

# **Innovating Science Education for Technical Entrepreneurship: The Curriculum Dimension**

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## **Abstract**

The status and rating of nations today in the League of Nations is dependent on the capacity to meet domestic needs of citizens as well as positing products in the global marketplace. Innovation in Technical and Vocational Education occupies important place in ability of nations to achieve this. This paper advocates needed innovations in the curriculum of technical and vocational institutions through an integrations of entrepreneurship education programmes. Suggestions for improvement in the entrepreneurship qualities of Technical and Vocational graduates were also proffered

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## **1 Introduction**

Nigeria is in a quest for technical manpower to lift her technical and industrial stardom. In the, 1970s, 1980s and 1990's huge resources were spent on importation of expatriate manpower for our small and medium scale enterprises where technical skills were needed. At that time, a huge chunk of the nation's foreign exchange was spent on procuring and maintaining these foreigners. Efforts to address this colossal wastage of resources led to the introduction of the 6-3-3-4 system of education with a primary focus of laying the foundation for producing Nigerians with technical skills and who will feed the technical colleges and poly technical where science and technology knowledge and skills for work can be acquired.

Consequently, technical colleges, polytechnics, monotronics, and technical departments of colleges of education were set up to produce the necessary manpower needed to lift the nation technologically. It was also aimed at stemming the tide of unemployment which

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was gaining ground at that time. To enhance the success of the project, the technical teachers training programme (TTTP) was founded to produce teachers for the 6-3-3-4 programme and the technical colleges. These teachers were sent overseas to acquire the necessary technical skills and methodology for teaching in those colleges. The TTTP programme was later indigenized with the establishment of Federal Colleges of Education (Technical) in some states of the federation to cater for the manpower needs of these institutions.

As stated in the National Policy on Education (FGN, 2004), technical education refers to “educational processes involving general education, the study of technologies and related sciences as well as the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic life” (NPE 2004). Though technical and vocational educations are used as synonyms most times, Nata’ala (2009) conceptualized technical education as having more scientific and mathematical implications than vocational education. The goals of technical and vocational education as provided by the policy makers (NPE 2004: 30-31) include:-

- a) Provide trained manpower in the applied sciences, technology, and business particularly at craft, advanced craft, and technical levels.
- b) Provide the technical knowledge and vocational skills necessary for agricultural commercial and economic development
- c) Give training and impart the necessary skills to individual who shall be self-reliant economically.

UNESCO (2008) explains that technical and vocational educations are geared towards emphasizing the application of traditional skills, entrepreneurship, modern information and communication technology and generic competencies required in formal and informal sectors of economy.

The basis for technical education therefore is to help fight unemployment by channeling young people towards useful skills for setting up their own businesses and fighting poverty through the acquisition of productive skills as well as provide technical assistance to government offices and parastatals when necessary. Such technical assistance includes repairs and maintenance of equipments, fabrication of implements, and useful tools for work. Technical and vocational education is therefore necessary for the development of self sufficiency in manpower needs of every nation. The interest of this paper is therefore to take a look at the technical education curriculum and the place of entrepreneurial education in the development of entrepreneurial skills necessary for possible innovations that will enhance utility and relevance to the achievement of national goals.

## **2 Historical Foundation of Technical Education**

Technical education can be considered to be a more recent institution compared to university education. From the beginning of civilization, man has been involved in the use of his initiative to produce crude implements that ease his work. This informal education of craftsmen thrived on the apprenticeship system and family trade (Ayomike, 2010). Formal type of technical education is traced to 18<sup>th</sup> century during the beginning of the European industrial revolution (Aina, 2000:14). University education on the other hand dates as far back as the 10<sup>th</sup> C when the first university, (Al Azhar) was established in Egypt. The focus of university education at that time was the traditional liberal arts, humanities, and theology. Adventurous pursuits in science and technology were not

accommodated by university education. Technical colleges came thus as a result of the quest for institutions that will meet the demands of the time. These technical institutions later metamorphosed into polytechnics in 1964 (Eze, 1990 in Aina, 2000) in Britain to meet demands for tertiary education in technical education. Other polytechnic institution such as the “Ecole” (founded by Napoleon Bonaparte), Virginia polytechnic institute, California polytechnic in the USA as well as those in Soviet Union sprang up, offering education with strong attachment to the integration of theoretical knowledge with practical application firmly based on work and training. The Chinese polytechnics were modeled after the Soviet types but with university status specializing in Engineering and Technology (Price, 1970 in Aina, 2000) and with focus on in-service training and continuing education. Technical Education in the United Kingdom was established basically for two purposes.

1. To maintain close link with industry, commerce, the professions and the public service in the locality
2. To meet the needs of part-time students and as a means of widening access to higher education.

