level of content development of the leaner.

The main focus of this paper therefore is to identify those contents in the physics curriculum that can best promote the acquisition of entrepreneurial skills among senior secondary school physics students and also to find out the best approaches to be used in teaching those Physics contents to promote the inculcation of these Physics entrepreneurial skills in the Physics students. The study however sought to investigate the physics contents that can best promote the acquisition of physics entrepreneurial skills as well as the approaches for teaching them among the physics students.

Research Questions

Two research questions guided the study.

1. Which of the topics in the senior secondary school physics curriculum can promote the inculcation of physics entrepreneurial skills in the physics students?
2. What are the approaches that can be used to teach the topics in the Senior Secondary School Physics curriculum for the promotion of physics entrepreneurship among physics students?

Hypothesis

There is no significant difference between the mean ratings of physics teachers and industrialists on the physics topics in the Senior Secondary Physics curriculum that can promote the acquisition of physics entrepreneurship among the physics students.

Method

The study adopted the descriptive survey design. This design was adopted because it concerned with investigating events in their most natural settings and without manipulating of the variables. According to Kpolovie (2010) in Nsimeneabasi, Ado & Udo (2017), descriptive survey design is appropriate for obtaining factual, attitudinal or behavioural information from selected samples. The study was carried out in Nnewi Education Zone. The population of the study consisted of all the 70 physics teachers in all the 15 government owned secondary schools and also all the 25 industrialists in Nnewi Education Zone. Forty (40) physics teachers and ten (10) industrialists were randomly selected in the study area.

Identification of Physics Content that can promote Entrepreneurial skills Questionnaire (IPCPESQ) developed by the researcher was used for the study. The questionnaire had two parts: part A sought information on the extent to which each of the contents in the physics curriculum promotes the acquisition of entrepreneurial skills among the Physics students. Part B sought information from the physics teachers only on the best approaches to be used in teaching the physics contents to make for the inculcation of entrepreneurial skills among the Physics students.

The instrument was face and content validated by measurement and evaluation expert; expert in science education department and expert in physics department all in Chukwuemeka Odumegwu Ojukwu University. Their corrections were incorporated into the final form of the instrument before administration. The instrument was trial tested on 20 physics teachers outside the zone of the study but had all qualities of the population of the study. Spearman Brown correlation procedure was used to determine the reliability with 0.78 co-efficient. This was considered reliable.

A four point rating of great extent, moderate extent, little extent and no extent was provided for them to make their responses. The cut off mean mark was 2.5. The instrument was distributed to physics teachers and the industrialists for their responses by the researcher and the researcher also collected the instruments from the respondents to ensured 100% return. Mean and Standard Deviation were used in answering the research questions while the t-test statistics was employed in testing the sole-formulated hypothesis for the study.

Result

Research Question 1

Which of the topics in the Senior Secondary School Physics curriculum can promote the inculcation of the entrepreneurial skills in Physics students?

Table 1: Topics on Senior Secondary Physics that can promote inculcation of entrepreneurial skills

The results and statistical analysis of data obtained are presented in the table below.

S/N	Physics topics	Mean	Standard deviation	Decision
1.	Content of particulate nature of matter, state of matter, difference between crystalline and amorphous substance	1.07	0.27	Little extent
2.	Measurement and measuring instruments	3.17	0.71	Great extent
3.	Density	3.30	0.47	Great extent
4.	Pressure	2.57	0.50	Moderate extent
5.	Floating and sinking	3.72	0.45	Great extent
6.	Levers and machine	3.72	0.45	Great extent
7.	The gas laws Boyles, Charles etc	1.75	0.63	Little extent
8.	Light waves	2.12	0.50	Little extent
9.	Pin hole camera	3.17	0.17	Great extent
10.	Mirrors	3.00	0.64	Great extent
11.	Lenses and optical instruments	3.92	0.19	Great extent
12.	Dispersion of light	2.75	0.48	Moderate extent
13.	Thermometer and types	3.42	0.43	Great extent
14.	Effects of heat	3.72	0.45	Great extent
15.	Quantity of heat	1.03	0.16	Little extent
16.	Heat transfer	2.87	0.56	Moderate extent
17.	Water cycle	2.37	0.51	Moderate extent
18.	Lightening conductors	3.15	0.15	Great extent
19.	Electric circuits (d.c and a.c)	2.47	0.55	Little extent
20.	Electrolysis	2.75	0.48	Moderate extent
21.	Electrochemical cells	3.10	0.74	Great extent
22.	Ohms law	2.57	0.50	Moderate

