Science teachers' knowledge, attitudes and skills as determinants of classroom practices in entrepreneurship education in senior secondary schools in Lagos, Nigeria

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Abstract: Entrepreneurship behaviour is a 21st century attribute required for transforming the industrial and employment spaces into spaces of high performance and increased productivity. Science students are a critical factor towards the achievement of these requirements. To ensure quality entrepreneurship education, science teachers' entrepreneurship background and characteristics become germane. The proposed study, therefore, investigates the extent to which science teachers' entrepreneurship knowledge, attitudes and skills determine their classroom practices in entrepreneurship education in selected Senior Secondary Schools in Lagos, Nigeria. Adopted, from that perspective, was the correlational type of the cross-sectional descriptive research design. A purposively selected sample of 245 SS2 science teachers from thirty schools in Lagos mainland, Nigeria participated in the study. The following instruments were considered reasonably appropriate: Teacher Entrepreneurship Knowledge Test (r=.86), Teacher Entrepreneurship Attitudes Scale (r=.89), Teacher Entrepreneurship Skills Inventory (r=.85) and Classroom Practices Rating Scale (r=.89). The data were processed using the Pearson's Correlation method and the Regression analysis. The findings led to the conclusion that there are strong and significant bivariate relationships between each of teachers' knowledge (r=.59), attitudes r=.55), skills (r=.52) and classroom practices. The three factors jointly measured up to 46% of classroom practices with significant relative effects. Inasmuch as teachers require good knowledge, attitudes and skills for effective implementation of entrepreneurship programmes in science education, they need to be exposed to in-service training in entrepreneurial studies.

Keywords: Science Teachers, entrepreneurship knowledge, entrepreneurship attitudes, entrepreneurship skills, classroom practices

1. Introduction

Development is being measured today against the level of industrialization of nations. Industrialization is the transformation of agricultural to industrial economic development (Chappelow, 2019). According to the author, in industrialised economies, there is the replacement of manual labor with mass production of goods using mechanical gadgets. Also, artisans and local craftsmen give way to skilled labour working in factory lines and the indices to look out for are exponential growth in the economy, division of skilled labour, innovative deployment of machines for problem-solving and a general improvement in the quality of life. In his own words, Biernacki (2001) defined industrialization as the process of applying mechanical, chemical and electrical devices in the reorganization of production using sources of energy other than man and animals. Based on these features, Nigeria cannot be said to be among the industrialized nations of the world at the moment. Undoubtedly, such a situation will definitely classify the country among those that are less economically developed.

Unemployment is another serious problem facing Nigeria today (Agommuoh & Ndirika, 2017). According to World Bank statistics, in Bakere (2013), the rate of unemployment among the youth exceeds 38 percent. Among the most affected strata of the population are the secondary school leavers and the rural dwellers who account for about 75 million out of the population of over 150 million people. The implication of this scenario is that if the rate of unemployment is not checked, it could escalate into youth involvement in brigandage, oil pipe vandalism, crude and refined oil theft, armed robbery, kidnapping and insurgency (Uka, 2015). Since the state has limited capacity to create jobs,

which are mostly in the public service areas, Nigerian youths have to be self – reliant and eventually become employers of labour. One of the consequences of unemployment is poverty, which could be social, economic and political. The first Sustainable Development Goal aims at ending poverty in all its forms everywhere. This goal, alternatively, calls for entrepreneurial skill acquisition programmes to improve citizens' employability. By all means, these entrepreneurial skills may not be efficiently and effectively acquired without the knowledge of scientific concepts, processes of science and scientific attitudes which are components of science education taught in schools. Indeed, science education fosters a culture of scientific thinking and use of evidence-based reasoning for decision making, confidence, knowledge and skills for contribution to the increasingly complex scientific and technological world. Ogunleye and Fasakin (2011) had declared that the application of scientific knowledge in everyday life and daily living could bring about positive changes in societal and cultural order, thereby impacting quality of life.

