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NEW TRENDS IN SCIENCE EDUCATION CURRICULUM FOR KNOWLEDGE BASED ECONOMIC DEVELOPMENT IN NIGERIA

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Abstract
Since Nigeria's philosophy of education presents education as "an instrument for national development" as enshrined in the national policy on education, curriculum development in Nigeria should aim at transporting the country from the old industrial economy to the new knowledge – based economy. To achieve this goal of education requires a paradigm shift from the present time bound model of education to life-long model of education. By implication, curriculum development for a knowledge economy is based on the development basic skills-thinking skills, interpersonal management and of communication skills, social competencies and other personal qualities such as responsibility, self-esteem, self-management and integrity. The quest for the achievement of this aim of education in different learning contexts in Nigeria is resulting in the emerging issues in curriculum development in the country. These issues among others that are discussed in this paper are curriculum development in education for peace, education for global citizenship, teaching and learning strategies and teacher education. Curriculum development in these emergent areas will help the nation to "live in unity and harmony as one indivisible, indissoluble, democratic and sovereign nation founded on the principles of freedom, equality and justice as enshrined in the national policy on education.

Keywords: New trends, Science education Curriculum, knowledge based, economic development.

Introduction

The recent development in information and communication technologies with the resulting digital revolution have launched the world into the knowledge economy in which ideas and technology are used to promote socio-economic development through the generation and exploitation of knowledge. Consequently, educationists all over the world are making frantic efforts to realign educational endeavours to equipping learners with the necessary skills and competencies for effective life in a knowledge dominated society. Since Nigeria's philosophy of education presents education as "an instrument for national development" (FRN, 2013:6), curriculum development in Nigeria should aim at transporting the country from the old, industrial economy to the new knowledge-based economy.

To achieve this goal of education requires a paradigm shift from the present time bound model of education to a lifelong model education. This is the model of education that is aimed at developing in the learner the ability to effectively create, acquire, use and transmit knowledge for the promotion of human activities in a knowledge dominated society. In this regard, emphasis in instructional aims is shifting from the acquisition of factual knowledge to the acquisition of tacit knowledge and generic skills while that of the instructional process is shifting from teaching for examination to teaching how to learn, how to perform effectively in team work. By implication, curriculum development for a knowledge economy is based on the development of basic skills (reading, writing, listening and speaking), thinking skills, interpersonal management and communication skills, social competencies and other personal qualities such as "responsibility, self-esteem, self-management and integrity" (Stinson,1994:21). Obanya (2007) expressed a similar view when he summarised the core generic skills curriculum requirement for the knowledge economy as knowledge, communication skills, adaptability, creativity, team spirit, literacy, ICT fluency and life-long as well as life-wide learning.

The development in this 21st century required skills and competencies that constitute a driving force for the emergent trend in the aim of education. This involves the preparation of learners for effective life in a knowledge based economy that is known for its network and volatile characteristics. The quest for the achievement of this aim of education in different learning context in Nigeria is resulting in the emerging issues of curriculum development in the country especially, in science education.

These issues among others as observed by educationists are curriculum development in education for peace, education for global citizenship, electronic learning, teacher education, gender studies as well as diversification and enrichment of learning content. Only four of these issues are discussed in this paper and these are: science education for peace, science education for global citizenship, teacher education and teaching and learning strategies.

Science Education for Peace

The world is experiencing great technological breakthroughs that ushered in the 21st century but these advancement are coupled with rising incidences of physical, economic, political, psychological, and ecological violence at personal and interpersonal levels as well as communal, national and international levels. To tame this tide of violence different countries are resorting to peace education as instrument for institutionalizing the adoption of peace and non-violence to conflict resolutions. The two arms of peace education being implemented in most societies are education about peace as a subject of studies in schools and education for peace which is concerned

with the in and out of school processes of inculcating in learners the knowledge, skills, attitude and values to live in harmony with oneself and others by adopting peaceful resolutions to intrapersonal and interpersonal conflicts. In fact education for peace presents peace as one of the aims of education. It is in this regard that the United Nations(UN) has been piloting a global movement for the establishment of a culture of peace through education by promoting initiatives to help people recognize the role of education in establishing a culture of peace. This is a culture in which people act with the mindset of peace consciousness and, peace becomes a way of life and doing things. Achieving this global objective of establishing peace in the society through education requires the inculcation of peace dimensions in different aspect of science curriculum development, from instructional goal to content, methodology and evaluation.

