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Assessment of Chemistry Teachers' Knowledge on Entrepreneurial Chemistry Topics in Senior Secondary Schools

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Abstract: The study investigated the entrepreneurship knowledge of chemistry teachers in Otuocha education zone of Anambra state, towards some topics in senior secondary school chemistry curriculum. Three research questions guided the study. 31 chemistry teachers from Otuocha education zone were involved. Twenty-four item questionnaire generated from five branches of chemistry mainly taught in senior secondary schools were used for data collection. The instrument was validated and its reliability was found to be 0.91 using Cronbach alpha. The data analysed using mean and standard deviation indicated that twelve (12) out of the twenty three topics were found not to be significant on teachers' knowledge of entrepreneurship in teaching. This is an indication that students are not being cultured with these skills during lesson. This was also confirmed in the analysis of the data collected from how teachers relate the topics to real world / entrepreneurial skill, where sixteen (16) out of twenty three topics were found not to be significant on teachers' in relating to entrepreneurship in teaching. Out of the fifteen (15) entrepreneurial teaching strategies tested, twelve were found not to be significant on teachers'. Some recommendations were made based on the findings to improve the development of entrepreneurial skills in students.

Keyword : Chemistry Topics, Chemistry Teachers, Assessment, Knowledge, Entrepreneurial skill,

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Introduction

Chemistry is a utility course filled with lots of business opportunities. Chemistry deals with the composition, properties, changes, reactions and uses of matter. Nnoli (2021) said that Chemistry, involves experimentation which impact in the students the skill of observation, careful record, calculation, and then the ability to infer. Chemistry as a subject that deals with the nature of matter and its transformation is essential in the production of varieties of products. Chemistry can help to turn scientific discoveries into practical solutions such as, creation of new jobs and industries, growing of the economy, drive innovation and promote sustainability. All these leads

to entrepreneurship. According to Onwudinjo (2004), the practical application of physical chemistry principles has the potential to enhance students' analytical skills through experimentation, problem solving and critical thinking. Chemists should have the knowledge, skills, adaptability, entrepreneurial mindset, and expertise necessary for starting a successful business, thereby, impacting positively on the society. Chemistry as a subject has many topics and practical which can be converted into useful products. Such topics as Nature of matter / separation techniques, Atoms / moles/ formulae/ equations, Kinetic theory of matter, Acids/ bases/ salts, Carbon and its compounds, Periodic tables, Mass and volume relationships, Volumetric and qualitative analysis, Electrolysis, Energy and chemical reactions, Rate of chemical reactions, Chemical equilibrium, Pollution, Solution and solubility, Metals and non-metals, and Organic chemistry (Ababio, 2013). The question is, how come Chemistry is filled with lots of business opportunities, still there is high unemployment rate in Nigeria especially among young school leavers to be precise. For a nation to be developed, it has to develop younger ones who are self-confident in critical thinking and entrepreneurship. Properly teaching of these topic by relating them to the entrepreneurial skills associated to them by the chemistry teachers will motivate the students in the development of entrepreneurial skills. Hence, the ability of the teachers to integrate the entrepreneurial skills in their teaching will help in equipping the young school leavers to be entrepreneurs. Thus, the reason for the assessment of chemistry teachers' knowledge on entrepreneurial chemistry topics in senior secondary schools. A teacher utilizes various methods to gauge students' understanding of the subject matter and track their academic progress.

Aminu (2008) in Chiemeka (2019), defined entrepreneurship as a process (rather than as a result), of creating new things with value through financial, psychic and social risks. Entrepreneurship, is an instrument of empowerment which aim at educating a person on how to promote and start new idea, new business' and also improve old ones (Ikokwu, 2020). Hence, an entrepreneur is a person who has the ability to see and evaluate business opportunities, gather the necessary resources to take the advantage of them and initiate appropriate action to ensure success. It is then necessary for the skills required for this entrepreneurship (entrepreneurial skills) to be impacted in the young school leavers so that they will be self-reliant, hence, entrepreneurs. Entrepreneurial skill is an instrument of empowerment which aims at educating an individual on how to start and improve businesses. Chemistry entrepreneurship is the process of turning the findings in chemistry research work into commercial products. Robert (2023) was of the view that turning scientific knowledge into products and services in order to solve problem and generate income is a big challenge to many. The integration of entrepreneurial skill holds substantial implication for the reduction of this challenge, and thereby reduces unemployment in Nigeria and the world at large. Employers would like to employ one who would apply

the chemistry knowledge to real world situation. The inability of these young school leavers to possess entrepreneurial skills has made them unemployed and thereby, creating serious unemployment problems. This is in accordance to Uka (2015) who was of the view that if the rate of unemployment is not checked, there would be escalation of youth social vices, such as what we have in Nigeria today. The solution of unemployment in Nigeria seems not to be in sight. Then what is the reason behind the inability to checkmate this cankerworm militating the nation growth? Secondary education is the education for career development which provides trained manpower in commerce, applied science and technology. Hence, the need the researcher sought to assess the chemistry teachers' knowledge on entrepreneurial chemistry topics in senior secondary schools