According to Uka (2006), scientists need to be persistent, self-confident, patient, inquisitive, thorough, competent, risk-takers, resourceful, rational, optimistic, realistic, systematic, determined, hardworking and resilient. The 21st Century science teacher needs to appreciate the holistic dependence of the modern society on scientific knowledge and technological know-how. Science teachers also require an understanding of the possibility of conversion of the entrepreneurial skills taught and learnt in the science classrooms and laboratories to productive use outside the classroom and in the larger societal space (Adeyemo, 2009). According to Das (2006), science teachers need to equip themselves with the necessary entrepreneurial skills to transmit them to the students through effective classroom instructional activities. These skills, according to Adeyemo (2009), include instructional leadership capability, management and communication skills, development of collaboration, vision and mission mindset, change management, dexterity in data analysis and processing, evaluation, economy and frugality. Without these skills, the teacher cannot be the mentor and guardian for students to learn from.

Entrepreneurial characteristics are among the most important characteristics that can be gained by students in the 21st century (A guide to Enterprise Education, 2009). While entrepreneurship education is narrowly defined as a process for initiating students into the worldview of the business-minded, it is also identified as the process by which a number of characteristics that will primarily provide individual, social and economic benefits are acquired. Moreover, people are able to extensively implement these characteristics in every area of their lives (European Commission, 2011). The logic behind entrepreneurship is the enabled characteristics that can be used practically in life by engaging in school-based and real life knowledge (Bikse, 2009). It is believed that the acquisition of the characteristics that are required for the market and the workplace is possible through entrepreneurship. Therefore, the idea of entrepreneurship has been described as an individual ability that enables them to implement this idea in practice, to turn it into reality (European Commission, 2011). It is these informed efforts that transformed the current Nigeria Senior Secondary School Science Curricula (Biology, Chemistry and Physics) by infusing into them those elements that pertain to the entrepreneurial education. The curriculum implementation is, however, yet to translate into certain gains for the Nigerian nation (Ige, 2003; Alam, Oloruntegbe & Orimogunje, 2010; Babajide, 2010).

As a panacea, the pedagogy adopted by teachers in implementing entrepreneurship education needs to allow for students' active roles. Methods and techniques such as collaborative learning, project, field trips, practical learning, diaries, drama, entrepreneurial implementation, cognitive apprenticeship and work place visits are expected to be used (Neck & Greene, 2011; Seikkula-Leino, 2011). Rae and Carswell (2001) defined the learning process that enables the development of entrepreneurial characteristics as the implementation of the characteristics and abilities that are necessary to recognise and seize or take advantage of every opportunity that comes up. These types of learning processes are dynamic and enable entrepreneurial characteristics to assume an active form to ensure quality (Ogunlela & Ogunleye, 2015). Experiment-based learning is accepted as more effective in the development of characteristics and skills befitting any distinguished entrepreneur, instead of the use of the lecture mode of instruction (European Commission, 2008). Understanding is the dominant factor in the transfer of school knowledge into daily life, and engaging school-based knowledge with daily life knowledge and activities, in its turn, is mostly associated with the constructivist approach. This approach serves the same purpose as the knowledge and characteristics that learners have to grasp or absorb in the process of learning.

Entrepreneurship education suggests possible conversion of entrepreneurial objectives in the curriculum to learning achievement both in school and out-of-school activities. Therefore, the constructivist approach has been stated to be the theoretical background for entrepreneurship education (Lobler, 2006). Students in purposive and intentionally designed programmes of learning acquire entrepreneurship characteristics especially when experiential educational environments are provided. For instance, countries such as Finland place entrepreneurship at the forefront of their educational programmes (Seikkula-Leino, 2011). Others are Singapore where school activities reflect a huge array of entrepreneurial concepts and skill acquisition (San-Tan & Ng, 2006); Sweden whose schools share far too much with the existing industrial outlook (Rasmussen & Sorheim, 2005) and England where the traditional education is firmly giving way to entrepreneurship education (Raffo et al., 2000). This approach has been reported to improve students' participation, performance and patterns of behaviour in the relevant courses (A Guide to Enterprise Education, 2009). Moreover, the necessity of engaging in entrepreneurship education within the science education discipline has been stressed by Achor and Wilfred-Bonse (2013). Bolaji (2012) also posited that entrepreneurial characteristics can be acquired through science education. Moreover, Achor and Wilfred-Bonse (2013) claimed that the entrepreneurial characteristics of students can easily be developed in technology, Physics, Chemistry and Biology because the connections between real life and school issues are apparent in science education (Akinsola & Ogunleye, 2003). The level of knowledge, attitudes and skills which science teachers should have to inspire them participate fully in innovative and effective classroom practices that could foster students' entrepreneurial behaviour have remained uncertain given the quality of the successfully completed graduates. Entrepreneurship education empowers the youth to take charge of their future, becoming job creators and employers of labour in conjunction with one of the goals of Nigerian secondary education which is to prepare citizens for effective living in the society (FRN, 2004).

