Curriculum Planning and Development in Mathematics from the Formative Stages

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Abstract
Curriculum of a school consists of all the experiences that a learner encounters under the direction of the school. The curriculum of any educational system is planned and developed according to the needs of the society. Just as the society is dynamic, the curriculum is also dynamic. Hence, curriculum is usually changed from time to time.   This paper focuses on the processes of curriculum development in mathematics.This includes determination of educational goals and objectives, selection of learning experiences, organization, try out of the curriculum, implementation and evaluation. Some models for curriculum development are also discussed.
Keywords: Curriculum planning, Curriculum Development Model

Introduction
Many plausible definitions of the word curriculum have been offered by different educators. One of these by Okunrotifa in Longe(1984) defines curriculum as ''all the learning experiences or educational programmes planned for students under the auspices of the school. According to this definition, curriculum comprises, programmes of study which are academic courses offered, programme of activities comprising interscholastic and intramural activities, career development and so forth (Longe, 1984). Curriculum development implies the planning of these learning experiences, the aims of which are to bring about some derived change in the students and the assessment of the extent to which these changes have taken place. One can perhaps bring to bear here, the argument that curriculum development is but one form of reform intended to bring a change in the educational system. A responsive curriculum is particularly central to the achievement of the uttermost goal of education, that is, the total development of the child.

In contemporary educational usage, the curriculum at the school consists of all the experiences that a learner encounters under the direction of the school. Further moiré, the modern concept of curriculum includes the programme of studies, the method of instruction employed in each course, the guidance programme of the school and the extra class-activities programme. The content of the curriculum and the methods employed to present the content have to be determined by the nature of the society, the nature of the learner, and the nature of the subject (Badmus, 2002). Hosford in Badmus (2002) defined curriculum as the set of experiences planned to influence learners towards the goals of an organization. Organization here refers to both schools and many other different situations for which courses my be run. Learners include both people and animals. Animals have schools and animals are learners. e.g. Dog training school.

According to Hosford in Badmus (2002)the curriculum planning and development include agreement on the essential elements of the task:
(i)   Statement of objectives and purpose
(ii)   Content selection
(iii)   Organization and determination of the sequence of learning opportunities
(iv)   Selection of materials and facilities
(v)   Evaluations.
(i.e. purpose, content, sequences, materials and evaluation)

Curriculum development design and is a part of a whole process of curriculum renewal according to Feyereisen et al, and Walton and Walton in Badmus (2002).

Curriculum according to Lewis and Miel in Akangbou (1984) is ''a set of intentions about opportunities for engagement of persons to be educated with other persons and with things (all bearers of information, processes, techniques and values) in certain arrangements of time and space''

On the other hand, Tanner and Tanner in Akangbou (1984) see curriculum as being defined as:

-       The cumulative tradition of organized knowledge;
-       Modes of thought;
-       Race of experience\guided experience;
-       A planned learning environment;
-       Cognitive/affective content and process;
-       An instructional plan;
-       Instructional and or out comes; and
-       A technological system of production.

However Saylor, Alexander and Lewis in Akangbou(1984) think of the curriculum as ''the subjects and subject matter therein to be taught by teachers and learned by students.

Anderson and Bowman quoted by Akangbou defined planning as ''a process of preparing a set of decisions for actions in the future. Curriculum planning is therefore concerned with the preparation of a set of decisions on the subject and subject matter that teachers are to teach those to be educated in the future (Akangbou, 1984). In that sense, the curriculum plan has to go through certain stages. These, according to Lewy cited in Akangbou(1984) are :
(a)   The preparation of the syllabus of the subjects which are in essence clearly spell out of the subject matter;
(b)   The production of instructional materials; and
(c)   The implementation of the curriculum in the system.

The Processes of Planning and Development of Curriculum
Five stages of operation are involved in the process of curriculum planning and development. These are goal determination, technical operations (Technology), the application stage (Try on), implementation and evaluation (Longe, 1984)

(1)   Goal Determination (Aims and Objectives)
This function involves the determination of the general educational aims and specification of major objectives. The general aims of education are of political significance.   They are usually stated in broad terms so that they secure the consensus of the great majority of the society. They serve as the basis for making decisions on how school life should be organized and what should be taught in school, but in themselves they do not constitute or directly determine the practical details of school life. (Longe, 1984) . Examples of such political aims are that education should be a preparation for life, ''increase the supply of high level manpower'' or develop a ''more complex thinking in children. General education aims are formally stated by Governmental or Legislative acts.

Decisions about curriculum objectives are affected by three basic factors. They are the learner, the society and the subject matter (discipline) (Akangbon, 1984; Badmus, 2002)

The society – The needs, values and other social forces influence and demand upon the institutions of learning. The society is in a constant state of change. As a result of this, the curriculum planner should select educational objectives that take these changes into consideration. It is the role of the curriculum planner to analyze the implications of changes in the society when deciding upon the new programme of study for the school. Some of the changes in the society to be considered include employment pattern since schools are to provide basic skills, and the requirements arising from the development of new behaviour in health , welfare and political activities. A case in point is the inclusion of ICT, HIV/AIDS education and quantitative reasoning in the Basic Education curriculum for mathematics in 2006. (FME, 2006)

The needs of the learner. This includes the characteristics of the learner and how he learns. As in the case of the society, the employment and occupational needs of the learner are to be considered in curriculum planning. This is because the essence of education is to make one fit to live and fit to live with.

