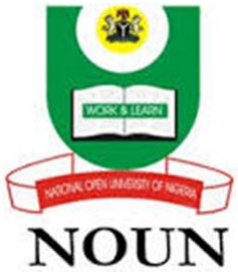

NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF EDUCATION

COURSE CODE: SED 422

COURSE TITLE: INTEGRATED SCIENCE CURRICULUM DESIGN AND IMPLEMENTATION

Course Code	SED 422
Course Title	Integrated Science Curriculum Design and Implementation
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SED 422: **INTEGRATED SCIENCE CURRICULUM DESIGN AND IMPLEMENTATION**

COURSE GUIDE
NATIONAL OPEN UNIVERSITY OF NIGERIA

Introduction
Integrated Science Curriculum Design and Implementation is a two-credit course. It is a core course for all those offering Bachelor Degree in Integrated Science Education B.Sc (Ed). This course will prepare you and change your outlook to Integrated Science teaching for good. It will help you to begin to think and act like a professional. The course involves aspects of stages of curriculum Design and Implementation with reference to Integrated Science curriculum projects in Nigeria and Africa (Ghana) . The course includes: principles and techniques of designing an Integrated Science curriculum development with reference to Ghana and in particular, Nigeria; inputs in Integrated Science curriculum design, implementation and evaluation of the curriculum.

What you will learn in this course
The overall aim of the course in Integrated Science Curriculum Design and Implementation is to keep you abreast with development in Integrated Science Education. The course is developed on the premise that if a good curriculum is found to be in the hand of a good teacher, there will be successes in our science classrooms. This course will further expose you to better understanding of your job as a seasoned Integrated Science teacher that needs to be deeply involved in curricular problems because this is one of the pivots on which the education of the child revolves. For those of you who have undergone some training in curriculum, you still need to be constantly reminded of the major issues and problems involved and further enlightened on some issues that are central to Integrated Science Education curriculum. Some of the topics will inform you about how to teach Integrated Science effectively such as the art of teaching integrated science and the making of an effective integrated science teacher.

Aims of the Course
This course aims at providing meaningful guidelines. Explanation of Integrated Science education in Nigeria, curriculum development, evaluation and implementation and familiarization with some issues that concern the teacher and Integrated Science teaching.

Course Objectives
To achieve the aims set out above, the course sets over all objectives. In addition, each unit also has specific objectives. The unit objectives are always included at the beginning of a unit; you should endeavour to read them before you start

reading through the unit. You may as well want to refer to them during your study of the unit to check on your progress. You should always look at the unit objectives after completing a unit. In this way, you can be sure that you have done what was required of you by the unit. The wider objectives of the course as a whole are stated below. For you to say you have achieved these objectives, you should have successfully achieved the aims of the course. On successful completion of this course, you should be able to:

1 Define curriculum
2 Identify the common misconceptions of curriculum
3 List characteristics of curriculum.
4 Explain Integrated Science
5 Briefly trace the history of Integrated Science in Nigeria
6 State problems associated with the idea of Integrated Science in Nigeria
7 Define curriculum design
8 Examine various categories of curriculum design
9 Discuss decisions that determine curriculum design.
10 State principles for designing Integrated Science curriculum
11 List prerequisites for designing Integrated Science curriculum
12 Mention reasons for defining curricular outcomes
13 Discuss factors to consider in making headway in Integrated Science curriculum design
14 Identify constraints to curriculum design
15 Identify elements (components) of a good Integrated Science curriculum design
16 Differentiate between aims and objectives
17 Discuss classes of objectives
18 List criteria for the selection of learning experiences
19 Explain curriculum development
20 Discuss the various views of schools of thought on curriculum development
21 List Steps in Integrated Science curriculum development
22 Discuss rationale for curriculum development
23 State factors to consider in curriculum development
24 Define curriculum development agency?
25 Give examples of curriculum development agencies in Nigeria
26 Identify general aims of Integrated Science curriculum for high school in Ghana