Chemistry is an important science subject and is central to the study of all the sciences, hence its indispensable status in the school curriculum. It has also been described as contributing to general education in the area of life and daily living (Eya, 2015). The subject not only connects learners to activities and live events unfolding around them (Fahmy, 2000), it teaches so much about the industry and industrial processes (Ababio, 2005). The new chemistry curriculum for senior secondary schools in Nigeria was revised based on the specifictions of the Education for All (EFA), Millennium Development Goals (MDGs) the National Economic Empowerment and Development Strategies (NEEDs) as well as the State Economic Empowerment and Development Strategies (SEEDs). What was worthy of inclusion in the curriculum at that point were the industrial and technological realities, poverty eradication strategies, drug abuse and other contemporary issues which help the society to become literate and skillful at the same time in line with the recommendations of Fensham (2006). The guided discovery approach was recommended as the main instructional method and preferred above all others. Over the years, the adoption of the field trip strategy, discussion method, demonstration, laboratory practical work (Ogunleye, 2010) and cooperative learning (Ogunleye, 2011) has also been advocated. A significant relationship was reported to exist among the science teachers' science process skills, scientific attitudes and chemistry students' performance in the subject (Ogunleye, 2012). The hallmark of an effective chemistry teacher, therefore, is the knowledge and skills for selecting different strategies or mixing them in the classroom teaching of chemistry in order to develop entrepreneurship capabilities in students. Teachers' perceived barriers to successful implemetation could also limit their classroom effectiveness (Ogunleye, 2007).

Entrepreneurship knowledge and innovation are needed everywhere in the society. New business organizations are needed to expand the available job space. The survival of organizations and entrepreneurs in the competitive business environment also require the ingenuity of the business leadership as well as the employees. Obviously, the underlying reason behind the existing societal problems that tend to limit the process of industrialization is not due to the lack of brilliant business ideas given the fact that universities and a fair amount of the large companies are seen to parade lofty ideas that have never been realized or translated into productive use (Ogunleye, 2014). Some of them are of course not good enough, but there are others that are well-founded and constructed and even they failed to translate into reality perhaps because of lack of time, poor skills, or due largely to lack of interest (Esaiasson, 2018). According to the author, the problem transcends a lack of good ideas, along with the absence of the required number of entrepreneurs. This underscores the importance of entrepreneurship knowledge, in terms of its role in the effectiveness of the science teacher. Indeed, it is the one that

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should take pride of place. Also, Llopis (2013) argued that entrepreneurship is much more than starting a business, being one's own boss, converting innovative ideas into revenue or being socially self-reliant. Entrepreneurship was presented as an attitude which represents how people think and act (Llopis, 2013). It has therefore become necessary to investigate entrepreneurship knowledge, attitudes and skills as they impact science teachers' classroom practices for effectiveness in entrepreneurship education.

From the foregoing, industrialization as a necessary feature of any developed nation is yet to be attained in Nigeria. Entrepreneurship education which is intertwined with science education programmes in schools offer bright opportunities for equipping students with entrepreneurship behaviour which can transform the industrial and employment space for the better. At present, it is doubtful if classroom practices reflect the basic entrepreneurship content and strategies to drive the movement towards the desired change. This study, therefore, investigated the extent to which science teachers' entrepreneurship knowledge, attitudes and skills determine their classroom practices in selected senior secondary schools in Lagos State.