				extent
23.	Heating effects of electricity	2.10	0.54	Little extent
24.	House hold wiring	3.00	0.64	Great extent
25	Wave motion	2.67	0.57	Extent
26	Properties of waves	1.82	0.64	Little extent
27	Sound	2.90	0.52	Moderate extent
28	Musical instruments	3.92	0.19	Great extend
29	Transmission of sound	2.55	0.50	Moderate extent
30	Echoes	3.81	0.29	Great extent
31	Atomic structure	2.10	0.67	Little extent
32	Thermionic emission and photo electric effects	2.87	0.56	Moderate extent
33	Radioactivity	2.55	0.50	Moderate extent
34	Quantu numbers	1.82	0.64	little extent
35	Electronic structure of atoms: Qualitative treatment of the wave nature of light orbital's, origin and shapes of S, P, d and f orbital's.	2.10	0.65	Little extent
36	Half life	3.81	0.29	Great extent
37	Nuclear energy	3.27	0.68	Great extent
38	Simple harmonic motion	2.87	0.56	Moderate extent
39	Projectile	3.85	0.36	Great extent
40	Forces: Moments of a force	2.17	0.55	Little extent
41	Linear momentum	1.70	0.65	Little extent

Table 1 indicated that some topics in the physics curriculum can promote the physics students while some others do not. Using 2.5 as cut off points, twenty nine major topics namely: linear momentum forces, simple harmonic motion, household wiring, mirror, lenses and optical instrument, thermometer, pin hole camera, levers and machinery floating and sinking, density etc promote the inculcation of entrepreneurial skills in physics students while twelve topics namely: particulate nature of matter, light waves, linear momentum and forces etc do not promote the inculcation of entrepreneurial skills in physics students.

Research Question 2

What are the approaches that can be used to teach the topics in the senior secondary school physics curriculum for the promotion of entrepreneurship among physics students.

Table 2: Mean and standard Deviation of the approaches that can be used in teaching physics contents in the senior secondary physics curriculum to promote the inculcation of entrepreneurial skills among physics students.

S/N	Teaching approaches	Means	Standard Deviation
1	Guided discovery	3.70	0.47
2	Field trip/excursion	3.60	0.50
3	Use of Home work/Assignment	2.32	0.53
4	Use of practical activities	3.40	0.50
5	Inquiry approach	3.33	0.55
6	Demonstration	2.50	0.51
7	Concept mapping	2.83	0.53
8	Cooperative learning	3.00	0.59
9	Conventional lecture	1.57	0.50
10	Discussion	2.83	0.65

The result table 2 revealed that the use of field trip/excursion, use of practical activities, inquiry approach, cooperative learning and guided discovery approach promotes the inculcation of entrepreneurial skills in the physics students to a great extent. The use of home work/assignments and conventional lecture approaches do not promote the inculcation of entrepreneurship among physics students.

Hypothesis:

There is no significant difference between the mean ratings of physics teachers and industrialists on the topics in the senior secondary physics curriculum that can promote the acquisition of entrepreneurial skills among the physics students.

Table 3: t-test difference in mean scores in physics teachers and industrialists with regards to contents in physics curriculum that promote the acquisition of entrepreneurial skills among senior secondary school physics students.

