



INNOVATIVE METHOD OF TEACHING SCIENCE THROUGH INTERDISCIPLINARY APPROACH

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Abstract

A number of common factors influence science education today. The most importantly are the scientific and technological outburst and the increasing national and international issues and problems. The intension of this paper is to examine the roles and effects of science education in encountering these challenges. It proffers that science teachers in Nigeria should consider these challenges and changes by applying innovative approaches to methods of teaching science through interdisciplinary science to attain knowledge, skills and attitudes necessary to compete with the global trend and standard.

Keywords: *Science Education, Innovation, Teaching, Technology, Interdisciplinary, Nigeria*

INTRODUCTION: Science is a great enterprise which nations depend on in-order to advance technologically. Science therefore, is receiving much emphasis in education because of its significance and relevance to life and society. Computers and ICT tools offer exciting approaches to teaching that were not even dreamt of many years ago. Use of computers can revolutionize teaching and learning and could bring advances that would improve education dramatically. In line with this view UNESCO (2002) asserted that teacher education institutions are faced with the challenges of preparing a new generation of teachers to effectively use ICTs in their teaching practices.

The educational system in every country aspires to giving young people the basic skills required in the modern world and to equip them to solve problem logically. The world today is confronting an outsized scientific and technological progress which represents an intricate challenge for education in general and science education in particular. This challenge requires individuals to gain sufficient perception of scientific and technological

development. This means preparing individuals to gain sufficient, more predicting and progressive way of doing things than for previous ways of doing it. In this effort, Nigeria as a country should not lag behind in improving its capacity to add value to whatever resources it has, or can lay hands on.

Obviously, a nation is generally characterised by efforts and a determination to gradually but steadily move towards a stage of maturity, and a state of well being for the individuals that constitute such nation. It is imperative that science education should be given serious attention in our school curricular considering the benefits derivable from it. This demands innovative approaches in science methodology to enable students to cope with the modern world.

Science Education: The word “Science” may be defined as rationally structured knowledge about nature which embraces systematic methods and positive attitudes for its acquisitions, teaching, learning and application. Science is composed of knowledge, skill and attitude each of which has different domains involved. For example, knowledge involves cognitive domain and skill involves cognitive and psychomotor domains. This is because science in skill involves critical thinking in attributing (cognitive domain). We also have manipulative skill that uses psychomotor domain. While attitude such as accuracy, involves affective domain. Each of these domains is catered for in the process of education.

Science Education can be defined as a discipline or field of study concerned with the integration of science content and processes with pedagogy in order to promote meaningful understanding and application of science among learners, or the study of science content and process with emphasis on how best to promote their teaching and learning in order to achieve optimum benefits. (Nworgu, 2010)

Purpose of Science Education: Today, Science is studied principally for possibilities of offers for development of technology. Technology is indeed the application of science in production of goods and services for man. Nations are ranked today, according to their capacity to practise science and technology effectively. Awele M (1997) in Badmus et al (1997) stated it as the capacity to add value to whatever natural resources one has, or one can lay one’s hand on, is the true test of the practice of science and technology in any country.

Roles of Science Education: Science Education having been recognised worldwide as the bedrock of scientific and technological accomplishments and development, science educators therefore have been increasingly concerned with ways of improving the quality of teaching and learning of science in schools for a greater height as;

1. To give an essential background of knowledge for cultural development. It expands the individual's knowledge of the universe and of his position in it. It helps in the appreciation and enjoyment of nature and life.
2. It gives many opportunities to foster the scientific method and discipline, since it trains students to observe and think clearly and carefully. This training should whenever possible be applied to real and worthwhile problems affecting the personal life and thought of the individuals so that such benefits may be transferred to his other activities.
3. It stresses the need to appreciate the meaning of scientific life, spirit and endeavour, open-mindedness, intellectual honesty, self sacrifice and devotion which ought to serve as ideas to future citizen.
4. Science acquaints the individual with knowledge of chemical facts needed not only for many trades and professions, but also by all citizens, to enable them to live happily, well-balanced and useful lives. Future citizens ought also to know of possible influence of new chemical discoveries and should realise need for proper control. It is therefore necessary to understand, as a minimum the simpler words and definitions in science, the relationship between science and other fields of knowledge and the elementary facts and principles of this subject, so that in later life the individual may keep himself informed of important developments.