2. Research Questions

Answers were sought to two questions considered appropriate for the study.

1. To what degree do the three science teacher factors (entrepreneurship knowledge, attitudes and skills) explain their classroom practices in entrepreneurship education?

2. What are the relative contributions of each of the three science teacher factors (entrepreneurship knowledge, attitudes and skills) to their classroom practices in entrepreneurship education?

3. Hypotheses

1. There is no significant relationship between science teachers' entrepreneurship knowledge and their classroom practices.

2. There is no significant relationship between science teachers' entrepreneurship attitudes and their classroom practices.

3. There is no significant relationship between science teachers' entrepreneurship skills and their classroom practices.

4. Research Methods

The study adopted the cross-sectional type of the descriptive survey design to facilitate the coverage of the selected number of schools included in the study. The correlational research method was also adopted to investigate the relationships among the independent and the dependent variables (Akinsola & Ogunleye, 2004). A total of 245 science teachers (100 males and 145 females) purposively selected from 80 senior secondary schools across the 20 Local Government Areas of Lagos State participated in the study. Two instruments were developed and used to collect data. These are: Teachers' Entrepreneurship Knowledge, Attitudes and Skills Questionnaire (TEKASQ); and Teachers Classroom Practices Scale (TECPS). TEKASQ covered basic definitions and ideas about Entrepreneurship: Intrapreneurship, 4H rule, Startup Strategy/Success, Private Funding Types, Y-Combinator, Business Ideals and Pivot using the multiple-choice objective format. It also measured key attitudes of entrepreneurs –passion, bravery, flexibility, work ethic and integrity as well as entrepreneurship skills of curiosity, time management, strategic thinking, efficiency, resilience, communication, networking, finance, branding and sales. These were presented on a 4-point Likert scale of Very Much Like Me (4), Like Me (3), Unlike Me (2) and Mostly Unlike Me (1). TECPS is a 10-point rating scale of aspects of teachers' classroom practices. Both instruments were subjected to peer/expert review and reliability with Cronbach Alpha value of .87 and Inter-rater index of .85 respectively. Copies of TEKASQ were administered to the teachers with the help of research assistants across the Local Government Areas while TECPS was used to rate the teachers during classroom teaching sessions. The Pearson's method for determining bivariate relationships and the simple regression were adopted in the analysis of the data while inferences were made based on the templates of Bamgboye, Lucas, Agbeja, Adewale, Ogunleye and Fawole, 2006).

5. Results and Discussion

Research Question 1: To what extent do the three science teacher factors (entrepreneurship knowledge, attitudes and skills) explain their classroom practices in entrepreneurship education?

Table 1: Summary of Multiple Regression of Classroom Practices on the 3 Factors

R	R Squared	Adjusted R Squared	Df		F-Ratio	p
			Regression	Residual		
.68	.47	.46	3	241	69.80	0.00*

*Significant at $p < 0.05$

Table 1 shows that the three factors: entrepreneurship knowledge, attitudes and skills, taken as a whole, correlate strongly and positively with the dependent measure (R=0.68). They also accounted for 46 per cent of the total variance in the teachers' classroom practices (Adjusted R Squared = 0.46). This implies that the remaining 54 per cent is due to other factors and residuals. The F-ratio of 69.80 is significant ($p < 0.05$) meaning that the R value cannot be ascribed to chance. This result is represented on Figure 1.
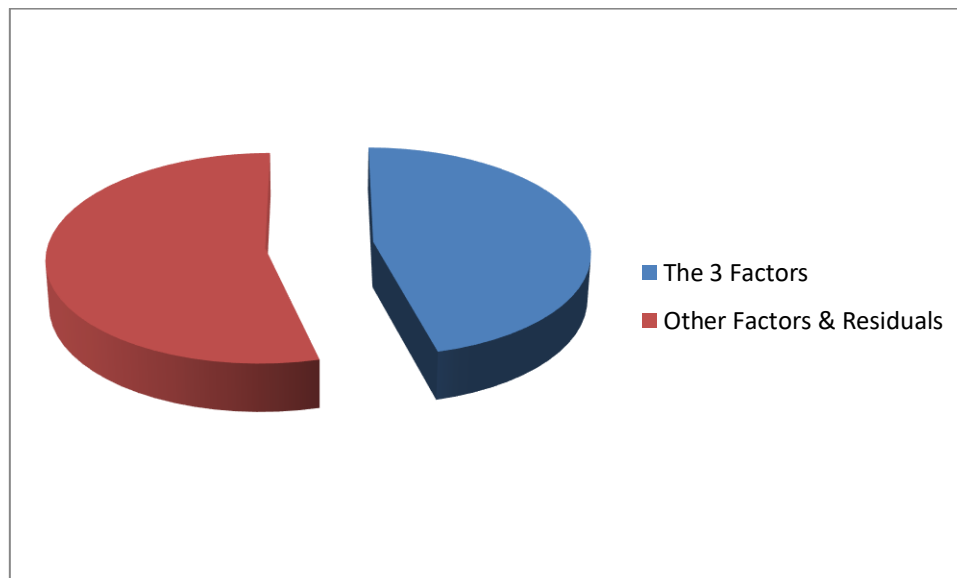