Statement of the Problem

There is an increasing rate of unrest and criminality in the whole regions of Nigeria. The reason to this ugly trend may not be farfetched, taking a look at the rate of increasing unemployment in Nigeria. Enterprising the youth and growing populace will help to minimize this wave of unemployment in Nigeria and the world at large. Ibeh, and Okoli, (2021) pinpointed the lack of entrepreneurial skill among school leavers as the major cause of unemployment in the country. Thus, the reason the researcher sort to identify the level of awareness of entrepreneurial skills in chemistry topics taught in secondary school chemistry by teachers in Otuocha education zone of Anambra state as the case study. Is it that the Chemistry teachers' lack sufficient understanding of entrepreneurial concepts and their application in Chemistry, or that the concepts are often not explicitly taught nor integrated into chemistry curriculum?

Purpose of the Study

This study tend to assess the teachers' understanding of chemistry topics relevant to entrepreneurship in secondary school, and how often they integrate these skills in lessons. To identify challenges faced by teachers in teaching chemistry topics related to entrepreneurship. Young school leavers possessing these entrepreneurial skills will make them to be self-reliant, thereby, reducing unemployment that undermine the development of any nation. This also gives way to look into reason for lack of essential skills to innovate and solve real-world problems by school leavers.

Methodology

This study sought to examine the knowledge of secondary school chemistry teachers on the entrepreneurial skills that are in the chemistry topics they teach. The researcher employed random sampling technique to gather data from 31 teachers. Self-structured entrepreneurial skill questionnaires were distributed to the teachers for data collection. The research instrument was guaranteed by seeking input from three

professionals in Chemistry education. The instrument consists of six entrepreneurial skill indicators containing 23-items, rated on 4-point scale of; Strongly agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2, and Strongly disagree (SD) = 1. This instrument was validated and reliability was established with Cronbach alpha which gave a reliability coefficient of 0.91. Research questions were answered using mean.

Result and Discussion

Results

The summaries of the analysed data collected were presented in the Tables.

Table 1. Mean response rating on Teachers' Awareness of Entrepreneurial skills in some Senior Secondary School Chemistry Topics

S/N	Entrepreneurial Skill Indicators	Mean Ẍ	Standard Deviation SD
A	**Physical Chemistry**		
1	Kinetic theory of matter	2.21	1.49
2	Rates of reaction	2.53	1.59
3	Chemical equilibrium	1.98	1.14
4	Oxidation reduction reaction	2.50	1.58
5	Energy and Chemical reactions	2.70	1.64
6	Electrolysis	2.41	1.55
	Average Mean	**2.39**	**1.50**
B	**Inorganic Chemistry**		
7	Atoms, mole, formulae and equations	1.65	1.28
8	Atomic Structure and Chemical Combinations	2.04	1.43
9	Periodic Table	1.48	1.21
10	Stoichiometry of reaction	2.64	1.62
11	Shape of molecules and solids	1.41	1.19
12	Water, solution and solubility	2.59	1.16
Average Mean		**1.92**	**1.32**
C	**Analytical Chemistry**		
13	Volumetric and qualitative analysis	3.58	1.26
14	Acid, base and salt	2.64	1.62
15	Separation technique	1.40	1.30
16	Mass and volume relationships in reactions	2.51	1.58
17	Spectroscopy	1.39	1.34
Average Mean		**2.30**	**1.42**
D	**Organic Chemistry**		
18	Production of Alkanols	2.70	1.64
19	Reaction of alkanols with alkanoic acids	2.41	1.55
20	Reaction of organic acids with bases	2.64	1.62
	Average Mean	**2.58**	**1.60**
E	**Environmental Chemistry**		
21	Air water pollution mitigation	2.52	1.59
22	Waste management and recycling	2.70	1.64
23	biodegradable materials	2.49	1.58
Average Mean		**2.57**	**1.60**

based on the table 1 above, the average mean score range of the research indicators were as follows; teachers' awareness of entrepreneurial skills in Physical chemistry (2.39), Inorganic chemistry (1.92), Analytical chemistry (2.30), Organic chemistry (2.58), and Environmental chemistry (2.57) respectively. The most significant entrepreneurial skill acknowledged by the teachers is Organic chemistry and environmental chemistry which had a score of 2.58 and 2.57 respectively above the criterion mean of 2.50.