Before 1960 in Nigeria, training of technical personnel were in the hands of private venture companies except in a few formal government institution that undertake training in forestry, veterinary and agriculture as well as Yaba higher college and the Nigerian colleges of Arts, sciences and Technology established in 1952. These pre-independent institutions were Nigeria’s earliest attempts at promoting technical education (Aina, 2000). Courses offered in those technical institutions included diploma in secretaryship, Art, surveying, Architecture, Accountancy, administration, Estate Management, Pharmacy and Teacher’s certificates (Aina, 2000:17). These institutions were quickly followed by the establishment of technical institutes in Enugu and Kaduna in 1958, Ibadan Technical College in 1960, and Auchu Technical College in 1964. These institutions were later upgraded to polytechnics as the need for technicians and technical personnel continued to rise. The 1980’s witness an increase in the demand for technicians and technical staff for the young steel industry and other related oil mineral sector as well as the desire to lay a foundation for technological growth of the country.

This was however not sustained as some of the established technical colleges died out with the on-set of global down turn in oil prices ( a major source of the country’s financial wealth). Hence Batagarawa (2001) (cited by Otomewo, 2010) attributed the slow pace of development of technical schools in Nigeria to the huge capital and infrastructural requirements for their establishment and sustenance.

### **3 Concept of Entrepreneurship**

Entrepreneurship is not a new concept in Nigeria. It has however grown in dimension from the services rendered by one man through his sole investment and focus on making personal profit to all efforts at getting things done through risk bearing mechanisms towards satisfying human wants. Otomewo (2010) in an attempt to conceptualize entrepreneurship see it as a dynamic and social process where individuals alone or in collaboration identify opportunities for innovation and act upon these by transforming ideas into practical and targeted activities, whether in a social, cultural or economic context.

An entrepreneur therefore is a person vested with attitudes and behaviours that enable him.

- Understand his environment, people and their needs
- Take initiatives towards solving identified problems
- Set machinery in motion towards turning resources and materials into practical solutions to problems
- Bears risks and accepts success,

Describing an entrepreneur, Akpomi (2009) has this to say

“Thus effective entrepreneurs are exceptional learners. They learn from everything. They learn from customers, suppliers, and especially competitors. They learn from experience. They learn by doing. They learn from what works and more importantly from what doesn’t work” (Akpomi 2009 as cited by Kayoma 2010:2).

An entrepreneur is therefore not only an innovator, he is a life-long learner, a creative person a initiator and a potential industrialist and big time business person separated from his dreams only by time and opportunity. The destiny of nations lies in the hand, the head, and mind of entrepreneurs since they shape, actualize, and drive the developmental dreams of any nation to reality. Wilkens (1979) emphasizes the role of entrepreneurs when he stated that their emergence in any nation accounts for economic change, growth, and development. For success in achieving this, the need for entrepreneurial skill infusion in technical and vocational education has become a necessity. Infusion of entrepreneurial studies into technical education provides the technician and the technologist the mind set for creating and sustaining innovations. Such an infusion might produce the necessary hub for job creation, poverty reduction and possibly lunch Nigeria into the product market. This is the holistic approach to educating for sustainable development.

#### **4 Entrepreneurial Approach to Innovation in Technical Education**

Innovation in the common sense means the introduction of anything new with the purpose of improving quality, quantity, output, or procedures. Rogers (2003) conceptualized innovation as “as idea, practice or object that is perceived as new by an individual or group” innovative strides in education generally have helped to address issues that relate to instructional materials, methodologies, learning environments and even teacher preparation and retraining. Innovative learning environments focus on the facilitation and utilization of new knowledge acquisition modes, adoption of problems solving strategies, utilization of self-directed learning and knowledge extension.

In Nigeria, technical education is expected to produce the human capital necessary for the technological growth which is essential for the development of the country technologically and economically. Innovation in technical education should thus explore ways and means of producing individuals who are independent, imaginative, constructive, creative, artists and with ideas capable of adventures that break new grounds. Innovation is the propeller for development of any nation.

From the entrepreneurial angle, innovations are for productivity, skills display, and self reliance. The main peculiarity of technical education is that it aims at producing individuals who are self sustaining and self reliant. Entrepreneurs utilize innovation for development, sustenance, and expansion of small and medium scale enterprises and self employment. Innovations also serve as pivot to risk initiatives in business and manufacturing of products. Innovativeness and creativity are essential ingredients in

entrepreneurship and are indispensable in this era of few jobs or no jobs at all. Entrepreneurial aspect of the Technical and vocational manpower training should incorporate skills in establishment, managing and sustaining businesses, at both individual and partnership levels. Acquired technical skills need to be able to explore and interpret the terms of needed implement of works, devices that save time, devices that save energy, artistic, agricultural implements and aesthetic demands as well as desires and industrial technical demands and repairs of machines and equipments. These should cover areas such as engineering, building, secretarial, business, environmental, and even health. Udeh (1999) cited by Kayoma, (2010) enumerates entrepreneurial skills needed for technical and Vocational manpower building to include