Figure 1: Percentage Explanation by the 3 Factors Versus Others

Although the three factors presented in Figure 1 comprise a smaller proportion compared to that ascribed to other factors and residuals, 46 per cent is still a huge magnitude to be reckoned with towards the determination of teachers' classroom practices in entrepreneurship education.

Research Question 2: What are the relative contributions of each of the three science teacher factors (entrepreneurship knowledge, attitudes and skills) to their classroom practices in entrepreneurship education?

Table 2 presents the individual contributions of the three factors to science teachers' classroom practices.

Table 2: Relative Effects of the Three Factors on Teacher Classroom Practices

Variables	Unstandardized Indices		Beta	Rank	t	p
	B	Std. Error				
Constant	171.26	10.99			15.58	0.00
Entrepreneur-	2.03	0.30	0.38	1st	6.79	0.00*

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ship Knowledge						
Entrepreneur-ship Attitudes	1.11	0.35	0.20	3rd	3.14	0.00*
Entrepreneur-ship Skills	1.10	0.26	0.25	2nd	4.22	0.00*

*Significant at p<0.05

Examining the results in Table 2 we can infer that entrepreneurship knowledge made the greatest contribution to teacher classroom practices (β=0.38). It was followed by entrepreneurship skills (β=0.25) while entrepreneurship attitudes made the lowest of the contributions to the dependent variable (β=0.20). Each of the relative contributions of the three independent variables was significant (p<005). This means that all the contributions are considered highly relevant to the classroom effectiveness of the science teacher in the delivery of instruction as it relates to entrepreneurship education. The magnitude of these contributions is represented on Figure 2.
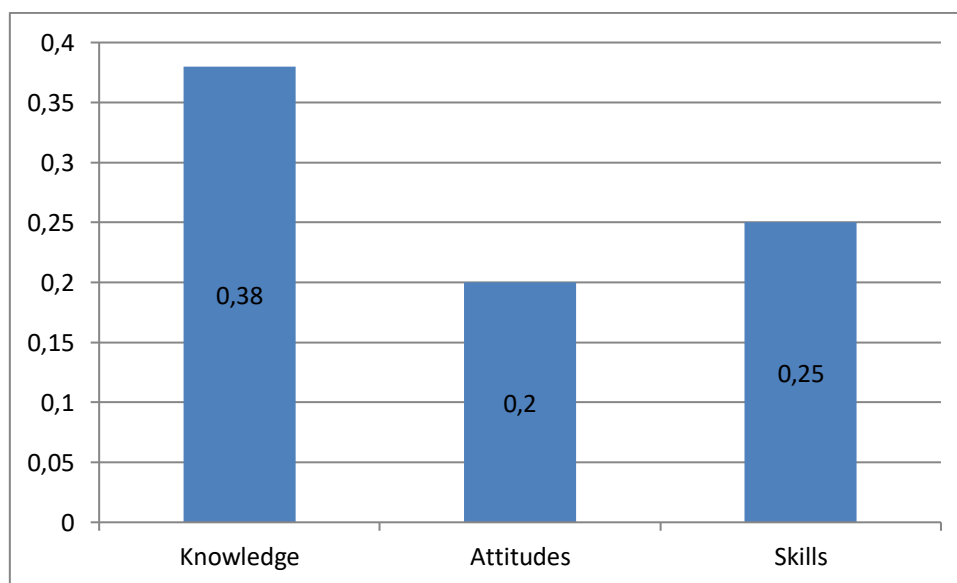

