RE-ENGINEERING CREATIVITY IN SCIENCE EDUCATION: IMPLICATION FOR EMPLOYMENT AND SELF PRODUCTIVITY IN NIGERIA

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Abstract

The relevance of creativity in science cannot be over emphasized. Owing to the fact that science is a tool with which nations are using to solve their societal problems such as unemployment, this has made each nation a potential searcher on how best to tackle the problems of science teaching and learning. The teaching and learning of science should be geared towards producing creative citizens that will be capable of facing so many societal and economic challenges. Science teachers should rise up to the expectations of teaching science faithfully. The Government should provide a conducive environment for teaching and learning science.

The importance of science to the technological development of any nation cannot be over emphasized. The impact of science on the life of man is now more striking than ever before. The achievement of science and technology has been so significant that the extent of scientific discovery in the next half century is difficult to imagine or predict. Scientific knowledge is continuously being refined through research. Nigeria like other countries appreciates the need for effective science education and recognizes the fact that this is necessary not only for the production of high caliber professional scientists but also for a well informed public who will be scientifically equipped lo live in a fast growing technological age (Gadzama, 2008).

Creativity is an essential part of science education. The proper study of science as a way of knowing and a way of doing helps students to reach deeper in their creative talents. Weisberg (1986) claimed that creativity occurs through a series of small steps in which earlier ideas are modified and elaborated. The nature of creativity occurs when the problem solver runs into further obstacles, and then refines and elaborates the earlier solution! Torrance (1988) defined creativity as the process of sensing gaps or disturbing missing elements; and communicating the results, possibly modifying ad retesting the hypotheses. Creativity is thinking and responding process that involves connecting with previous experience, responding to stimuli and generating at least one unique combination.

Throughout the history of modern civilization, education and science played the central role in change and development, its absence is associated with dependency and underdevelopment. It was the great English philosopher Francis Bacon (1561-1626) who said "Knowledge is power,'[1] and when this knowledge is embodied in the form of innovations in science and technology, it is indeed the force that drives history (Louis 2009).

Therefore to re-engineer science education is to apply all possible techniques of teaching science in our schools so as to produce creative citizens that will be self-dependent and self-productive for national development.

What is Creativity?

Creativity has been considered in terms of process, product or person (Barron and Harrington 1981) and has been defined as the interpersonal and intrapersonal process by means of which original, high quality, and genuinely significant products are developed. From the psychologist's point of view, creativity is the ability to make something new out of available and stored information (Isenberg & Jalongo 1997). Researchers agree that creativity is the production of useful new products and ideas (Amabile, 1983), ability to wonder, ability to solve problems, understanding the world around you, seeking solutions and ability to think (Torrance, 1988; Weisberg, 1986;

Steinberg, 1988). According to Torrance, (1988) central features of creativity are fluency, flexibility and originality.

Creativity in science according to Moravcsik 1981 may be viewed as the attainment of new and novel steps in realizing the objectives of science. Creativity can manifest itself in the conception of new ideas contributing to scientific knowledge itself, in the formulation of new theories of science, in the devising of new experiments to prove nature's law, in the development of 5:.entitle ideas applied to particular domains of practical interest, in the realization Of new organizational features of scientific research and of scientific community, in the novel implementation of plans and blueprints for Scientific activities, in trail-blazing undertakings to transmit the scientific outlook into public mind, and in many other realms.

Why Creativity

According to Otuka (2004), creativity is something everyone possesses in varying degrees; everyone is born with some creative potentials. Creativity occurs at almost all ages and in all fields of human endeavour. A creative engineer produces new, original unique ideas or constructs. According to Maw and Maw (1965) in Otuka (2004) it is found out that highly creative Children, When compared to less creative children, had a greater level of self- sufficiency, felt more secure, were more flexible and dependable, and exhibited a healthier participation in group activities. Highly creative boys, specifically, were found to exhibit a higher level of maturity and social skill, and in addition, these more creative boys exercised better overall judgment than their less creative peers.

Studies have also demonstrated that creative people are more observant, seeing and valuing things as others do not. Creative people are viewed as healthier and more energetic. Getzels (1958) and Jackson (1962) in Otuka (2004) pointed out that creative thinking abilities contribute significantly to the acquisition of new knowledge. Creative people have well-developed ability to sense problems. They possess originality and flexibility which is spontaneous and adaptive. Their fluency of associations, expressions, and ideas allows them to relate and perceive ideas in unusual ways. This leads to a redefining and juggling of ideas, further visualizing, and still more elaborating. The tendency to think at right angles to the mainstream and develop an ability to focus attention in many ways while working and thinking on problems is very common. Creative people also show an ability to evaluate their own creativity, ability perhaps related to their generally strong drive, inner-directedness, self confidence, intellectual thoroughness, and aspiration to making theoretical and original contributions.

Teaching of Science for Creativity

Science is the foundation upon which the bulk of present technological breakthrough is built. Through the application of science, man ensures the longevity of his existence. Also, the prestige and political power of any nation resides in its level of scientific activities. It is thus of importance that as part of strategies of popularizing science among pupils, science teachers should always seize every opportunity to make pupils appreciate the fact of science being a means of achieving technological development and economic survival.

Scientific thinking can also help solve social and personal problems. As Nigeria is shifting from an agrarian to a technological society, science teaching will help the children adjust to the changing environment. The study of science can bring some educational advantages that will foster intellectual and emotional growth. The nation needs engineers, doctors, architects, 5eologists and science teachers, e.t.c. and these professionals could only be obtained through the proper method of teaching science in our schools (Aliyu, 1982).

