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# FOSTERING CREATIVITY IN SCIENCE/TECHNOLOGY EDUCATION TOWARDS FUNCTIONAL EDUCATION IN NIGERIA FOR NATIONAL DEVELOPMENT

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## **Abstract**

*There is no doubt that in the recent past, Nigeria has witnessed and continues to witness increased concern in the science and technology sectors by government and it agencies towards realizing the goals of science education for National development. However, inspite of the renewed emphasis on new methods for teaching science, the level of science education in Nigeria has not led to the production of quality and functional manpower needed for sustainable national development. The structures and agencies engaged in science education do not seem to possess the skill and knowledge needed to embark on a deliberate development of creative abilities of pupils and students in the basic levels of education in Nigeria. This paper attempted to; create the need for fostering creative behaviours in science classes; stress on roles of science education in National development, discuss characteristics of creative children and concludes by how creativity can be fostered through teaching methods in science classes.*

Nigeria has a lot of challenges that should spur her to the action of developing the creativity of her citizenry. They include: insecurity (Boko Haram insurgency), threats to the environment, unemployment, inter-ethnic and tribal conflicts, hunger, refugee problem, urban decay, menace of kidnapping and armed robbery, a host of diseases that have so far resisted any cure, religious clashes, desert encroachment, erosion menace etc. These and many other challenges are enough to inspire Nigerian leaders, educationist, scientist and other various agencies of education to seek ways of circumventing them. Well equipped graduates are capable of turning Nigeria's fortune around.

The role of the school in the encouragement of creativity cannot be embarked upon without the teacher. The science teacher is the prime mover in every successful programme on creativity in the science class. Nigeria as a developing country supports this view in her National Policy on Education (1977 revised 1981, 1989, 1998 and

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2004) when she explain that “No education system can rise above the quality of its teacher”. The policy explained further that the purpose of teacher education is “to produce highly motivated, conscious and efficient classroom teachers for all levels of our educational system and to create further spirit of enquiry and creativity in teachers” The policy laid emphasis on the inculcation of creativity in pupils in pre-primary, primary and secondary levels of education (National Policy on education, 1977). This is only a policy which is easy to formulate but very difficult to implement.

The questions to ask are: (a) Are Nigerian science teachers creative enough to foster creativity in their children? (b) Are our teaching/Learning environments conducive enough to encourage children to be creative? (c) Do our curriculum planners consider creativity very vital for the development of science education? (d) Are our institutions of learning turning out enough creative graduates to occupy our productive vacancies? The answers to these questions if in the affirmative would no doubt lurch Nigeria into a developed Nation from her present status of developing country, unfortunately, the answers are collectively “NO”.

The reality on ground regarding the enhancement of the creativity of Nigerian children clearly demonstrates that Nigeria is doing little or nothing (Ekpenyoung, 1992). The large number of children enrolled in schools in Nigeria does not give room for close monitoring of children who show signs of creativity. The facilities are over stretched by the large number of pupils/students enrolled.

### **Science Education and National Development**

Science can simply be described as an integral area of study which considers both the subject matter of science disciplines such as the traditional science; Biology, Chemistry, Physics as well as the processes involved in the learning and teaching of science. Ogunniyi (1986) opined that people confuse science and science education, while science like other subjects has well defined disciplines such as Biology, Chemistry, Physics and Geology, science education cuts across many fields of human endeavours such as; the natural sciences, sociology, philosophy, psychology among others.

It is also a field of study that is concerned with producing a significantly literate society. Achievement in science education will go a long way in reducing illiteracy and poverty which are impediments for national development. There is need to produce scientifically and technologically literate citizens through well structured programmes to lay the foundation for future works in science and science related fields by acquainting the young students with basic knowledge and skills. Education in general and science education in particular remain the most potent factors that promote national development (N.P.E, 2004).

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Science education is the bedrock upon which scientific and technological development depend. It is believed by most educators that the rapid development made by the developed countries such as Japan, United State of America (USA) and Britain is connected with the science education available in those countries. Science education would need to be efficiently transmitted to produce kinds of manpower with functional scientific and technological knowledge and skills in order for the nation to utilize its manpower to attain its development.