Figure 2: Magnitude of Contributions to Classroom Practices

From the findings in Figure 2, the contributions could be represented as: Entrepreneurship knowledge > Entrepreneurship skills > Entrepreneurship attitudes.

Hypothesis 1: There is no significant relationship between science teachers' entrepreneurship knowledge and their classroom practices.

Table 3: Bivariate Relationships between Teacher Attributes and Classroom Practices

Variables	N	r	p
Teacher Classroom Practices	245		
Entrepreneurship Knowledge	245	0.59	0.00*
Entrepreneurship Attitudes	245	0.55	0.00*
Entrepreneurship Skills	245	0.52	0.00*

*Significant at p<.05

Table 3 shows that teachers' entrepreneurship knowledge has a strong positive relationship with their classroom practice (r=0.59). This means that as entrepreneurship knowledge increases, teachers' classroom practices become more effective. The observed relationship is also considered significant

(p<0.05). Accordingly, hypothesis 1 is rejected. There is, therefore, a significant positive relationship between teachers' entrepreneurship knowledge and their classroom practices.

Hypothesis 2: There is no significant relationship between science teachers' entrepreneurship attitudes and their classroom practices.

Table 3 describes that the relationship between science teachers' entrepreneurship attitudes and their classroom practices is positive and strong (r=0.55). This means that as entrepreneurship attitudes increase, teachers' classroom practices in fostering entrepreneurship education become more effective. The observed relationship is significant (p<0.05) and hypothesis 2 is rejected. Based on this finding, therefore, a significant positive relationship exists between teachers' entrepreneurship attitudes and their classroom practices.

Hypothesis 3: There is no significant relationship between science teachers' entrepreneurship skills and their classroom practices.

Table 3 illustrates that there is a significant positive relationship between science teachers' entrepreneurship skills and their classroom practices (r=0.52; p<0.5). This means that an increase in the science teachers' entrepreneurship skills leads to higher level of effectiveness in the teachers' classroom practices towards fostering entrepreneurship education. On the basis of this result, the null hypothesis 3 is rejected. A significant positive relationship, therefore, has been found between teachers' entrepreneurship skills and classroom practices.

The magnitude of the strengths of the correlation coefficients depicting relationships of each of the three factors, viz: entrepreneurship knowledge, entrepreneurship attitudes and entrepreneurship skills with teacher classroom practices are represented in Figure 3.
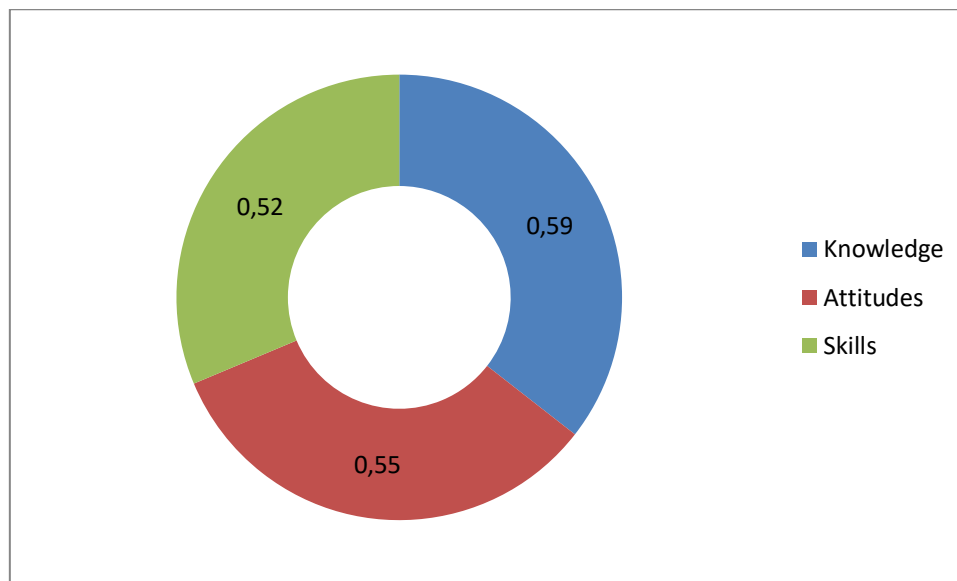

