

Innovative Tools for Teaching Science and Technology Education: Beacons for Self-Reliance

Idris, U. S. B., Babagana, M. & Yaki, A. A.

*Department Of Science Education, School Of Technology Education
Federal University of Technology, Minna.*

Abstract

Innovation is a product of creative and innovative skills learnt from the classroom. Innovation paves way to entrepreneurship that also leads to self-reliance. This paper focused on the innovative teaching tools that can be used by teachers in schools to enhance creativity and innovation among learners capable of making them to be self-reliant. It examines the weaknesses of traditional method of teaching science and technology education that could be bridged by the innovative tools if properly utilized. It went further to suggest some ways teachers could follow in order to teach innovation in schools. It concluded that if innovative tools and the ways of teaching innovation are implemented by teachers in schools, students will become creative and innovative and eventually become entrepreneurs that could lead the nation to be self-reliant.

Keywords: Innovative tools, innovation, creativity, self-reliance, entrepreneurship.

Introduction

Education has remained the basic tool for sustainable development in the past and the present world. As a result of the dynamic nature of the universe, science and technology remain the sinequanon in meeting up with the demands for better living. Most of the developed and the developing countries have been investing heavily in science and technology in quest for sustainable development, Nigeria inclusive. But the irony is that, Nigeria is still battling with a trembling economy and unskilled school leavers and graduates that are not self-reliant (Nwagwu, 2007 in Mustapha, 2013).

Since independence, as prescribed in the Federal Republic of Nigeria (F.R.N., 2004) National Policy on Education, one of the goals of education in Nigeria is to equip students with both physical and intellectual skills to be self-reliant which could go a long way in making the country a self-reliant nation. It is interesting to remember that science as a field of inquiry develops and nurtures inquiry mind, whereas, Technology helps in creativity and innovation (Mustapha, 2011). The question here is that are the science and technology curricula functional or ineffective in all these years of their implementation? The answer could be no because the nation educational goals are set to solve or to meet up with the societal problems. Consistently, the society changes as the world is dynamic in nature. In this case, there is need for review and modifications in curricula implementation and the terminal is the classroom instruction. There is need for innovative methods and strategies in teaching science and technology capable of increasing inquiry and creativity skills necessary for self-reliance among students.

Entrepreneurship Education for Self-Reliance

Entrepreneurship education is the one that aims at cultivating the comprehensive qualities and abilities of entrepreneurship and value of innovatory spirit (Li and Wei, 2010). Entrepreneurship can be seen as a dynamic and social process where individuals alone or in collaboration identify opportunities for innovation and act upon it by transforming ideas in to practical activities in social, economic or cultural context (Otomewo, 2010). The basic objectives of entrepreneurship among others are strengthening professional qualities such as leadership, risk-taking and team working; and as well expanding ways to employment (Li and Wei, 2010). In this regard, it will be a panacea to high unemployment rate that has been a great challenge to this nation for a long time there by creating job opportunities for millions of Nigerian youths. Consequently, Per Capita

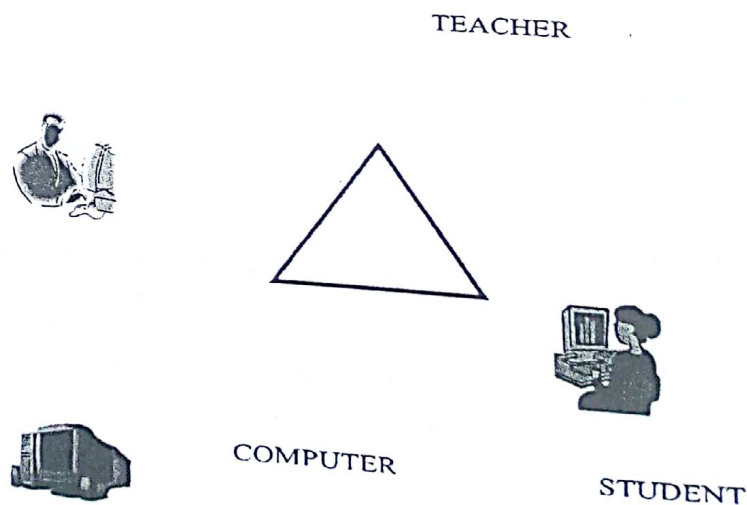
Income will increase, Gross Domestic Product will shoot up leading to a buoyant economy for self-reliance. This is achievable if entrepreneurship is inculcated in students through the use of innovative methods and strategies of teaching sciences at all level of education