In Nigeria curriculum development process, peace education is not offered as a separate subject but salient topics from this area of study have been added to the social studies curriculum which is offered to learners in the Universal Basic Programme. Peace education should be part of the curriculum in all the subjects including science from the Basic Education level to the tertiary institutions. However, adequate curriculum development for education for peace requires more than the addition of some peace topics to the learning content of some school subjects. Consequently, while proposing peace education as a transdisciplinary education that takes place in all learning spaces, Akudolu (2010:7) observed that "since peace behaviour is more caught than thought, it pays to complement school learning of peace behaviour with concerted, conscious efforts to promote peace behaviour in a systematic way both in school and out-of- school". In-school, promotion of education for peace implies integrating basic elements of peace education (Akudolu 2010:5) appropriately, into all instructional activities in the school while out of school promotion involves all strategies for the promotion of dimensions of peace education in informal learning.

Curriculum development for peace education should aim at developing these basic elements of peace education in learners in all forms of education (formal, non-formal and informal). This implies that the emergent science curriculum development for peace education should be the one that covers education about peace and education for peace.

Science Education for Global Citizenship

One of the ways that development in information and communication technology (ICTs) is reshaping human activities is in the area of availability and accessibility of information, anytime and anywhere in different modes. With ICTs, a person in one corner of the globe communicates with another person at the other corner of the globe simply at the press of a button. In the same vein, a person stays in front of his /her room and follows world events through the internet. People stay in their houses in different countries and participate in teleconferences and electronic discussions. Davy (2011:3) summarises these technology based developments by stating that "the world is changing, and there is evidence that we are entering a post-international environment: borders are weakening, multiple citizenships are more common place, migration has reached record level, and we have encountered the death of distance".

The use of ICTs has removed the problem of distance in information exchange and everybody appears to be close to everybody else regardless of the location. Consequently, the world at present

time is often referred to as a global village. There is a growing need for people to understand different cultures as well as what, how and why of global events. Every society hopes to satisfy this need through education. Andrzejeski and Alessio (1999:7) opined that " by learning how global issues affect individual and community lives, how and why decisions are made which affect the planet and life on it, and ,most importantly, means by which the future can be influenced, education can prepare students to become socially responsible global citizen".

Since one of the goals of education in Nigeria is to prepare the learner for effective life in the society and the present 21st century society is a globalized one, science education for global citizenship is an emergent issue in curriculum development. The overall philosophy in Nigeria is to live in unity and harmony and promote inter-African solidarity and world peace through understanding"(FRN, 2013:6). The national educational goal that is derived from this philosophy is "the training of mind in the understanding of the world around" (FRN, 2013:8). However, global events indicate that science education for citizenship offered to learners at the universal basic education(UBE) level is inadequate for achieving this goal of education. For learners in Nigeria to be prepared for international competitiveness, science curriculum development efforts that cover both national and international affairs is the ideal. This is the type of curriculum that can prepare the learners for effective local citizenship and responsible global citizenship.

Many countries all over the world are already implementing education for global citizenship. The United Kingdom (UK) developed a curriculum for global citizenship in 1997 and since then, learners are acquiring education for global citizenship in schools and in global citizenship projects funded by such bodies as Department for International Development (DFID) and International Development Education Association for Scotland (IDEAS). Science education for global citizenship (EGC) gives learners "the knowledge, understanding, skills and values that they need if they are to participate fully in ensuring their own, and others' well-being and to make a positive contribution, both locally and nationally" (Oxfam, 2006:1). The aim is for the learner to become a responsible global citizen. Oxfam (2006) itemized the three key elements of responsible global citizenship as knowledge and understanding, skills as well as values and attitudes. The element of knowledge and understanding covers social justice and equity, diversity, globalization and interdependence, sustainable development, as well as peace and conflict. Items in the skills element are critical thinking, ability to argue effectively, ability to challenge injustice an inequalities, respect for people and things as well as co-operation and conflict resolution. Items in values and attitudes element are sense of identity and self esteem, empathy, commitment to social justice and equity, value and respect for diversity; concern for the environment and commitment to sustainable development as well as belief that people can make a difference. These skills, knowledge and values should guide the development of science curriculum for global citizenship.