Like a barometer, the scientific and technological capability of a nation has easily become the social index and determining factor for assessing the economic progress, prosperity and power of nations.

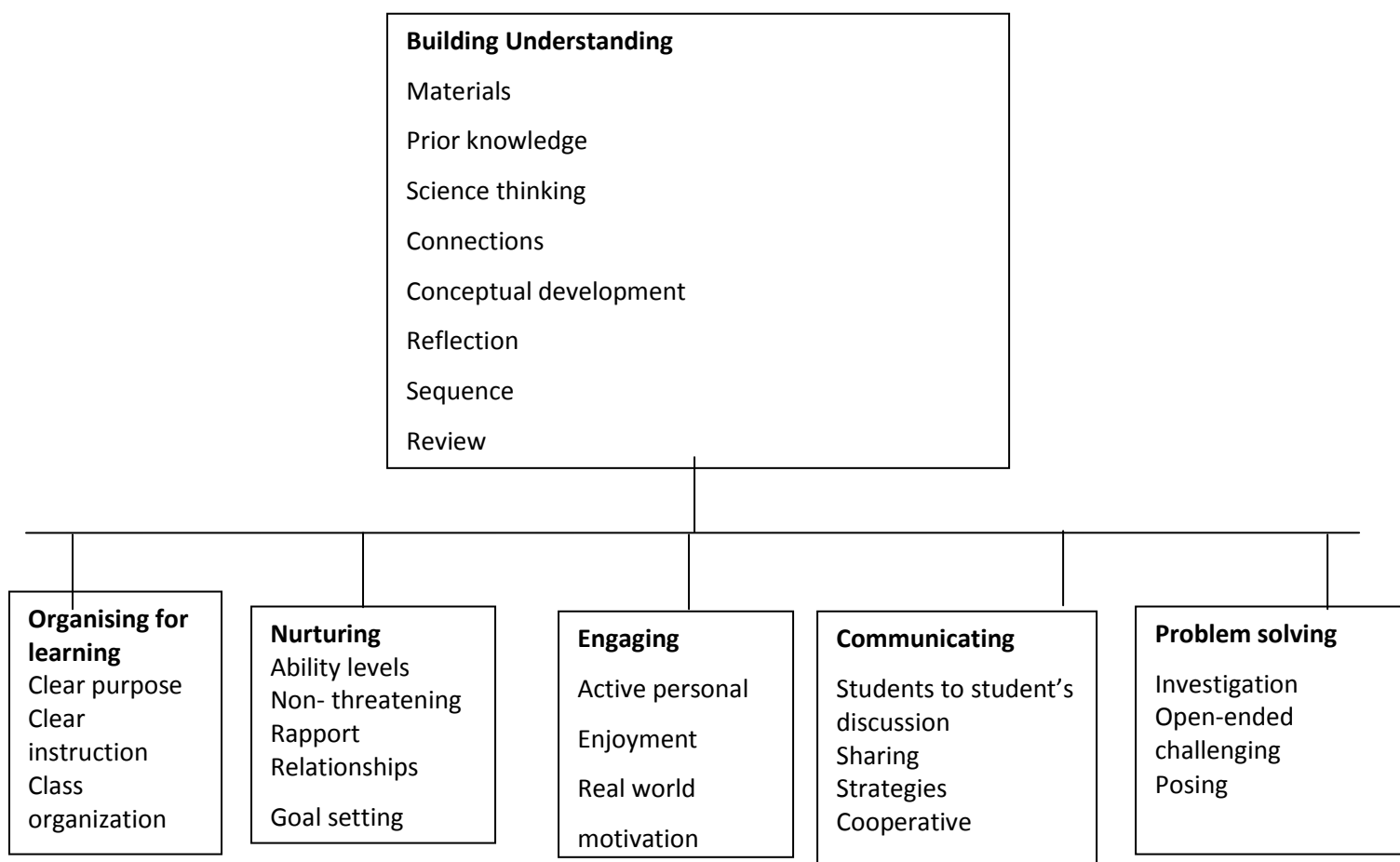
QUALITY TEACHING AND LEARNING OF SCIENCE: Research shows that students can learn science when they have access to high quality science teaching and are given sufficient time and support to master a challenging curriculum.

