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GREENING THE SCIENCE, TECHNOLOGY, MATHEMATICS (STM) CURRICULA: A SYNTHESIS FOR SUSTAINABLE DEVELOPMENT IN NIGERIA

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ABSTRACT

Sustainable national development requires unflinching ecofriendliness and relevant curriculum particularly in the areas of science, technology and mathematics. These should be based on well-grounded sustained environmental awareness. Recently, both formal and non-formal education approaches have been employed to raise the level of environmental awareness and ecofriendliness with little attention to the curriculum contents and processes. Analysis of the current STM curricula objectives shows an appalling deficiency in green concepts, talkless of the processes and the methodology. Agenda 21-based curriculum review is urgently required. Ecocentric teacher training pogrammes, relevant instructional materials and media production which are both ecofriendly and ecodidactical and effective utilization of ecologically oriented methods and instructional materials are suggested in order to facilitate sustainable national development

INTRODUCTION

Sustainable national development is predicated on relevant action-oriented educational system, environmental awareness, unalloyed commitment to the course of humanity and the biosphere and ecofriendly technologies. These are facilitated by effective information and communication technologies. Science, technology and mathematics (STM) curricula are therefore an indisputable pre-requisite to sustainable national development. STM curricula not only form the bedrock for such development but more importantly, play a catalytic role through their varied proactive strategies. The various subject disciplines express and vindicate commanding positions for viewing development and society. Coupled with environmental education (EE) these subjects become veritable vehicles of sustainable national development and therefore great partners in national progress.

For the purpose of this presentation, environmental education is seen as an area of study and action. It involves the lifelong educational processes. It is

> ***concerned with the motivation and evolution of intellectual capabilities, skills, attitudes and commitments necessary for positively modifying human interactions with the biosphere in such a way that through development in sciences, culture and technology, natural resources can be sustainably utilized and conserved at minimal cost for maximum benefit to the present and future generation (Inyang-Abia and Usang, (1992: 3)***

On the other hand, development has to do with positive innovations and changes in socioeconomic circumstances and living standards of a people, their acquired level of marketable skills, and improved responsibility, among other desirable changes. It starts from the human mind. It is not necessarily a harmonious and self-

propelling process but sometimes conflict generating and self-contradictory, which resolution brings desirable positive changes to the generality of the people. When such changes enhance the welfare of the masses without compromising the ability of the future generations to meet their own needs, then it is sustainable. It becomes national when majority of the people of a nation are so affected.

THE PROBLEM

If education can heal the already sick earth as accepted by the Stockholm Conference of 1972 (United Nations, 1973) and the Earth Summit at Rio de Janeiro (United Nations, 1992), then how ecologically friendly are the current curricula objectives for science, technology, mathematics (STM)? It is against this backdrop that this presentation is designed to:

a) justify the increasing urgency and need for greener curricula for the STM.;
b) assess the ecocentricity of the curricula objectives of STM in relation to sustainable national development; and
c) propose measures for greener STM curricula objectives for sustainable national development

METHODOLOGY

The study adopted the purposive sampling approach to assess the ecocentric nature of the curriculum objectives of STM. Fifty-three randomly sampled post-graduate students of Environmental Education (EE) programme of the University of Calabar responded to a 36-item 4-point Likert type questionnaire. The items were based on the published objectives of STM curricula designed by the Federal Ministry of Education, Science and Technology (1985) and the West African Examinations Council (WAEC) as currently used in senior secondary schools in Nigeria. Volumes 3, 5 and 8 of the STM curricula were assessed using Adara (1992) model.

FINDINGS

An analysis of the curriculum objectives for each of science, technology and mathematics as tabulated on Table 1 shows that Agricultural science and Biology had the most ecocentric objectives while technology and mathematics had the least, tending towards ecohostility; chemistry and physics had moderately ecocentric objectives, with physics expressing econeutrality.