S/N	STATUS	N	MEAN	STD. DEV	T	DF	SIG	DECISION
1.	Physics teacher	30	1.07	0.25	-0.34	38	0.74	Not significant
	Industrial worker	10	1.10	0.32				
2.	Physics teacher	30	1.23	0.43	-0.41	38	0.68	Not significant
	Industrial worker	10	1.30	0.48				
3.	Physics teacher	30	3.43	0.50	0.73	38	0.69	Not significant
	Industrial worker	10	3.30	0.48				
4.	Physics teacher	30	1.40	0.38	0.55	38	0.58	Not significant
	Industrial worker	10	1.25	0.32				
5.	Physics teacher	30	2.53	0.57	0.16	38	0.87	Not significant
	Industrial worker	10	2.50	0.52				
6.	Physics teacher	30	2.30	0.53	2.68	38	0.01	Not significant
	Industrial worker	10	2.80	0.42				
7.	Physics teacher	30	1.00	0.00	1.78	38	0.08	Not significant
	Industrial worker	10	1.0	0.31				
8.	Physics teacher	30	1.58	0.50	0.29	38	0.77	Not significant
	Industrial worker	10	1.54	0.49				
9.	Physics teacher	30	2.30	0.53	2.68	38	0.59	Not significant
	Industrial worker	10	1.30	0.42				
10.	Physics teacher	30	1.80	0.66	0.87	38	0.71	Not significant
	Industrial worker	10	2.60	0.52				
11.	Physics teacher	30	2.40	0.55	-0.80	38	0.40	Not significant
	Industrial worker	10	2.60	0.50				
12.	Physics teacher	30	2.53	0.51	-0.36	38	0.72	Not significant
	Industrial worker	10	2.60	0.52				
13.	Physics teacher	30	3.67	0.64	1.15	38	0.26	Not significant
	Industrial worker	10	2.80	0.63				
14.	Physics teacher	30	2.80	0.47	1.12	38	0.27	Not significant
	Industrial worker	10	2.60	0.48				

15.	Physics teacher	30	3.10	0.71	0.38	38	0.70	Not significant
	Industrial worker	10	3.40	0.74				
16.	Physics teacher	30	3.47	0.43	1.07	38	0.30	Not significant
	Industrial worker	10	3.30	0.42				
17.	Physics teacher	30	3.20	0.55	-1.03		0.31	Not significant
	Industrial worker	10	3.00	0.47				
18.	Physics teacher	30	2.57	0.50	-1.80		0.86	Not significant
	Industrial worker	10	2.60	0.52				
19.	Physics teacher	30	2.51	0.49	0.37		0.71	Not significant
	Industrial worker	10	2.44	0.46				
20.	Physics teacher	30	3.63	0.49	-2.34		0.02	Not significant
	Industrial worker	10	4.00	0.00				
21.	Physics teacher	30	3.90	0.30	0.00		1.00	Not significant
	Industrial worker	10	3.91	0.31				
22.	Physics teacher	30	1.13	0.35	1.21		0.23	Not significant
	Industrial worker	10	1.00	0.00				
23.	Physics teacher	30	3.07	0.64	1.15		0.26	Not significant
	Industrial worker	10	2.87	0.63				
24.	Physics teacher	30	3.70	0.47	1.14		0.26	Not significant
	Industrial worker	10	3.50	0.53				
25.	Physics teacher	30	2.93	0.46	-1.64		0.00	Not significant
	Industrial worker	10	3.20	0.42				
26.	Physics teacher	30	2.70	0.49	-4.00		0.01	Not significant
	Industrial worker	10	3.40	0.52				
27.	Physics teacher	30	3.27	0.74	2.63		0.06	Not significant
	Industrial worker	10	2.60	0.52				
28.	Physics teacher	30	2.83	0.53	-1.98		0.49	Not significant
	Industrial worker	10	3.70	0.42				
29.	Physics teacher	30	3.03	0.72	-6.91		0.01	Not significant
	Industrial worker	10	3.70	0.42				