Scientific research requires creativity in the sense of creating original solutions and new understanding. Problem solving in science requires a student to explore his/her repertoire, to imagine a variety of routes to a solution. This is the justification for

considering creativity as worthy of attention in the education of students who will either become scientists or who need an understanding of society and ability to solve problems (Hu and Adey, 2002).

Solving problem in science is a process in which investigative/inquiry activities aim at giving opportunities to students to solve a problem using their creativity and conceptual framework (Gott and Duggan, 1995). By doing these, students use their skills of applying the science processes. These skills can be grouped within five major categories:

1. Identification of the problem and formulating hypothesis
2. Designing the experiment by deciding the variables.
3. Making measurements, observation and finding evidence and defining them.
4. Presentation of the data using tables and graphs.
5. Evaluation of the process by criticizing the validity and reliability of the data and drawing conclusions (Pekmez, 2000).

According to Martin, Sexton, Wagner, and Gerlovich (1998), the science process skills are also grouped into two as follows:

Basic skills: Observation, classification, communication, measurement, estimation, prediction, inference.

Integrated skills: Identifying and controlling variables, hypothesizing, experimenting, drawing graphs, interpreting, and modeling. The skills are also encompassed within four major categories:

1. Formulation includes identification of the problem, hypothesizing, prediction of the outcomes, and planning of the study.
2. Implementation - includes observing, making measurement and recording.
3. Evidence - involves analyzing and interpreting the data, and drawing conclusions
4. Explanation - entails providing the link between theory and the findings (Dhillon, 1996).

All the categories above are actually explaining scientific process skills which are much related to the components of creativity.

The creativity component of the investigative work could be measured by checking the students' skills of producing a problem and deciding the variables, planning experiments, trying different methods and etc. It is believed that finding out students' scientific process skills will also show how much students' have the creativity components. Findings are also helpful for Science teachers in order to understand their specifications as a scientist (Hu and Adey 2002).

Rao (2003) stated that learners engaged in laboratory work, searching, need ideas in books, reading journals, identifying problems, developing hypotheses, planning experiments, conducting experiments and gathering data. It needs creative thinking. Science teachers employing hands-on method in their lessons will obviously develop the learners' creativity talent.

Conclusion

Creativity is a highly desired and precious commodity which has specific purposes to stimulate manifestation of creative enterprise (Otuka 2004). Science teaching which researchers believed to have enhanced creativity talent of the learners is obviously discovery and or science process approach. They concluded that creativity and science process approach have the same procedure as both of them follow the same processes of solving problems. The production of science related professionals in various fields could only be obtained through proper teaching of science. Science as a twin brother of technology provides a starting point for technology related professions.

Suggestions

- There is need for the government to provide schools with all necessary infrastructure and other teaching and learning materials.
- Science teachers should be motivated by creating special science teaching allowance for them at all levels.
- Science teachers should have intrinsic motivation in both doing and designing science

investigations, and encourage their students to do the same.

- Science teachers should always think of improvising the apparatus that their school does not have.

- Science teachers should try and develop confidence to do more experiments ahead of what textbooks have provided.
- Science teachers should have the sensitivity to link up everyday materials with science phenomena.
- Science teachers should have the divergent thinking abilities in finding alternative ways to do practical work, other than those offered in the textbooks.

References

Aliyu, A. (1980) *Science Teaching in Nigeria,* Ilorin. Ototo Press Limited, Ilorin. 75-77.

Dhillon, A.S. (1996). *Obtaining an understanding of investigative work in school science.* Paper presented at the Australian science education research association conference. Canberra. University of Canberra.

Gadzama, B.I. (2008). *Effects and relationship of science process skills approach on students achievement in integrated science in JSS in Potiskum Educational Zone, Yobe State.* A Seminar paper presented at science education unit ABU Zaria.

Gott. R. & Duggan, S. (1995). *Investigative Work in the Science Curriculum.* London: Open University Press.

Hu. V. & Adey. P.A. (2002). Scientific creativity test for secondary school students. *International Journal of Science Education.* 24 (4) 389-403.

E -. M 1009). *Science reform in education and national development. Ohsener.* Retrieved on 6102009 from hup://vvwwjainaicaobscrvcr.cofn/columns/htinJ

Martin. K. ScxtOIl. C. Wagner. K. & Gerlovich, J. (1998). *Science for All Children.* Boston: Allyn and Bacon.

Moravcsik. M.J. (1981). Creativity in science education. *Journal of Science Education.* 65 *(2): 22* 1 -227.

Otuka, J.O. (2004) *Foundation of science education.* Macmillan Nigeria Publisher Limited for National Open University of Nigeria.

Pekmez, E.S.(2000). *Procedural understanding: Teachers perceptions of conceptual basis of practical work.* Unpublished PhD Thesis, University of Durham, School of Education: UK.

Rao, V.K. (2003). *Science education.* New Delhi: A.P.H. Publishing Corporation.

Sternberg, R.J, (1988). *A Three-facet model of creativity.* New-York: Cambridge University Press.

Torrance. E.P. (1988). *The creativity as manifested in its testing. Contemporary psychological Perspective.* New-York: Cambridge University Press.

Weisberg, R.W. (1986). Problem solving and creativity contemporary psychological perspective. New-York: Cambridge University Press.