Quality teaching and learning of science has been and will continue to be major concern to scholars in the field as well as other people whose areas of specialization require some application of it. (Opara *et al*,2010b)

In the words of Gobel, Samuel, Helgeson, Novak and Butzow (1986) one way of improving the quality of teaching in schools is by the application of the science education researching finding to teaching. Many research works have been carried out on methods of teaching science. For instance , Koleosho (1991) worked on a strategy for teaching the concept of relative atomic mass of an element, Nnadi (1991) had a review of some uses of computer simulation in the teaching of physics concepts at Secondary School level, Amusan (1992) worked on hints on the teaching of Carbon Compounds at the Senior Secondary level

and Nwagbo (1999) looked at the effects of guided discovery and expository teaching methods on the attitude toward biology of students of different levels of scientific literacy etc.

Sullivan and Mousley, (1994) conducted a study in which 125 teacher educators and experienced teachers were asked to respond to fixed format and open response items on aspects of mathematics teaching. Based on the findings, the researchers were also to develop a model for quality teaching of science as follows:



Source: Sullivan and Monsley (1994)

Based on the diagram, there are some relationships that exist between the six components of quality teaching in sciences. For instance, Building understanding facilitates the other components; organising for learning, nurturing, engaging, communicating and problem solving.

The methods of teaching adopted by teachers influence the students learning style and the acquisition of science skills which is greatly needed for science and technological accomplishments in Nigeria. In addition, this is the activity based teaching methods that involves the learner in the teaching- learning process. Osuafor (1999) listed some of the activity based on teaching methods advocated by scientists as a result of research findings

and these includes discovery, problem-solving, cooperative learning, excursion/field trips. Others include teaching method, like concept mapping, demonstration, laboratory investigation and problem-solving methods among others.

Obviously, as awareness in science and technology increases, science education curriculum and methodology also increases to follow upcoming trends by associating the curriculum with the environment and society.

IMPROVING SCIENCE TEACHING THROUGH INTERDISCIPLINARY APPROACH: There is more to science education than simply learning about theories and laws. It also includes learning how to initiate a functional integrative association between science curriculum and other curriculums arising at providing individuals with a solid technological background to gain knowledge, skills and attitudes required in a rapidly changing world.

Firstly, the concept of interdisciplinary science is one of the important disciplines that concentrate on teaching science courses alongside with other courses such as social Studies and linguistic studies (Glatthom and Jailhall, 2000). In developing science methodology, it is expected that science curriculums will be more associated and integrated with other curriculums such as technology, mathematics, social science, environmental science, health education and others(Opara *et al*,2010a)

Secondly, the innovative approaches for implementing interdisciplinary science in science methodology are very rewarding. Enhancement in this approaches are as follows:

1. Integrated Science Approach: Based on the development in society and advancement in social, economical, political and cultural life brings the integrated science approach as a new trend in the field of science. Many studies approve the effectiveness of the integrated approach which reacts to the traditional approaches that aims to deal with the topic as an integrated coordinated unit, away from the dualism and duplication.

2. Environmental approach: This is considered as appropriate for systematizing the interdisciplinary science curriculums. It recognises the place of the child's environment in the child's life and overall wellbeing. Hence, the child's learning is always designed in a way that it can enable him fit into his environment. This should among others: (i) inculcate social norms (ii) the spirit of inquiry and creativity through exploration of nature, the environment, art, music and playing with toys, etc.

3. Citizenship approach: This approach helps citizens to acquire analytical thinking, and problem and understanding of the past as a guide for the appreciation of the present. The science curriculum that attempts to acquaint scientific illumination and civilization combines

between science and technology, society and environment in a dynamic constant relation for a real world.