Table 2. Mean Response on How the Teacher Relate the Topics to Skills

S/N	Entrepreneurial Skill Indicators	Mean Ẍ	Standard Deviation (SD)
A	**Physical Chemistry**		
1	Production of fire extinguisher (Kipps apparatus) amount of pressure in closed containers (any other).	2.49	1.58
2	Decomposition of H_2O_2 in the presence of MnO_2 (oxygen production or any other)	2.10	1.45
3	The reaction between nitrogen and hydrogen (Haber process) Ammonia production, optimum condition.	1.84	1.36
4	Rusting of metals, yellowing of white paper or change in colour of some drugs when exposed to air.	2.70	1.64
5	Anaerobic decomposition of organic matters (CH_4 gas production)	1.65	1.25
6	Purification of metals	2.87	1.52
	Average Mean	**2.28**	**1.47**
B	**Inorganic Chemistry**		
7	calculation of the amount of substance in compound For quality assessment	2.41	1.55
8	Determination of possible physical structure and chemical properties of product	2.06	1.44
9	Understanding properties of elements for industrial applications (use of MnO_2 as catalyst)	1.94	1.40
10	Optimization of chemical processes and production.	2.00	1.41
11	Feasibility and stability of product	1.87	1.37
12	Purification crystallization and precipitation of substances.	1.47	1.99
	Average Mean	**1.96**	**1.53**
C	**Analytical Chemistry**		
13	Quantity and texture of product	2.59	1.61
14	Development of diagnostic tools.	1.67	1.38
15	Quality assurance	2.41	1.55
16	Accuracy in production	2.56	1.26
17	forensic chemistry	1.23	1.10
	Average Mean	**2.09**	**1.38**
D	**Organic Chemistry**		
18	Fermentation	3.51	1.23

19	Esterification (production of perfume)	2.32	1.52
20	Saponification (production of soap)	3.58	1.26
	Average Mean	**3.14**	**1.34**
E	**Environmental Chemistry**		
21	Risk management.	2.52	1.58
22	recycling of used plastics and metals	1.40	1.31
23	Production of paper bag from recycled paper	1.47	1.21
	Average Mean	**1.71**	**1.37**

In Table 2, only eight (8) out of the 23 items listed on the topics to skills relationship by the teachers scored above 2.50 (criterion mean). This is an indication that out of the 23 items, only 8 items were found significant by the teachers while the other 13 items remain insignificant. This is a clear indication to lack of adequate reference of topics to entrepreneurship. The Average Response Assessment of Teachers' Teaching Strategies in Facilitating Entrepreneurial Skills in Students can be seen in table 3 below.

Table 3. Mean Response Rating on Teachers' Teaching Strategies in Facilitating Entrepreneurial Skill in Students.

S/N	Teaching Strategies	Mean Ẍ	Standard Deviation SD
1.	Incorporate entrepreneurial concepts into –lessons	2.1	0.4
2.	Case studies and analysis	1.8	0.7
3.	Group projects and collaborations	3.58	1.26
4.	Simulations and role-playing	1.6	0.9
5.	Guest lectures and industry partnerships	1.6	0.9
6.	Field trips	2.2	0.3
7.	Entrepreneurship competitions	1.7	0.8
8.	Environmental audits	1.8	0.7
9.	Design challenges	2.3	0.2
10.	Risk taking and experimentation	1.6	0.9
11.	Real-world problem-solving exercises	1.9	0.6
12.	Questioning and curiosity	3.6	1.21
13.	Online courses and webinars	2.0	0.5
14.	Virtual reality and augmented reality experiences	2.2	0.3
15.	Interdisciplinary projects and teams	2.6	0.37
	Average Mean	**1.91**	

Conclution

From the findings, it shows that Chemistry teachers do not possess the entrepreneurial skills to impact on the students. The inability to impact in the students entrepreneurial skills will as a consequence demoralize their entrepreneurship creating unemployment and other social vices. Teachers should therefore use teaching

methods and strategies that will help in relating the entrepreneurial skills in each of the topics taught to the students in other to develop entrepreneurial mind. Relating the topics to real world case studies will help the students in the understanding of the basic principles in chemistry which helps them to develop intellectually, technologically, socially and physically.

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