Subject matter. Here we consider the specialized fields of knowledge, the nature and philosophy. Just as the society is in a constant state of change so also is the subject matter in a constant state of change. In this regard the curriculum to be devised has to consider the introduction of new findings, topics structures etc., that are relevant to living in the contemporary setting.

Usually when the educational programme organized according to subject matter, with unique curriculum materials developed for each subject, the major educational objectives (MEO) inherent in them or which can be

obtained through their study have to be identified. The MEO delineate broad areas of human behaviours and should first be translated into more specific guidelines for preparing instructional materials (Akangbou, 1984).

For instance, the revised nine-year National Mathematics Curriculum for basic education in Nigeria is focused on giving children the opportunity to:

(i)   Acquire mathematical literacy necessary to function in an information age;

(ii)   Cultivate the understanding and application of mathematics skills and concepts necessary to shrive in the ever changing technological world;

(iii)   Develop the essential element of problem solving, communication, reasoning and connection within their study of mathematics;

(iv)   Understand the major ideas of mathematics bearing in mind that the world has changed and is changing since the first National Mathematics Curriculum was developed in 1977 (FME, 2006).

Although the above three considerations are the major ones that directly affect decisions about school curriculum objectives, the curriculum planner has to consider in addition the characteristics of the educational system before deciding on the objectives. This can be discussed as comprising the general educational aims and the organizational features of the educational system.

General educational aims and objectives

The general educational aims and objectives as stated in the National Policy on Education are derived from the main National Objectives of the Country which are the building of:

(a)   Free and democratic society;

(b)   A just egalitarian society;

(c)   A great and dynamic society; and

(d)   A land full of bright opportunities for all citizens (FRN, 2004)

Also, the National educational goals are:

(a)   The inculcation of national consciousness and national unity;

(b)   The inculcation of the type of values and attitudes for the survival; of the individual and the Nigerian society;

(c)   The training of the mind in the understanding of the word around; and

(d)   The acquisition of appropriate skills and the development of mental, physical and social abilities and competencies as equipment for the individual to live in and contribute to the development of the society (FRN, 2004)

Organizational Features of the School system

Here, we consider if the school system is both vocational and academic or not.   We also need to consider the structure and the length of years for the completion of the course.   These would affect the objectives of the curriculum.

Technology (Selecting and organizing learner experience)

Once the general educational goals have been determined, these professional planners start to translate them into specific curriculum activities. Decisions are made concerning the objectives of particular course of study, the content, the teaching –learning, the curriculum team would develop the first version of the instructional material to be used in the class. This includes writing the text, preparing demonstration materials, devising students, - activity plans and so on.

Tyler in Badmus (2002) enunciates five principles for selecting learning experiences.   That learning experiences:

(1)   Must be related to objectives;

(2)   Must be such that learners obtain satisfaction from carrying on the kind of behaviour implied in the objectives;

(3)   Must be within the range of possibility of the learners;

(4)   Must be such that many of them relate to a particular objective; and

(5)   Must be such that a learning experience could have several outcomes.

He emphasized that a learning experience could have several outcomes. He emphasized that learning experience

to be provided should be useful in attaining various types of objectives. This he illustrated with the following:

(1)   Learning experiences to develop skill in thinking;

(2)   Learning experiences helpful in acquiring information; and

(3)   Learning experiences helpful in developing (social) attitudes and interest.

After selecting the learning experiences, the curriculum items have to be organized. Tyler notes that important changes in human behaviour are not produced overnight and advocates that educational experiences should be organized as to reinforce each other in order to produce a cumulative effect on the learning. Learning experiences should be put together to form some kind of coherent programmes and suggests procedures for organizing learning experiences into units, courses and programmes. He suggested that consideration be given to the relationship between learning experiences over time and also from one area to another, and refers to these two kinds of relationship as the vertical and horizontal relationships. Three major criteria for effective organization are continuity, sequences and integration according toTyler in Badmus (2002).

Another task for the curriculum planner is in determining the strategy(ies) that will be most effective in the teaching learning process. The literature on teaching – learning strategy shows that the following strategies are available for choice by the curriculum planner (a) expository teaching (b) inquiring learning (c) small group teaching (d) individualized learning (e) mastery learning (f) games; and (g) programmed instruction. The curriculum planner is free to limit himself to the use of a single strategy for an entire programme although a curriculum does not necessarily have to utilize a single strategy (Akangbou, 1984).