Adara (1996) found out that 42% and 77% of the content of chemistry and physics curriculum respectively were ecologically unrelated. Only 2% of the content of physics curriculum represented each of human environment/development and environmental changes/impact. Whereas agricultural science had an equitable distribution: 32%, 34%, 34%, representing ecological foundations, human environment/ development and environmental changes and impact, Biology had the ratio of 71%, 19% and 10% respectively. The present study confirms Adara's (1996) findings that were also supported by Igbozurike (1997). The latter confirmed that none of the well-known secondary school textbooks in chemistry and physics even mentions air pollution or water pollution as basic manifestations of chemical reaction or physical processes.

The present study further establishes the econeutral position of mathematics and the tendency towards echositility of introductory

technology. Since curriculum objectives provide the guidelines for the design, selection and modification of instructional content, methods, and materials, it is obvious that ecofriendly curriculum inputs are also starkly inadequate. All these presuppose and re-emphasize the need for curriculum innovations to incorporate adequate dosage of ecofriendliness.

TABLE 1
ECOCENTRICITY OF CURRICULUM OBJECTIVES N = 53

Objective	Percentage of Respondents			
	A	B	C	D
1. AGRICULTURAL SCIENCE				
i. Sustain and stimulate students interest in Agriculture	3.8	11.3	73.6	11.3
ii Enable students acquire basic knowledge and practical skills	1.9	85.0	7.5	5.7
iii Prepare students for further studies in Agriculture	-	3.8	92.4	3.8
iv Prepare students for occupation in Agriculture	5.6	5.6	69.8	18.9
2. BIOLOGY				
i. Acquire adequate laboratory and field skills in biology	1.9	47.2	45.3	5.7
ii Acquire meaningful and relevant knowledge in biology	37.7	39.6	18.9	3.8
iii Acquire ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture	5.7	47.7	47.7	-
iv Acquire reasonable and functional scientific attitudes	1.9	54.7	41.5	1.9
3. CHEMISTRY				
i. Facilitate a transition in the use of scientific concepts and techniques in integrated science with chemistry	3.8	5.7	81.1	9.4
ii. Provide the students with basic knowledge in chemical concept and principles through efficient selection of content and sequencing	-	18.9	71.7	9.4
iii. Show chemistry in its inter-relationship with other subjects	-	52.8	45.3	1.9
iv. Show chemistry and its link with industry, everyday life, benefits and hazards	79.2	18.9	1.9	-
v. Provide a course which is complete for pupils not proceeding to higher education while it is at the same time a reasonably adequate foundation for a post-secondary chemistry course.	73.6	13.2	5.6	7.5
4. PHYSICS				
i. Provide basic literacy in physics for functional living in the society	7.5	69.8	13.2	9.4
ii. Acquire basic concepts and principles of physics as a presentation for further studies	5.7	1.9	15.1	77.5
iii. Acquire essential scientific skills and attitudes as a preparation for the technological application of physics	-	-	49.1	50.9
iv. Stimulate and enhance creativity	-	-	3.8	96.2
5. BUILDING CONSTRUCTION				
i. Understand the process, materials, tools and equipment used in building construction	-	-	94.3	5.7
ii Construct or supervise the construction of a simple residential building	-	-	1.9	98.1
iii. Prepare for further studies in the construction or allied professions	-	-	-	100
iv. Earn a living through participation in building construction work	-	-	3.8	96.2
v. Inculcate safe working habits in building construction	-	3.8	81.1	15.1
6. METAL WORK				
i. Acquire further knowledge of tools and materials as a preparation for further studies in metal work	-	1.9	90.6	7.5
ii Develop basic skills of good workmanship and design	-	-	1.9	98.1
iii. Acquire the knowledge and techniques necessary for self reliance and gainful employment	-	1.9	5.7	92.5
iv. Inculcate safe working habits in metal workshop	-	1.9	73.6	24.5
v. Acquire basic understanding of metal work technology for functional living in the society	-	-	79.2	20.8