27 Describe briefly history of the Ghanaian education system

28 Describe educational administration in Ghana

29 Compare Integrated Science curriculum content organization in Nigeria and Ghana

30 State functions and activities of the following curriculum development agencies:

i. The Nigeria Education Research and Development Council

ii. National Teachers Institute

iii. Nigerian Educational Technology Centre

iv. National Board for Technical Education

v. National Commission for Colleges of Education

31 Give examples of subject associations. What are the specific functions of these associations?

32 Discuss aims and functions of Science Teachers Association of Nigeria

33 Identify the participants in the development of curriculum.

34 Explain the role of each participant in the development of curriculum.

35 Discuss some Initial science curriculum development efforts in Nigeria.

36 List problems of the early curricula programmes.

37 Discuss national science curricula programmes.

38 Identify problems of the Nigerian Secondary Science Project (NSSSP) Projects.

39 Discuss the history of Integrated Science curriculum development in Nigeria

40 Discuss the 9 year basic science and technology curriculum development in Nigeria

41 State the objectives and reasons for 2012 Revision of Basic Science and Technology curriculum

42 Define curriculum evaluation

43 State purposes of curriculum evaluation

44 List and discuss various types of evaluation methods

45 Discuss framework for examining curriculum evaluation.

46 Define Curriculum Implementation?

47 Discuss briefly stages involved in Integrated Science curriculum implementation

48 List and discuss Problems confronting the implementation of Integrated Science curriculum.

49 Outline factors affecting successful implementation of Integrated Science curriculum.
50 State reasons for low motivation of teachers to accept changes in curriculum
51 Identify rationale for training teachers
52 List and discuss various ways of motivating students for successful curriculum
implementation
53 Identify the goals of an effective Integrated Science teaching
54 Identify the components of an effective Integrated Science teaching?
55 Identify what makes Integrated Science teaching really effective?
56 Identify who is an effective Integrated Science teacher?
57 Highlight the attributes of an effective Integrated Science teacher
58 State the functions of an effective Integrated Science teacher?
59 List the criteria for measuring an ineffective Integrated Science teacher?
60 Highlight the roles of an effective Integrated Science teacher.

Working through this course

To complete this course, you are required to read the study units, read set of recommended books and other materials prescribed by your tutor. Each unit contains activities to enable you follow the trend of what you are reading and be sure you understand it. There are tutor-marked assignments which you are expected to complete and submit to your tutor for assessment. There will be a final examination at the end of the course.

Assessment

There are two aspects to the assessment of this course. First are the Tutor-Marked Assignments, second is a written Examination. In doing the assignments, you are expected to apply information, knowledge and technique gathered during the course. The assignments must be submitted to your tutor for formal assessment in accordance with the deadline agreed upon in the Assessment file. The work you submit to your tutor for assessment will count for 50% of your total course mark. At the end of the course, you will need to sit for final written examination of two hours duration. This examination will also count for 50% of your total course mark.

Tutor-Marked Assignments (TMA)

There are marked assignments in this course. You are encouraged to submit all except any counter directive from your tutor, in which the best require number, will be counted. Make sure that each assignment reaches your tutor on or before

the deadline given in the Assignment file. If for any reason you cannot complete your work on time, contact your tutor before the assignment is due to discuss the possibility of an extension. Extension will not be granted after the due date unless there are exceptional circumstances.

Tutors and Tutorials

There are 12 hours of tutorials provided in support of this course. You will be notified of the dates, times and location of these tutorials, together with the name and phone number of your tutor, as soon as you are allocated a tutorial group. Your tutor will mark and comment on your assignments, keep a close watch on your progress and on any difficulties you might encounter and provide assistance to you during the course. You must mail your TMAs to your tutor well before the due date (at least two working days are required). They will be marked by your tutor and returned to you as soon as possible. Do not refuse to contact your tutor by telephone, e-mail or direct discussion if you need help. The following might be circumstances in which you would find help necessary. Contact your tutor in case:

1. You do not understand any part of the study units or the assigned readings
2. You have difficulty with the self-tests or exercises
3. You have a question or problems with an assignment, with your tutor's comments

on an assignment or with the grading of an assignment you should try your best to attend the tutorials. This is the only chance to have face contact with your tutor and to ask questions which are answered instantly. You are free to raise any problem encountered in the course of your study. To maximise the benefit from course tutorials, prepare question list before attending them. You will learn and gain a lot from participating in discussions group actively.

