SCIENCE AND TECHNOLOGY IN AFRICA FOR THE TWENTY FIRST CENTURY: PERSPECTIVES FOR CHANGE

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Abstract

There is no doubting that the role of science and technology in modern society is changing. More importantly, all the challenges facing the world and communities in Africa particularly today depends solely on science and technology education to find appropriate solution. It is noteworthy in this century that nations will wholly dependent on others as 'experts' without science and technological knowledge. But with it, they will be empowered to become participants rather than merely observers. Science and technology in this sense is more than a means for getting ahead in the world of work. It is a resource for becoming a critical and engaged citizen in a democracy. However to realize this, the teaching of science and technology in schools should help in development of science and technology literacy. Also in the formation of scientific and technological attitude, this is essential to dispel social evils as well as in the development of open mindedness and decision taking ability. Therefore, this study suggests the teaching and learning of science and technology in schools with the looking glass of 21st century skills for efficient pedagogical format and content responsibility by the teachers and the society. This perspective involves the position of government as policy formulators, the teachers as policy implementers and disseminators as well as the society as policy facilitators.

Keywords: Knowledge, Modern society, 21st century skills, Education, Teacher and democracy

Introduction

There is recognition that creative and innovative learning skills are important for the emerging work environment in the 21st century. On this note, in agreement with (Lazonder, Pascal and Hagemans, 2008), natural skills such as successful problem solving requires a strong relevant knowledge as well as the will to acquire the knowledge as shown in (Griffin, Care and McGaw, 2012). The "Will" which reflects the motivation to

approach difficult problems and persistency towards a solution was also a concern according to European commission (EC, 2007). Taking a clue from (Fernandez, Holbrook, Malmok-Naaman and Coll, 2013), there is an awareness that science and technology educations can play a role in guiding students towards their expected role within the society as responsible citizens, while still building a background for future education and for lifelong learning.

However in line with National Research Council (NRC, 2010), this incorporate a range of generic skills such as adaptability, complex communication, social skills, non-routine problem solving, self-management, self-development and system thinking. Globalization according to (Levy and Murnane, 2005) relating to technological advancement, scientific innovation, paradigm shift in work force demands are redefining the broad skill set that students need to be adequately prepared to participate in, and contribute to today's society. In another study by (Binkley, Erstad, Herman, Raizen, Ripley, Miller-Ricci and Rumble, 2012), it has been indicated that within science education related attributes encompass critical thinking, problem solving, communication and collaboration. Hence, there is the need for science and technology education to meet society expectations all over the world.

Therefore, attention is thus needed to clarify the purpose of science and technology education in the 21st century for greater employability, social responsibility and an interest in lifelong learning in an ever developing, knowledge based world. This work in agreement with (Fensham, 2008) reviews emerging issues in the field of science and technology as related to the 21st century education in the following areas.

1. 21st century education
2. Scientific and technological literacy
3. Educational purposes of science and technology
4. Quality assurance of science and technology Education

1. The 21st Century Education

The 21st century of seems quite different to the previous century due to capabilities the citizens need for work and self-actualization. In response, According to Dede, 2007), society educational systems must transform their objectives, curricular, pedagogies and assessments to help all students attain the sophisticated outcome requisite for a prosperous attractive life style based on effective contribution in work and citizenship.

However, a conceptual frame work for understanding the challenges and opportunities involved in a transformation will definitely give rise to a new pedagogy to attain sophisticated 21st century understanding and performance. Every society is presently at the mercy of the 21st century skills which

learners must master to cope with the drastic global changes in line with (NCREL/Metri, 2003; Partnership for 21st century skills, 2006; Leitch Review of Skills, 2006 and AACU, 2007).

Clearly, educational objectives in the 21st century will need to distinguish between knowledge and skills a learner must have to cope with the world of works. (Scardamana and Bereite, 2006) research in cognitive science has established that knowledge and skills are richly intertwined, rather than knowledge as content on which skills acts as a process. The frameworks therefore categorizes what student needs for the 21st century as understanding and how student actualize those understanding in practice as performances based on interwoven content knowledge and process skills which is a more accurate depiction of has the mind works.