1. Generating business ideas
2. Identifying investment opportunities
3. Making decisions towards exploiting such opportunities
4. Formulating organizational objectives
5. Conducting market surveys
6. Establishing and starting the business enterprise
7. Distributing and promoting the organization's products and services
9. Organizing the human and material resources for the attainment of the goals of the enterprise
10. Bearing risks and uncertainties
11. Innovations ( Udeh, 1999 in Kayoma, 2010: 4)

Other entrepreneurial functions identified by Schumpeter (1950) as cited by Akinseinde (2010) include:-

- Undertaking new and untried business responsibilities
- Producing new commodity or producing an old one in a new way
- Reorganizing industry
- Opening up a new market
- Developing a new sources of supply
- Exploiting and invention
- Creating society's wealth

Processes that demand experience in networking, access to capital and possible global market for products (Otomewo, 2010) as well as studies in global market trends have also been identified. If technical school leavers become equipped with these skills and competences, they become assets to the society and as well as key elements in the achievement of government's visions and policies for development.

## **5 Curriculum Implications of Entrepreneurial Skill Infusion into Technical Education.**

Productivity and acceptability are the soles of a nation's development. A productive nation in which her goods and services are not only required but sought for, represent a growing economy. Nigeria's vision of becoming one of the first 20 biggest economies in the world by 2020 (vision 20:2020) is a very tall ambition. It is achievable if matched with necessary curricula reforms for grassroots application of the vision in the preparation of human resources for the driving of such economy. A completely consumer economy

has slim chances for sustainable development. An economy that is able to produce what she requires and give to others is more likely to attain sustainable growth.

The curriculum is a vehicle for change and development. A dysfunctional curriculum will definitely lead to the production of individuals without the capacity and competence for lifting the country to desired status. The separation of the technical course offerings from business courses and subjects in the technical schools and polytechnics introduce a huge gap between skills and their eventual utilization in the world of work and enterprise. Technical and vocational skills standing on their own can only produce individuals with useable skills but without the necessary initiative and impetus for utilizing them at the functional level enough to create a self reliant economic effect. Entrepreneurial aspects of technical and vocation education advocates for inclusion of courses in

- Business innovation
- Job creation
- Managing small and medium scale enterprises.
- Accessing funds/finance sourcing.
- Introduction to financial accounting.
- International business fora
- Consumer market
- E-market and global economy.

The development of the business mindset and knowledge in the business world help an entrepreneurial mind to key into international policies that direct production. A perfect need assessment of the consumers will help the skilled technician cater for would –be customers and consumers of products through worthwhile innovations. Curriculum innovation for ushering in this change must be preceded by systematic course/content planning (chang and Sung. 2009), appropriate teaching resources, sequenced instructional procedures, and appropriate competence assessment techniques. The content of technical and vocational education curricula needs to change to link training to job creation and employment (Akinseinde 2010).

Akinseinde (2009) had earlier advocated that Technical and Vocational Education should change to suit modern technological methods of production; courses designed for competency and essential skills acquisition as well a serious attention paid to infrastructures and facilities for training and practice. Such innovations in the curriculum of technical and vocational education must emphasize acquisition of skills that relate to national needs.

## **6 Conclusion**

The central role of technical and vocational education in the sustainable development of any nation is noteworthy. Any Technical and Vocational Education (TVE) programme must provide the products with skills, attitudes and competencies, necessary for creating jobs, self employment production of necessary/need goods and services that will impact on the lives of the citizens. Entrepreneurial demand skills in risk bearing, risk taking, economic survey, and market trend understanding as well as knowledge in handling and nurturing young and growing businesses. The curriculum of TVE should provide contents which enhance the acquisition of knowledge, skills, and attitudes for venturing into areas that previously regarded as impossible. This is possible through the infusion of 21<sup>st</sup>

century consumer-linked products and dynamism in the search for functional technological education.

## 7 Recommendation

It is hereby recommended that Technical Education hold the key for job creating, manufacturing industry improvement, and advancement our SMEs. In order for the product of Technical and Vocational Education to possess the skills, the attitudes and mental mindset to engender sustainable development, they must receive entrepreneurial training and aspects of business education. For technical and vocational institutions to achieve these, the following measures are hereby recommended.

- 1) The curriculum of technical and vocational schools should be reformed to include training and offerings in entrepreneurship and business education and some elements of ICT and foreign market trends. This will enable them operate in a global milieu as well as access current formation in their trade.
- 2) There is a need for the improvement of practical skills acquisition and a closer link between school and industries.
- 3) Acquiring practical skills without the necessary entrepreneurial skills makes the products of technical education unprepared to face the competitive world of work. Instead of being enterprise minded, they add to the ever increasing number of job seekers in search of non-existent jobs. Advancement of soft and long term interest free loans to technical and vocational education graduates to set up businesses is here advocated.
- 4) Development of lifelong education programmes for registered technicians in technical skill updating, current business management techniques, and entrepreneuring advocated for vigorous pursuit.
- 5) Regular monitoring of adventurous and practicing / technical entrepreneurs will create a sense of relevance and recognition of their activities and contribution to the development of society as well as to achievement of government developmental policies.

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