7. WOODWORK				
i. Develop creative ability in the use of wood and related wood materials	-	-	-	100
ii. Equip learners with the basic analytical knowledge and practical skills for simple wood construction	-	-	1.9	98.1
iii. Provide the orientation for higher studies in Wood Technology and Woodwork	-	-	-	100
iv. Acquire the basic skills in Woodwork to make a functional living in society	-	-	-	100
8. MATHEMATICS				
i. Test computational skills	-	-	-	100
ii. Understand Mathematical concepts and their applications to everyday living	-	-	1.9	98.1
iii Translate problems into mathematical language and solve them with related mathematical knowledge	-	-	-	100
iv. test ability to be accurate to a degree relevant to the problems at hand	-	-	-	100
v. Test precise, logical and abstract thinking	-	-	-	100

Where:

A = Ecological foundations related objectives
B = Human environment and development related objectives
C = Ecological changes / impact related objectives
D = Not ecologically related objectives but tending to ecological hostility

GREENING MEASURES FOR THE STM CURRICULA

The following measures are suggested for a more ecocentric curricula in STM:

a) ***Local Agenda 21-based curriculum design.*** Agenda 21 is an official document expressing the outcome of the 1992 Earth summit at Rio de Janeiro. It proposes some major strategies to be adopted globally to ensure sustainable development. That document encourages local action for global benefit. More importantly it encourages sustainable human living which is capable of linking environmental and developmental concepts (Inyang-Abia, 1997) while promoting and strengthening environmental awareness, flexible and adaptable workforce, capacity building, international co-operation and national capabilities. This futuristic document allows the flexibility necessary for sustainable national development and therefore should form the focus of STM curricula contents. To meet international demands in this age of globalization, the curricula for science, technology and mathematics have to be more radical, more ecologically oriented, more human focused, more futuristic, more market-oriented and more relevant to the modern realities in Nigeria and globally.

b) ***Sustained environmental education***

The EE curriculum designed by the Nigerian Educational Research and Development Council (NERDC) (1997) for the primary, junior secondary, senior secondary and the non-formal education sectors can be a good start for sustained environmental education. But the personnel, materials and other infrastructure particularly those related to STM must be put in place for an effective experimentation and implementation. This is more so with the coming up of the Universal Basic Education (UBE) schemes.

c) ***Greening the teacher education programmes:***

No education system can rise above the quality of its teachers

(FRN,1998) therefore teacher trainers must themselves be ecofriendly, knowledgeable in the content, ecodidactical in methodology using ecocentric skills necessary for effective EE curriculum implementation. They must also be adequately motivated and religiously committed to the course of sustainability (Inyang-Abia & Umoren, 1995).

d) Ecocentric instructional methods and materials.

Textbooks, visuals, audiovisuals and other relevant instructional materials in STM should have environmental focus. Both the teachers and the learners should also fully explore and adequately utilize these ecocentric learning materials for effectiveness and efficiency. Instructional methods that encourage exploration of the local and distant environment and sustainable use of all categories of resources should be employed more frequently than it is being done now in STM

SUMMARY AND CONCLUSION

Sustainable national development cannot be faster than the national progress in education. Science, technology and mathematics (STM) curricula are implicit syntheses for rapid national development. The greener such curricula, the more sustainable the national development.

Difficult as the task my seem, where political will is available, well-prioritized educational process with proper administrative support can change the situation positively through sustainable greener STM curricula. These are a synthesis for sustainable national development. There is therefore a pressing need for Agenda 21- based curricula design in science, technology and mathematics. These should be capable of promoting, creating and utilizing appropriate curriculum technologies, greener teacher perception, committed core of dedicated and well-motivated teachers and effective use of ecocentric instructional methods and materials. Then and only then can sustainable national development be easily achieved through the science, technology and mathematics curricula for Nigeria.

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