Figure 3: Doughnut Chart of Strengths of Bivariate Relationships with Classroom Practices

The Figure 3 reveals that the three factors had comparable strengths judging by their respective bivariate relationship coefficients with teachers' classroom practices.

The findings have shown that the three variables: teachers' entrepreneurship knowledge, entrepreneurship skills and entrepreneurship attitudes have a lot to do with their capacity for effective classroom practices towards engendering students' entrepreneurship behaviour. The findings have provided empirical evidence that entrepreneurship knowledge, attitudes and skills are required by science teachers to prepare students for the all-important tasks of entrepreneurial lifestyle and livelihood after school. Indeed, the tasks of identification and dealing with threats and maximizing opportunities cannot only be in-born but could be developed and improved upon given effective entrepreneurship education. Teachers with high levels of entrepreneurship attributes are in the best of positions to assist students in exploring thoroughly the world around them, observe the varieties and the needs of the society in order to take full advantage of the opportunities presented in the holistic situation analysis.

Any failure on the part of the teachers to equip themselves with the necessary knowledge and capabilities for both entrepreneurship and entrepreneurship education could spell doom for the students, not only in terms of failure in their study of science but also in the world of work, therefore, making no meaningful contribution to the national economy.

The research results have also confirmed the earlier findings of Kaseorg and Raudsaar (2013) that entrepreneurship attitude of students depends on teachers' knowledge. That lack of technical support, which could only come from teachers in the school's environment, prevented students from gaining necessary environmental capabilities (Rudhumbu, Svotwa, Munyanyiwa & Mutsau, 2016) is another finding corroborated by the present study. Above all, a good entrepreneurship education helps students to acquire innovative practices (Wei, Liu & Sha, 2019). Teachers' skills for entrepreneurship is, therefore, required for building student confidence, creativity, capacity for starting a business, sense for tackling challenges when encountered, delay of gratification, management of scarce resources especially finances, volunteering to take leadership roles, effectiveness in persuasion and communication skills and ability to endure apprenticeship.

6.   Recommendations

The findings led to the conclusion that science teachers need to avail themselves of every avenue of professional development towards improved entrepreneurship knowledge, attitudes and skills. The teachers also need to implement science education curricula using strategies that could foster entrepreneurship capabilities and behaviour among the students. Government, non-governmental organisations and professional bodies also need to invest more in the science education programmes through facilities, seminars and workshops for teachers in order to equip them with the most fundamental entrepreneurial competencies. The study was limited to science teachers in Lagos State out of the existing 36 states and the Federal Capital Territory. Similar studies need to be carried out in other parts of the country, allowing for teachers of other specializations to join and participate in the research activities, thus, providing an opportunity for more reliable generalizations to be inferred. In addition, further studies in the area of strategies for improving teachers' knowledge, attitudes and skills in Entrepreneurship Education are herein advocated.

7.   Conclusion

The study has established that there is a close interrelatedness and highly positive relationship between science teachers' entrepreneurship knowledge, entrepreneurship attitudes, entrepreneurship skills and their classroom practices in entrepreneurial education. They also had joint positive multiple relationship with each of knowledge, attitudes and skills making tangible contributions to effectiveness of classroom practices. It is therefore, concluded that the three factors have great influence on teachers' classroom practices and could make or mar every effort towards implementing an effective entrepreneurship education in the senior secondary school science programme. Invariably, this is the type of education that has enormous potential for determining the direction, the progress and the ultimate industrialisation of the Nigerian nation.

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