For any nation to experience economic growth and development there must be a strong stimulation and growth in the teaching and learning of science and technology. According to Ajibole in Ogundara (2007), national development encompasses development in every aspect of life of the citizens. However, human resource development is central to any development. So any nation aspiring for development must identify the human and material resources it needs and their values, integrate them for a sustainable development. Sustainable development means development that continually meets today's needs of a nation in a way that does not jeopardize the future generation (Pietila, 1990). No nation can continually develop without resourceful human power.

Mustapha (2003) asserted that the teaching of science and technology has been guarantee in Nigeria education system but the utilization of science and technology to attain development and of course sustainable development have been very slow because of Nigeria's economic recession. To develop a scientific and technological human power by providing sound foundation in the basic scientific, technical principles and practice needed individuals to develop their potentials and take up career in science and technology in the service of the society. The attainment of the above is indeed part of the aims and purpose of science education. That is to equip individuals with appropriate skills, abilities and attitudes that will enable individuals to live and contribute to the development of the society (NPE 2004). Functional education is the education that equips the individual to contribute positively to the development of his/her society.

#### **What is Creativity?**

It is relevant to discuss the meaning and nature of creativity before going into ways by which it can be nurtured through science education in the school and out of school. According to Chambers 20<sup>th</sup> century Dictionary, the word "Creativity" refers to state or quality of being creative, ability to creat. Here creative means to bring into being or form out of nothing, to bring into being by force of imagination, to produce or form, to design, to be the first to act. However, creativity could not fetch a single definition because different thinkers consider it from different perspectives. All the definitions of creativity indicate that it involves development of something unique by the individual.

Some writers like Ekpenyong (1992) have followed the method of delineating the ingredients that make for creativity instead of defining it. Thus he defined creativity as the capacity to originate, invent, reflect, analyse and synthesize. Guilford in Fasko (2000) considers creativity as a thinking skill that can be developed through training after the identification of the characteristic traits possessed by the individual. Thus Guilford in Fasko (2000) explains those patterns of traits that are characteristic of creative persons. According to him, creative pattern is manifest in creative behaviour which includes such activities as: inventing, designing, contriving, composing and planning. People who exhibit these types of behaviour to a marked degree are recognized as being creative.

### **Characteristics of Creative Children**

Some characteristic of creative individuals were listed. Some non-cognitive factors according to Janos and Robinson (1985) include; energy, enthusiasm, vigour , vitality, will power, perseverance, striving, sacrificing for goals, ambition, competitiveness, high aspirations, curiosity, exploration and risk taking. Other non-cognitive factors found by Hamacheck (1979) include, openness to personal feelings and subjective experiences. According to him these are the most striking characteristic of the creative person. This supports Mackinna's (1965) research which proved that most creative individuals are more introverted. One most sensitive characteristic which Guilford (1959) associated with very highly creative children is impulsivity. This is the quality of highly creative children which makes them unable to cope with the routine activities in our traditional classroom such as memorization, rote learning and the unlimited imposition of teacher authority on the learner.

Other personality characteristics possessed by creative people is the unpredictability of their life styles which makes them seem less responsive to conventional and traditional issues. According to Adima in Jatau, Uzo and Lere (2001), highly gifted and creative children hardly succeed in the traditional classroom system where every thing is done on routine basis. Some of them who were forced to identify themselves with this type of environment, eventually dropped out of school. Glaring example of such children was Einstein who was considered a low starter, Edison whose IQ was estimated at 81 and Bill gate, who was a drop out and who eventually invented Microsoft which made the computer what it is today.

### **Specific Points for Identification of Creative Children**

Though every child is creative to some degree yet some children are more creative than others. The following are some of the characteristics by virtue to which children with better aptitude for creativity can be identified;

1. They are more self-sufficient and more independent in judgment
2. They are less teacher-motivated and more self motivated.

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3. They are more self-assertive, more resourceful and adventurous and more radical.
4. They are more self-controlled and possibly more emotionally sensitive and more introvert but bold.
5. They choose some sound over complete quietness while concentrating or studying.
6. They like to study alone rather than with classmates or grown-ups.

### **Strategies towards Fostering Creativity at School through Science Education**

Creativity cannot be taught but can be developed in children by using planned strategies and techniques. Divergent thinking aspects can be stimulated amongst the students who do not apparently show it. The role of the teachers or instructor is very important for fostering creativity among the pupils/students.