Innovative Methods of Teaching for Boosting Entrepreneurship Skills

Years in years out, traditional method of instruction has been the most practiced method of teaching world-wide. It could not be said to have failed but rather it is inadequate in terms of entrepreneurial skills. Among the weaknesses are learning not concentrated on practical aspects, no interaction with students, emphasizes more on theory than practical situation and learning based on memorization not understanding to mention but a few (Damodharan and Rengarajan). To aver this inadequacy, it becomes pertinent for teachers to explore more methods and strategies of teaching that could supplement or rather augment the traditional method of instruction capable of grooming students with entrepreneurial skills. These include:

1. Use of Computer-based Multimedia: - Multimedia is the combination of different digital media like texts, images, audio and video in to an integrated multisensory application to convey information to the target audience. Thus, Computer-based Multimedia is the integrated media contained in computer which are used for disseminating information. Computers have become the order of the day as they are widely used in education as innovative means of teaching. Aside basic functions accorded computers in various organizations and institutions, there are some unique tools that can be used to have optimum contribution of computers to classroom instruction, these include:
 - a. MS PowerPoint, Astound graphics & flash slide show software: - These are usually used in preparing presentation. Teachers can presents subjects or concepts in an organized and beautiful manner using these tools
 - b. Macromedia, flash author ware, and BPP: - These are used to create presentation using icons to represent media elements and placed in a flow line. Most of the current computer packages used in teaching are created using these tools.
 - c. Windows movie maker, Winmpp, macromedia director: - With these, presentation is created using movie making concepts such as casts, pictures, sound etc
 - d. Adobe Acrobat: - This is widely used in education, particularly with word documents. For example, acrobat reader 5 has some elements like graphs, charts, sound etc to have a wonderful presentation of information.

MULTIMEDIA INTERACTION



2. **Mind mapping:** - This is a way of teaching students by making them write notes using key words and images during instruction. This enables the teacher to teach concepts faster and with ease, and the learners to find it easier to refresh information at a glance of their notes. The use of mind maps engage the brain more in terms of assimilation and connection of facts than the traditional notes. For example, a teacher can have images of train, car, ship, aeroplane, camels, horses, donkeys, to teach concept of ancient and modern means of transportation. These images will help students develop mind maps of the concept which will make the learning more effective and retentive because of their visual quality. The unique feature of this method is that it improves innovative thinking of learners.

3. **Mnemonic words:** - The use of mnemonic words is another innovative method of teaching. The Teacher teach the concepts in mnemonics and their meaning until the learners come to the basic understanding. Afterwards, he begins to explain concepts in sentences. For example in biology, the teacher may use MRNIGER to teach the characteristics of living things in a class. This also makes learning faster and easier.

4. **Role playing and scenario analysis-based teaching:** - this is another outstanding innovative method of teaching mostly used by organizations and management institutions. The main aim of this method is to help inculcate problem solving skills. It is adoptable in science and technology courses as it is practical oriented students are given real life scenario to solve certain problems. The essence of this method is that it exposes learners to decision making in any given situation. For example, in a class of genetics, students play roles in explaining some genetic disorders, sex determination, random mutation or other ecological concepts.

5. **Z to A approach:** - In this method, attempt is made initially by explaining the application part of a concept and its effects. For example, a biology teacher can teach concept of pollination by first displaying different types of fruits and seeds to the class advocating that they are all from the same process, pollination. The learners will be eager to know that process which will enhance learning. This method helps in explaining concepts clearly, stimulate students' interest to learn and facilitate permanent memory of learning.

6. **Sense of humour;** - This is defined as the tendency of a particular cognitive experience to provoke laughter and provide amusement (Wikipedia, 2014). It is one of the basic characteristics of a good and professional teacher. Sense of humour stimulates learners' interest, enhances cordial relationship between teacher and student, and if inline with the subject matter, enhances recall (Damodharan and Rengarajan). The teacher should not be a subject of terror in a class as this will definitely serve as a negative reinforcement to the learners which gives less than reward in terms of motivation (Lahey, 2003). Therefore, an innovative teacher has to be humorous in a class as to carry along his students happily during instruction.