4. Systematic approach: There is an attitudinal problem with respect to science where students feel that science subjects are too difficult and therefore shy away from it. In this, science concepts must be divided into hierarchical bits in order for the learner to be in control from one bit to another, having a perfect knowledge of the preceding bit. This process enables the learner to move to the next stage of the learning process at his own pace thereby enabling proper understanding. This encourages the teaching of concepts and topics through an integrated system and as such enables the learner to create connections between diverse disciplines.

5. Real life approach: This will acquaint the learners with the understanding of the social problems and issues with regard to their real life in which solutions are proffered to solve these problems. There is need to associate science teaching with reality, and real life state of the learner's concentrations on the social dimension.

6. Science, technology and society approach: Interdisciplinary science curriculum is required to facilitate individual literacy through science, technology and society approach. Translated closely, it is science and technology that is apt to solve the problems of the society brought upon it by nature or itself. Therefore, science and technology are an indispensable component of the society. A bond therefore, exists between science and technology and society which is hard to break. Society is dynamic and grows more and more complex. As the complexity increases, science and technology gets more advanced, but simpler. This approach gained more attention from science researchers on the national and international circle as numerous studies are tackled in this field.

7. Futurist approach: This approach could be used to prepare individuals who are capable to keep up with scientific and technological accelerated progress in all fields. It presents modern topics and technological issues that have obvious effects upon individuals and sciences in future. Science education can follow these trends by associating curriculum with the environment and society.

WHY USE INTERDISCIPLINARY APPROACH

1. Interdisciplinary science in science methodology increases students learning. Helping them to develop knowledge, insights, problem solving skills, self confidence, self efficacy and passion for learning
2. It helps students to uncover preconception or recognize bias. First, by helping students identify insights from a range of disciplines that contribute to an understanding of the issue

under consideration. Second, to develop the ability to integrate concepts and ideas from these disciplines into a broader conceptual framework of analysis.

3. Helping students to acquire positive trends and attitude towards the environment which can help them to adjust to the modern world.

4. It helps advance critical thinking and cognitive development. Obtaining a clear understanding of problems with roots in multiple disciplines requires the capacity to integrate ideas and this skills is advanced by interdisciplinary science learning.

5. It helps students appreciate ethical dimensions of concerns. Ethical considerations entail moral concerns which mean accounting for perceptions of right verses wrong, good verses bad, and the provision of justice. Many disciplines steer clear of such subjective phenomena and confine their analysis to more objective factors in an effort to be scientific.

7. It promotes significant learning. Preparing individuals to be capable to keep up with the scientific and technological accelerated progress in all fields.

8. It promotes understanding when students learn in heterogeneous way. Students are heterogeneous in their learning styles and have diverse backgrounds, interest, interest, experiences, talents and values. Drawing in a broad array of frameworks and methodologies will enhance students learning.

9. Helping teachers to apply the topics they have learned which deal with environmental issues and problems related to the real life.

10. Help to prepare individuals who are aware of the scientific and technological civilization, which can help them sustain with the ever increasing national and international science and technology developments. To be able to pursue the present challenges and growth.

11. The world is interdisciplinary. According to the National Council for Teachers of English (NCTE,1995) “educational experiences are more authentic and of greater value to students when the curricula reflects real life , which is multi-faceted rather than being compartmentalized into neat subject-matter packages. In their view, real world problems are complex, so no single discipline can adequately describe and resolve these issues.

RECOMMENDATIONS

1. There should be regular seminar, conference and workshops to help teachers to improve their teaching skills, get adequate knowledge about modern topics, issues and problems challenging the society and how to solve them in their teaching activities. 2. Nigerian educational planners should include these approaches in the use of interdisciplinary science teaching.

3. Science educators should apply these approaches in interdisciplinary science for science teaching. 4. Government should encourage in-service training programme to get teachers acquainted with recent science teaching methodologies. 5. In cooperation of the social issues and problems into the course contents for teaching programmes. 6. Science curriculum is expected to follow upcoming trend by associating the curriculum with the environment and society. 7. There should be an emphasis on teacher education programmes to follow the social, cultural, scientific and technological transformations.