Torrance in Kyunghee (2006) suggested the following five steps for nurturing creativity amongst ones students:

- a. Be respectful to unusual questions.
- b. Be respectful to imaginative unusual ideas
- c. Show your pupils that their ideas have value
- d. Occasionally provide opportunity to pupils to do some things for practice without the fear of evaluation.
- e. Let pupils evaluate good or bad
- f. Do not point out consequences or results of an experiment before hand. In evaluation, try to tie causes with consequences.

Psychologists believe that the teacher's role in furthering the students' creativity is a protective and nurturing one. This role appears to consist of the following phrases or steps.

1. **Inspiration:** He should inspire the students to learn to disagree or to emulate.
2. **Stimulation:** He should provide for exciting and new experiences in the curriculum.
3. **Psychological Safety and Freedom:** He should provide a warm and permissive environment in which the creative students can feel accepted.
4. **Guided discovery:** The teacher should provide direction to a level and area where it is most effective for learning by independent discovery on the part of the students.
5. **Encouragement:** The teacher should try to develop children's ideas through constructive criticisms and referring them to competent authority, to books and to other sources.

Singh (1988) in his article "Encouraging creativity among the Gifted and the talented" has mentioned that a great advantage of experiments is that they enable the

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students to have first hand experience of the gradual development of events and the working of the inherent principles there in. A well directed experiment in science can generate in the students, plenty of new ideas and thus pave the way for further experiment and creative act.

In the report of the study group on science Curriculum and Instruction materials development, UNESCO, Bangkok, it is mentioned that in order to foster the element of open competence, the skills and modes listed below need to be taken into account:-

1. Science equipment – designing and utilization
2. Utilization of out-of-school facilities using home, farms, natural resources such as forests, science museums factories etc.
  - a. Field trips
  - b. Out door surveys
  - c. Raising plants and animals
3. Use of audio-visual materials

To sum up, the following strategies and techniques can be used to foster creativity, for science education at school level in particular.

1. **Providing favourable environment:** This means adequate library and laboratory facilities, freedom of thought and action, openness to new ideas, feeling of tolerance and above all, creative attitude on the part of teachers, parents and school authorities.
2. **Open ended subject content:** The content in the field of his/her choice may be provided, as far as possible. Students should be exposed to a variety of literatures through libraries.
3. **Removal of cultural, sexual and educational barriers;** An example of cultural barrier is that some parents impose their own choice subjects on their children rather than encouraging the latter to pursue courses according to their own creative impulses. In the area of sexual barriers, some parents discourage girls from engaging in technological oriented subjects regarding them as exclusive preserve of boys/men. Over emphasis on examination, teaching through foreign language, the uniform pattern of state produced textbooks etc are some of the educational barriers.

To remove these barriers, teachers should educate parents regarding cultural and sexual barriers and also should take precautions not to generate such barriers by their own acts of commission or omission.

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As regards educational barriers, the curriculum and instructional materials are imposed from the authorities on both teachers and students. So, the teacher should find out the relevant reference books, useful materials, and competent personalities and make his students to gain experiences from such sources.

#### **Fostering Creativity through Teaching Methods**

1. The teachers should adopt such methodologies that make the students become star-learners and thinkers. A teacher should incorporate questioning techniques in his teaching. He can use his questions to arouse in the students, feeling of curiosity, inquiry and experimentation for different phenomena.
2. Instead of lecture oriented method, the teachers should provide problem solving techniques or project method whenever possible. The students may be provided freedom to develop, design and express their ideas through creative investigatory projects and models.
3. The technique of Brainstorming can be used to stimulate the students. The students at higher primary levels may be asked to grow plants under different conditions of light: measure of soils, depth of seed sowing etc. Thus, providing open-ended experiments to work upon a problem of his own choice in his own way will go a long way in instilling creative behaviours in him/her.
4. Improvement in examination system: Our whole teaching/learning process should not be examination-oriented. Stress on getting higher marks in examination leads to convergent type of thinking. Evaluation may be on the basis of class performance, interest, orientation or creative ability in a particular concept.
5. Up-to-date knowledge of discoveries and inventions: This helps in developing divergent thinking amongst students and also helps them in learning scientific method and scientific temper. Some anecdotes in the life of great scientist can also be very useful.
6. Co-curriculum activities: Co-curriculum activities such as science exhibitions and science clubs develop certain competences which are compulsory elements of creativity, for example, planning, team work, open mindedness, clear understanding of concepts, theories and principles. Improvisation and innovations and use of low cost materials or use of methods which can make difficult concepts easily understandable-nurture creativity.
7. Home assignment: Appropriate home-assignment play vital role in developing scientific temper and creativity. Assignment such as observations and recording

the location of various constellations in the night sky, construction of working models like solar cooker, solar brooder etc can help one, foster creativity