2. Science and Technological Literacy

Many definitions of scientific and technological literacy have been developed, (Holbrook and Rannikmae, 2009) sees it to encompass the creative use of evidence based knowledge and skills while recognizing personal and social attributes. Also, (Feinstein, 2010) in another study seeks wide meanings to encompass societal and work force concerns and concentrate on a few big scientific ideas, rather than stress content information knowledge. In the same vein, (Choi, 2011) suggested the need to include other aspects such as mega-cognitive and self directing student abilities alongside content knowledge, habits of mind, character and values as well as science as a human endeavor.

In another study, (Feinstein, 2011) argues that science education should focus on the "usefulness aspect" of scientific literacy; i.e., the degree to which science education actually helps people solve personally meaningful, everyday problems and as well make important science related decisions.

3. Educational Purposes of Science and Technology

The goal of science education according to (Feinstein, 2011) should be to help students become competent outsiders "with respect to science and technology; i.e. teach them how to recognize moments when scientific and technological information would be useful and enable them to locate it, integrate it with their own experiences, and reach an informed opinion or decision. He alleges that traditional education instead produces marginal insiders, whose scholastic experiences and rudimentary understanding of science often dampen their interest and impede their confidence in dealing with scientific information.

In a review of the history of science education, Deboer (2000) concluded that although the concept of scientific and technological literacy is

a general one and has varied overtime, it usually implied a broad and functional understanding of science and technology for general education purpose as opposed to preparation for careers in the sciences and technology which brought about the suggestion of a pragmatic approach that embraces science and technology education as

i. a cultural force in the modern world
ii. a preparation for the world of work
iii. a direct application to everyday living
iv. teaching students to be informed citizens
v. a particular way of examining the natural world
vi. understanding reports and discussions of science that appear in the popular media.
vii. learning about science for its aesthetic appeal
viii. preparing citizens who are sympathetic to science
ix. understanding the nature and importance of technology and the relationship between technology and science.

4. Quality Assurance of Science and Technology Education

The concept of quality in education addresses the practitioners input and output in it's entirely. Quality in education according to (Mosbi, 2005) is considered as baseline standard in education, which can be measured on a scale of preference. Standards imply accepted principles, rules, guidelines or level established by group of people, organizations or society. Particularly in (Bisong, 2000), educational enterprise has to do with establishing and maintaining standards which form the basis of evaluation.

Quality in education therefore is an expression of standard or it is the means by which a certain set standard in education can be achieved by many factors that exist within the academic system. However according to (Akinbobola and Iktde, 2008), quality assurance can be improved upon in science education by:

i. Making provision for learning facilities and equipment such as infrastructures, electronic systems, tools and other materials that could be utilized for directing and controlling vocational technical operations thus reinforcing the teaching and learning of specific skills.
ii. Adequate staffing which will definitely provide the frame work within which teacher workload can be reduced to enhance efficiency and quality.
iii. Improvement of teacher remuneration beyond what it is presently, as high wages intend to produce commitment and efficiency.

Conclusion:

Education is a social process, it is growth and development and a better safe guard for liberty than a standing army. The future of any nation in the modern world depends to a great extent on the educational system. Science and technology have become crucial factors for sustainable development worldwide as both have contributed immensely to the material progress of nations. They are also necessary for the economic development of nations according to Olagunju, Adesoji, Iroegbu and Ige (2003).

However in line with Ezeliora (2005), the quantity and quality of science and technology education received by the future leaders of the nation depends solely on the effectiveness and efficiency of the science teacher. Low quality teachers and low quality facilities necessarily imply low quality products and low quality performance in the society by such products. Therefore, the quality of science education is affected by policy and contextual factors within the environment, the availability of inputs, the processes and the consumers of the products of science education.

Consequently, national growth and development can only be achieved when science and technology are given prominent attention where the goals and objectives of science at all levels of education should present the core curriculum as a functional science and as well relate it to real world of work.

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