CONCLUSION: The traditional methods of teaching and learning science are no longer adequate to prepare the competent individual who is capable to track the scientific and technological challenges by the modern world. The approaches though discussed differently have relationship between them. Obviously, there is need to create an integrated functional association between science curriculum with other curriculum to train individuals as to cope with the modern world.

Considering the role of science education in the new world of globalization and sustainable development, interdisciplinary science is a serviceable and pertinent solution to attain these goals.

REFERENCES

- Amusan, O.O.C. (1992). Hints on the Teaching of Carbon Compounds of the Senior Secondary School Level. *Journal of Science Teachers Association of Nigeria*, Vol.27, No.2, 98-103.
- Gallton, A. and Jaihall (2000). Curriculum for the New Millennium, in Brandt, R.E. (ed.) Educational in a New Era, U.S.A. Association for Supervision and Curriculum Development, Pp.97-121.
- Gobel, D.L., Samuel, K.U, Helgesons, Novak, J and Butsow, J (1986). *Journal of Research in Science Teaching* Vol. 23, No.2, 145-146.
- Halah Saeed, B.A and Najah, A.A. (2010). Interdisciplinary Science and Developing Science Teaching. *Proceedings of 10th International Educational Technology Conference and Exhibition*, Istanbul-Turkey 26-28 April, Vol.2.
- <http://serc.carleton.edu/48978.1921>
- Koleosho, A. (1991). A Strategy for Teaching the Concept of Relative Atomic Mass of an Element. *Journal of Science Teachers Association of Nigeria*, Vol.27, No.1, 139-142.

- Nnadi, E.N. (1991). A Review of Some Uses of Computer Simulations in the Teaching of Physics Concepts at Secondary School Level. *Journal of Science Teachers Association of Nigeria*, Vol.27, No.X, 175-180.
- Nwagbo, C. (1999). Effects of Guided Discovery and Expository Teaching Method on the Attitude towards Biology of Students of Different Levels of Scientific Literacy. *Journal of Science Teachers Association of Nigeria*, Vol.34, No.1&2, 43-66.
- Nworgu, B.G. (2010). Research in Science Education in Nigeria: Conceptual, Methodological and Analytical Issues. *Guest Lecture Delivered at the 2nd National Conference of the School of Sciences, Federal College of Education, Okene-Nigeria, August 10-13.*
- Opara, J.A (2009). Repositioning the Science Teacher for Student Action in the Classroom: Hard Choices and Policy Challenges. In N.S. Oguzor and H.E. Adebola (eds) *Education, Development and the Changing Environment*. Granada-Spain: International Association for Teaching and Learning(IATEL)., pp.300-385
- Opara, J.A, Oguzor, N.S, Pollyn, I.B, and Echendu, P(2010a). How Does Bajah's Model of Integration Reflect the True Concept of Science Education in Teacher-Training Colleges in Nigeria. In G.Perez-Bustamante, K. Phusavat and F. Ferreira(eds) *Proceedings of International Conference on Teaching and Learning*, Sevilla-Spain: International Association for Scientific Knowledge.<http://www.iask-web.org>, pp.702-706
- Opara, J.A, Oguzor, N.S, Adebola, H.E (2010b). Instructional and Learning Technologies for School Curriculum in Nigeria: Innovations and Challenges. In Pedro Acosta and Pedro Cravo (eds) *Proceedings of International Conference on E-Activity and Leading Technologies*, Oviedo-Spain: International Association for Scientific Knowledge. <http://www.iask-web.org>., pp.91-99
- Osuafor, A.M. (1999). Extent of Use of Research Findings on Instructional Strategies in Science Education. *Journal of Science Teachers Association of Nigeria*, Vol.34, No.1&2, 107-112
- Sullivan, Peter and Mousley, Judith (1994). Quantity Mathematics Teaching: Describing Some Key Components. *Mathematics Education Research Journal*, Vol.6, No.1, 4-22.