### **Conclusion**

As technological advancement and changes continue to pop up with increasing frequency, it becomes progressively and intensely more difficult for Nigeria to stay at top without giving priority to educating the young with readjusted set of skills and knowledge in science and technology. Requiring a child to successfully complete one additional credit in a core subject area will probably not ensure that that child secures a better paying job or a higher quality of life. The knowledge and skills needed to achieve or maintain success are constantly changing.

It becomes the responsibility of educators to better equip students, not necessarily with more textbook knowledge, but with different types of skills. Such skills include, but are not limited to: problem solving, time management, creativity, and how to be a self-learner. There is a very real need for education in general to support changes that will increasingly cultivate and encourage creativity in individual classrooms across the nation. By their nature, science and technology education should be an area in education where creativity is fostered and developed among students with relative effortlessness towards sustainable development in Nigeria. We should take care of the obstacles which hamper creativity namely; pressure to conform, authoritarian attitude and environments, ridicule and similar attitudes, traits making emphasis on rewards such as grades and success, hostility towards the divergent personality and intolerance of the “play” attitude. The combined efforts of parents, teacher trainer and politicians can help to a large extent in identification, development and encouragement to creativity and consequently in the sustainable development of our nation.

### **Recommendations**

1. Teacher training institutions in the country should make deliberate efforts to emphasis creativity in the core curriculum and minimum standard for training the teachers since only creative teachers can produce creative children.
2. It is equally important for the government at all levels to adopt programmes that encourage creativity in our youths, too much emphasis on paper qualification as the basis for employment and promotions should be reviewed.
3. Provision of science and technology equipment in our schools should be of utmost priority. A situation where obsolete and none functional equipment are supplied by bad contractors should be checked.
4. Our schools should be centres for promoting entrepreneurial skills so that before graduation, a student would have perfected the skills to make him self reliant and a nation builder.



### References

- Ekpenyoung L.E. (1992); A Forgotten concept in Education? Implications for Vocational Education Curriculum. *Nigerian Journal of technical Education*. 9, (1 & 2) 49-63
- Fasko D. (2000). *Creativity Research Journal*. 13, (3&4) 317-327. Bowling Green State University.
- Federal Government of Nigeria (2004). *National Policy of Education*. Lagos:Federal Ministry of education
- Hamacheck, D.E (1979); *Psychology in Teaching, Learning and growth*.London: Allyn and Bacon, Inc.
- Janos, P.M.& Robinson N.M (1985). Psychological Development In Intellectually Gifted Children, In F.D. Horowitz and M.O. Brien (Eds), *The Gifted and Talented: Developmental Perspectives* (149-196); American Psychological Association Washington, DC.
- Jatau, M.N.; Uzor C.C. & Lere M.M. (2001); *Elements; Special Education for Prospective Teachers*. Jos: Deka Publications.
- KyungHee Kim (2006). *Creativity Research Journal* 18, (1) 3-14. Lawrence Erlbaum Association Inc.
- Mustapha, M.T. (2003) *The Impediments in Utilizing Science Education*.Paper presented at the First National Conference FCE Kontagora.
- Ogundare, D.A (2007); Science Education: The Foundation for Technological and Economic Development in Nigeria. *Multi-disciplinary Journal of Empirical Research* 4 (1) 99-104
- Ogunniyi, M.B. (1986); *Teaching Science in African*. Ibadan: Salem media. Pielila, H (1990); *Environment and Sustainable Development. Reflection on Bruthlan Report. Our common stand on the IFDA dossier*. 61-70 dossier. 61-70
- Singh, .J. (1988); *The Creative and Comparative approaches* India: Thane Maharashtra.UNESCO Report (1981). *Report of a Study group on Science Curriculum and Instructional Material Development*. Bankok:: UNESCO regional Office for Education in Asia and the Pacific.