Application (Try on)

The application stage refers to ''try out and revision whereby educational programmes would be empirically tried out before they are approved for use on a large scale basis" In general, little regard is given to this idea of combining or complementing professional wisdom with empirical evidence for the job of materials preparation (Longe, 1984). Many curricula have failed in the past because of lack of try out of the curricula before implementation. Many of them are approved based on the subjective judgment the educational authorities.

At this stages, the curriculum team should carefully observe the teaching – learning process in the classroom situation, employ a variety of formative evaluation, instruments, including tests and students work sheets. The team should encourage both teachers and students to point our problems and difficulties encountered in the programme.

Also, the programme, should be submitted to various types of experts to pass judgement upon the material, indicate any specific modification that is necessary. On the basis of results of both the empirical trial run and the experts' judgments, a series of recommendations would be made concerning desired alterations of the original version of the programme.

Implementation

Implementation refers to an open use of the curricula throughout the entire school system. This would entail a number of changes within the educational system. Some of the activities are the provision of teaching – learning and inservice training for principals, teachers and school supervisors. (Longe, 1984; Akangbou, 1984).

The success of any curricula depends on the provision of the required instructional materials and the readiness of the school principals, teachers and inspectors. Many curricula in Nigeria have failed due to lack of compliance to this implementation strategy. Besides, the implementation of the curricula have to be monitored to ensure the achievement of the objectives of the curriculum. Any discovery would have to be corrected.

Evaluation

The process of evaluation according to Tyler, is essentially the process of determining to what extent the educational objectives are actually being realized by the programme of curriculum and instruction. In other words, the statement of objectives not only serve as the basis for the selection and organization of learning experiences but the standard against which the programme is assessed. To Tyler then evaluation is a process by which one matches initial expectation in the form of behavioural objectives with out comes. Such a conception of curriculum planning has a certain commonsensical appeal and especially when fortified with models from industry and systems management, it seems a supremely wise and practical way to appraise the success of a venture according Tyler in Badmus (2002).

Models For Curriculum Development
Some of the Models for curriculum development are shown bellow:

Tyler's Model
Tyler in Badmus(2002) based his work on four fundamental questions:
  (1)   What educational purposes should the school seek to attain?
  (2)   What educational experiences can be provided that are likely to attain these purpose?
  (3)   How can these educational experiences be effectively organized? and
  (4)   How can we determine whether these purposes are being achieved?
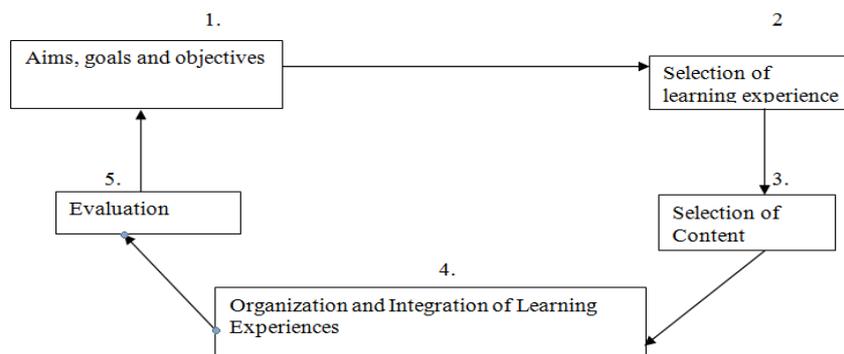
No attempt was made by Tyler to answer the questions; he argues that the answers will vary from one level of education to the other and suggests methods of studying these methods and his model is diagramed below:

Aims and objectives
(Purposes)

Content   Method
(Experiences)   (Organization)
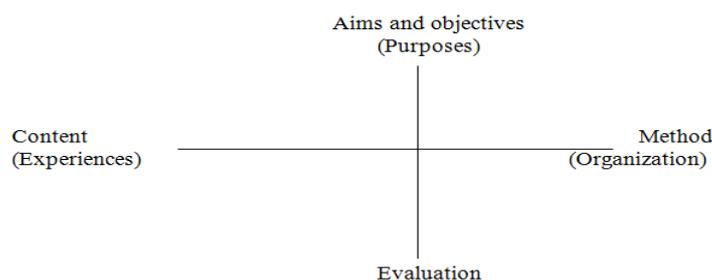
Evaluation

Tyler's Model

Wheeler's Model
Some people have argued that the Tyler model is rather too simple and suggest that evaluation need not be a terminal process, but should take place at every stage. Wheeler converted Tyler's original ideas into a cyclic form with five phases according to Wheeler in Badmus (2002)

1.
Aims, goals and objectives

2
Selection of learning experience

3.
Selection of Content

5.
Evaluation

4.
Organization and Integration of Learning Experiences

Wheeler's Model

Conclusion
The essence of the educational curriculum of any nation is geared towards producing ideal men and women in the society. Any error in the planning and development of the curriculum affects the entire educational system. Hence, curriculum planners must ensure the stages of curriculum are followed.   These include goal determination, selection of objectives, organization, try out, Implementation and Evaluation. Curriculum development is dynamic and changes as the society changes.

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