It should be noted that Education for Global Citizenship is a global ideology that covers all areas of the curriculum including science education. It is made manifest not only in what is taught and learnt but also in the schools decision making process, the entire school ethos, and the relationship among learners, teachers, parents, members of the community and other stakeholders in the school. In fact the curriculum for EGC encompasses the whole school from the learning content to presentation strategies as well as the people and the culture of the school (Akudolu, 2010).

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Teaching and learning Strategies

The teacher-centred instructional strategies that have dominated instructional processes since the advent of formal education are no longer adequate for inculcating in learner the knowledge, skills, attitude and values necessary for effective life in a knowledge driven society. They are instructional strategies in which the learner is merely a recipient of knowledge that comes out of the teacher. In most cases the learner memorizes the knowledge and presents it to the teacher on demand. These instructional strategies cannot develop in the learner, the abilities of autonomy, innovation, lifelong learning, collaboration, and other 21st century knowledge and skills especially in science. To prepare learner for effective life in this 21st century, the instructional process is shifting from textbooks – driven and teacher-centred methodology to flexible, creative, innovative and learner-centred methodology (Akudolu,2010). Consequently, the emerging instruction methods are participatory, interactive and learner-centred. A learner-centred methodology places the learner in charge of his/her learning and this leads to the development of autonomy in the learner. A learner develops autonomy in learning when he/she derives the meaning from the learning content. Participatory, cooperative and interactive methods are used to help the learner develop a sense of identification with the learning content. Examples of participatory methods are cooperative group work, peer teaching, different types of group discussion which can be used in teaching even science at the senior secondary level and humanistic methods such as role play, games, quizzes, simulations and brainstorming which can be used in teaching even science at the senior secondary level. The present curriculum focuses on this but, the problem is on the implementation which is as a result of inadequate knowledge on the part of teachers on the adoption of these approaches.

There is need for teachers (science teachers inclusive) to make a paradigm shift from traditional instructional strategies to these emergent instructional strategies so as to help learner develop the 21st century skills. There is need to include life and career skills. Life and career skills according to PCS (2011:2) in Panke(2016) encompass the following skills.

- Flexibility and Adaptability.
- Initiative and self- direction
- Social and cross-cultural skills.
- Productivity and accountability.
- Leadership and responsibility.

These and other 21st century skills are not just necessary for performing well in examination or job creation but above all for achieving the development of the learner as a "whole person" who can adequately face complex and challenging situations in life. None of these five skills can be acquired through the learning of a particular subject. Effort should be made to integrate these skills into different subjects in the curriculum. In this regard, the author suggests that curriculum implementation should be interdisciplinary, integrated and project based.

Teacher education

The recruitment of those to be trained as teachers poses a big challenge to teacher preparation in Nigeria because anybody can be recruited into any of the institutions to be trained as teachers. In fact, it is the applicants who have been rejected by other lucrative courses or those who failed to meet the admission cut off marks into those lucrative courses such as medicine, law, engineering,

pharmacy and many others that are often advised to or transferred to Faculties of Education or Colleges of Education to be trained as teachers. This is where the problem of quality, commitment and competence begin and run throughout the career of the people concerned.

In addition to this, there is no mechanism in place where the background of the applicants to be trained either of the College of Education, Institute of Education or Faculties of Education into the profession can be checked as is being done in advanced countries (kolawole, 2016). We are thus confronted with the challenge of admitting individuals who are either not qualified or committed to teaching profession to train as one and are left with the situation of bad foundation. This is why Kolawole (2007) remarked that the way prospective teachers are recruited into the Faculties of Education in most Universities and Colleges of Education has become a major source of worry to professionals and other stakeholders while Botzakis and Malloy (2006) in Kolawole(2016) noted that teacher preparation was inadequate in Nigeria for numerous reasons. Okebukola (2013) has recommended that the minimum qualification of those to be admitted into teacher preparation programme should be five SSCE credits as a first step toward improving the quality of those to be admitted for training as teachers to reflect what is being currently done in medicine, engineering, pharmacy, and other professional courses. This recommendation should be implemented to the later if teaching profession is to regain its place pride.

Closely related to recruitment is the actual training that takes place or the curricula that students are exposed to during their internship. The content of curricula is divided into:

i. Grounding the student-teacher in one or more academic subjects called teaching subjects
ii. Undertaking some foundational courses
iii. Engaging in experimental/practical teaching in real or contrived classroom situation (Akinpelu 2005 :41-42).