30.	Physics teacher	30	3.20	0.66	3.46	38	1.00	Not significant
	Industrial worker	10	2.40	0.52				
31.	Physics teacher	30	2.10	0.55	0.00	38	1.00	Not significant
	Industrial worker	10	2.10	0.57				
32.	Physics teacher	30	2.87	0.50	-0.16	38	0.87	Not significant
	Industrial worker	10	2.90	0.50				
33.	Physics teacher	30	2.50	0.51	-0.51	38	0.60	Not significant
	Industrial worker	10	2.60	0.52				
34.	Physics teacher	30	3.40	0.56	-0.99	38	0.32	Not significant
	Industrial worker	10	3.06	0.54				
35.	Physics teacher	30	2.85	0.44	-1.05	38	0.30	Not significant
	Industrial worker	10	3.05	0.57				
36.	Physics teacher	30	2.87	0.57	-1.60	38	0.87	Not significant
	Industrial worker	10	2.90	0.57				
37.	Physics teacher	30	2.63	0.56	-7.94	38	0.43	Not significant
	Industrial worker	10	2.80	0.63				
38.	Physics teacher	30	2.50	0.50	-0.18	38	0.86	Not significant
	Industrial worker	10	2.60	0.52				
39.	Physics teacher	30	3.27	0.45	0.41	38	0.68	Not significant
	Industrial worker	10	3.20	0.42				
40.	Physics teacher	30	3.37	0.49	1.50	38	0.14	Not significant
	Industrial worker	10	3.00	1.05				
41.	Physics teacher	30	3.53	0.50	1.27	38	0.21	Not significant
	Industrial worker	10	3.30	0.48				

The result on table 3 showed that no significant difference was recorded between the perceptions of Physics teachers and industrial workers towards the contents in the Senior Secondary Physics curriculum that can promote entrepreneurial skills among Physics students. Therefore the null hypothesis is accepted.

Discussion of Findings

The results of the findings indicate that twenty nine out of the forty one major topics in the Senior Secondary Physics curriculum namely: projectile, simple harmonic motion, pin hole camera, thermometer, levers and machines, density, floating and sinking, mirrors, lenses and optical instruments, radioactivity etc. promote the inculcation of entrepreneurial skills among Physics students while twelve of the contents namely, forces, particulate nature of matter, properties of wave, atomic structure etc do not. The result of the finding is in affirmation of the objectives of Senior Secondary Physics curriculum which among others is to show physics and its link with industry, to provide a course which is complete for pupils not proceeding to higher education while it is at the same time, a reasonably adequate foundation for a post secondary Physics courses, to acquire essential scientific skills and attitudes as a preparation to technological application of Physics (NERD, 2014). Thus proper studying of physics will actually prepare a Physics student to create job for himself/herself after school, especially now that unemployment is the order of the day.

The findings on the approaches to be used in teaching the physics content in the Senior Secondary Physics curriculum revealed that the use of field trip/excursion, practical activities, inquiry approach, cooperative learning and guided discovery etc can promote the inculcation of entrepreneurial skills to a great extent. The use of discussion and demonstration approaches promotes entrepreneurial skills to a moderate extent while the use of home work/assignment and conventional lecture method do not promote the inculcation of entrepreneurial skills among physics students. The findings agree with Bonwell and Elson (2000) which showed that active learning strategies are comparable to lecture for achieving content mastery, but superior to lectures for developing critical thinking.

The findings also are in consonance with the assertion of Osisioma (2005) who maintains that the students learn meaningfully when they are involved in the learning process. This is more so when they work in small groups and have the opportunity to negotiate meaning and construct conceptual understanding in a community of learners thereby making education more relevant and self reliant which are the prerequisite to entrepreneurial skills.

Conclusion

From the results of the research, it can be seen that many of the contents in the Senior Secondary Physics curriculum are designed to facilitate the acquisition of entrepreneurial skills among Physics students. The physics teachers should therefore, try as much as possible to combine the appropriate teaching approaches as identified by the researcher for the inculcation of these skills among the Physics students.

Recommendations

Based on the results of the findings, the following recommendations are made:

1. Serving physics teachers should be sponsored on a regular basis to workshops, seminars and conferences for continuous training in the skills for using the current teaching approaches that promote creative and manipulative skills among the Physics students and hence, prepare them for self reliant in the wider society.

2. The curriculum designed for Senior Secondary Physics education should be restructured in such a way that apart from the already existing contents, it should also include courses in entrepreneurial education proper.
3. The government should provide well-equipped Physics laboratory in secondary schools, the laboratory should have enough Physics equipment, Physics materials and even improvised materials. Physics laboratory technologists, technicians and laboratory assistances should be provided and re-trained in improvisation.

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