Suggestive Ways for Teaching Innovation in Schools

Apart from the innovative tools and strategies in teaching earlier discussed, there are other ways teachers can follow to teach or rather inculcate innovation in students that could enhance entrepreneurship among them. Markham (2013) suggested ten ways to teach innovation. These are:

1. Moving from projects to project-based learning:- this simply involves developing focused question, using solid and crafted performance assessments utilizing community resources and engaging students in a meaningful projects. The significance of this approach is that students learn by doing which will equip them with more practical skills and experiences.
2. Teaching concepts rather than mere facts: - Teachers should concentrate on teaching

students basic concepts not facts of subject matters. This will enrich learners with in-depth knowledge and skills in the areas of learning. It is however advisable to a teacher to use personal experience and resources to teach ideas in complex, particularly, if there is conceptual inadequacy in the curriculum of interest.

3. Distinguishing concepts from critical information:- teachers should always bear in mind that students need to know things for the purpose of transfer of learning not mere examination. In other words, for students to be innovative they need to study to know and understand concepts as opposed to studying for the purpose of being assessed only. This will only make them memorize concepts without deep understanding. There should be blend between open-ended inquiry and direct information
4. Making emphasis on skill acquisition:- Teachers should incorporate 21st century skills such as collaboration and critical thinking through the lessons. After teaching those skills, well designed marking scheme should be used for the assessment and grading of the skills, this will also motivate students to give more attention to learning the skills.
5. Teaming not grouping of students: - If students work in a group but independently, they are mere group. On the other hand, if they work collectively they can be called a team and innovation emerges from teams and networks not from mere groups. Therefore, team working is a determinant factor of innovation among students.
6. Using creativity tools: - Several tools enhancing creativity among learners were mentioned earlier. In addition, some playful games and visual exercises have the potential of enhancing creativity in the classroom. Thus, teachers should make sure that all the games and exercises are organized within the concepts and ideas taught in the classroom.
7. Making reflection critical of a lesson:- Teachers should not concentrate only on continuity of lessons as the gateway of teaching and learning activities, rather, they should give more concern to the reflection of the already learned aspects of teaching, This is because reflection anchors' learning and stimulate deeper thinking and understanding.
8. Rewarding students' discovery: - It is the responsibility of teachers, school administrators and government at large to motivate students in discovering new facts and ideas. This will encourage them to be more creative and innovative. In this regard, our system of assessment is faulty for the fact that it only rewards mastery of learned information. Thus, teachers have to design marking guide that will consider and reward students' innovation and creativity in the school.
9. Teacher should be innovative: - This entails teachers should be dynamic or flexible in the system, ever be ready to shift to changes necessary to boost learning. He should be against strict accountability in the system. This will go a long way in liberating creativity that makes teaching more exerting, interesting and participative.

Summary and Conclusion

Self-reliance at individual and national levels is dependent on quality education that is rich with entrepreneur skills. These skills can be manufactured from the classroom through innovative tools and strategies as explained in this paper. It is therefore left for the teachers to utilize or rather try out such tools in order to enhance creativity and innovation among students which could help in producing graduates with entrepreneur skills for self-reliance not only in Nigeria but the world at large

References

- Otomewo, A. G. (2010) Integrating entrepreneurship in vocational education for youth with Special needs for self-reliance. *Journal of Qualitative education*. 5 (2), 71-75.

Li, J. and Wei, C, (2010) Objectives and approaches of entrepreneurship education in Chinese colleges and universities. Proceedings of the 7th International Conference on Innovation and Management Policy. 1824-1827. Retrieved 10th September, 2014 from www.pucsp.br/icim/ingles/proceedings/papers/2010

Wikipedia Encyclopaedia (2014) Humour. Retrieved 11th September, 2014 from www.en.m.wikipedia.org/wiki/humour

Mustapha, M. T. (2011) Appraisal for the Nigeria JSS Basic Science and basic technology Curriculum. *Journal of Science, Technology Mathematics and Education (JOSTMED)*, 7(2)127-139.

Mustapha, M. T. (2013). The need for science and technology entrepreneurship curriculum at Secondary school level in Nigeria. *Journal of Science, Technology Mathematics and Education (JOSTMED)*, 9(2)192-203.

Nwogwu, O. (2007) Practical Approach to entrepreneurship: An imperative for Nigeria Economic development in Mustapha, M. T. (2013). The need for science and technology entrepreneurship curriculum at secondary school level in Nigeria. *Journal of Science, Technology Mathematics and Education (JOSTMED)*, 9(2)192- 203.

Lahey, B.B. (2003) Psychology: An Introduction. 8th Edition. New York: McGraw-Hill Companies.

Federal Republic of Nigeria (F.R.N., 2004) National Policy on Education. Abuja: NERDC
Markham, T. (2010) 10 ways to teach innovation. Retrieved 20th August 2014 from http://www.pucsp.br/icim/ingles/downloads/papers_2010/part_8/20