Today, students are made to take courses across various disciplines in their areas of specialization plus education and a short teaching practice exercise. Most of the time, they are not well grounded in those areas and are not fully available for teaching practice in their location (Kolawole, 2016). The basic purpose of education is the total development of human personality. This total development of human personality includes intellectual and moral development.

Since curriculum is concerned with the totality of what takes place in the process of teacher education in particular and educational development in the country in general, it is important to raise the question whether all has been well with curriculum development and implementation in teacher education in Nigeria. The immediate answer is No.

What the Nigeria Society of today needs is teachers who are worthy in character, (moral, affective), learning (knowledge, cognitive) and skilful, (psychomotor). Teachers who must be highly qualified and be able to work effectively in the school system are essential ingredient of the education that will drive development. For us to have that type of teachers, we need curricula that will contain the following competence and skills as identified by Shulman (1988) as shown below:

Shulman, (1987) and Peterson (1988) in Kolawole (2016:xxxiv)

Shulman(1987)and Peterson(1988) meet these four needs namely:
i)Knowledge of content ii) Pedagogical content of knowledge iii) General pedagogical knowledge and iv) Knowledge of learners and learning. Obanya (2014) and Kolawole (2015) modified their model to accommodate more issues that are of importance to improve teacher preparation respectively. Teacher preparation curricula must, according to Obanya (2014), contain these knowledge and skills- lifelong learning skills, broad general knowledge, broad field knowledge, specific/ specialization knowledge, education principles knowledge and pedagogic applications skills. Obanya (2014) Similarly, kolawole (2015) in his own paradigm also identifies the following as the skills that the curricula of teacher preparation must focus on. The skills are illustrated below: knowledge skills, counselling skills, supervisory skills, pedagogical skills and interpersonal/relationship skills. Counselling skills Interpersonal/Relationship skills, Supervisory skills, Knowledge skills Pedagogical skills Kolawole (2015): paradigm for skill- based teacher preparation

However necessary and useful these skills maybe, they will not meet the standard of the larger society if the curriculum does not reflect the values that we all hold sacrosanct. Such values include honesty, hard work, diligence, moral transparency, etc. We need these values because education can only be relevant when its products fit perfectly into the larger society and make it better than they met it. This was why traditional education focused on the production of a man of character, who is useful and acceptable member of his society.

Conclusion

The purpose of science education and its effect on education generally, is for imparting knowledge to learners for building the learners' knowledge, capacity and skills for successful real- world living. This shift of emphasis in educational endeavours has given rise to transformations in science curriculum development and in the teachers' roles in education delivery; from knowledge dispenser to facilitator of learning, from all-knowing teacher to life-long learner; from knowledge deity to knowledge professional and from educational bureaucrat to learners technocrat. There is also the need for emphasis on the use of ICT to help science educators and the learners' key into global events and knowledge of different cultures in the world. For teachers to play their roles and transform the learners into the desired knowledge workers, these teachers must possess and effectively manifest the desired 21st century knowledge, skills, attitude and values and also be capable of infusing these values into the school system.

Recommendations

The following recommendations are made based on the above discussions

- Teacher education programmes should be over hauled to ensure that apart from knowledge of context and traditional methodologies, the pre-service teachers have the awareness of and commitment to the promotion of relevant knowledge and skills in the learners.
- Interactive and participatory teaching method as well as content areas should be the focus on pre-service teacher education programmes. This will help teachers adopt teaching methods that

can motivate and engage learners and thereby promote in them the abilities for interaction, participation, cooperation, critical thinking, problems solving, self direction, responsibility and learning to learn along with the other 21st century skills.

- Peace education should be part of the curriculum in all the subjects including science education from the basic education level to tertiary institutions in Nigeria. Apart from the content in science curriculum reflecting peace education, signs and symbols should be part of all standard instructional materials to be used in teaching science at all levels of our educational system. This will help fast track the nation on the route to knowledge emancipation and peaceful coexistence. This is necessary in a nation that is struggling to survive the insurgence of ethnic and religious rivalry, different forms of security challenges and high illiteracy rate in knowledge economy.
- Science teaching strategies should include the use of ICT at all levels of education to help learners key into the knowledge of globalisation and global events.

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