Summary

SED 422 intends to introduce you to issues in Integrated Science curriculum design and implementation and issues that affect the teacher and what goes on in Integrated Science classroom. Upon completing this course you will be equipped with the knowledge of how to deal with the practical problems that confront you daily in the classroom as a science teacher as well as the constant shift in the way of looking at the Integrated Science curriculum process as a whole.

SED 422 **INTEGRATED SCIENCE CURRICULUM DESIGN AND IMPLEMENTATION**

MODULE 1 **PRINCIPLES AND TECHNIQUES OF DESIGNING AND DEVELOPMENT OF AN INTEGRATED SCIENCE CURRICULUM**

Unit 1

DEFINITION OF A CURRICULUM

CONTENTS

1.0 INTRODUCTION

The concept of curriculum is one which remains relatively ambiguous to many people even among the educated / elite. The reason arises from the inability of scholars to agree on the definition of curriculum and misconceptions of what curriculum is by the various authors and schools of curriculum theorists. Although, there exist from their various definitions common elements such as content, objectives, learning experiences and evaluation which really make for a good curriculum. In this unit, some definitions are presented.

2.0 OBJECTIVES

At the end of this unit, you should be able to:
Define curriculum;

State the characteristics of curriculum.

Identify some misconceptions of curriculum

3.0 MAIN BODY

3.1 WHAT IS CURRICULUM?

Some influential definitions combine various elements to describe curriculum as follows:

- Curriculum is “a plan for providing sets of learning opportunities to achieve broad educational goals and related specific objectives for identifiable population served by a single school center.” (Saylor and Alexander, 1974)
- Kerr defines curriculum as, "all the learning which is planned and guided by the school, whether it is carried on in groups or individually, inside or outside of school.’
- A good curriculum is the total environment in which education takes place; that is the child, teacher, subject, content, the method, the physical and psychological environment (Fafunwa, 1997)
- A curriculum is a programme of learning planned for a target group of learners for a specific period of time in order to achieve certain predetermined educational goals (Dada, 1999)
- Braslavsky states that curriculum is an agreement amongst communities, educational professionals, and the State on what learners should take on during specific periods of their lives. Furthermore, the curriculum defines "why, what, when, where, how, and with whom to learn (Braslavsky, 2003)
- Curriculum outlines the skills, performances, attitudes, and values pupils are expected to learn from schooling. It includes statements of desired pupil outcomes, descriptions of materials, and the planned sequence that will be used to help pupils attain the outcomes.
- Curriculum is the total learning experience provided by a school. It includes the content of courses (the syllabus), the methods employed (strategies), and other aspects, like norms and values, which relate to the way the school is organized.
- Curriculum is the aggregate of courses of study given in a learning environment. The courses are arranged in a sequential order to make learning of a subject easier. In schools, a curriculum spans several grades.

3.2 COMMON MISCONCEPTIONS OF WHAT CURRICULUM IS

The following are some common misconceptions that people or even scholars have about what curriculum is.

1. Curriculum is syllabus: Syllabus merely specifies what topics must be understood and to what level a particular grade or standard can be achieved.
2. Curriculum as only course of studies, which students must fulfill in order to pass a certain level of education.
3. Curriculum as list of courses of specific discipline. Curriculum as the courses required in order to receive one's diploma.
4. Curriculum in terms of the subjects that are taught. This can be explained in terms of taking the curriculum as a list of school subjects. For example, Physics, Basic Science, etc. and as set out within the set of textbooks.
5. Curriculum as Scheme of Work. Scheme of work is only the breakdown of the syllabus into instructional units based on the number of periods.
6. Curriculum as lesson note. This only explains what is done during instructional process.

3.3 CHARACTERISTICS OF A CURRICULUM

Dada (1999) extracted from the list of definitions what one would regard as the most essential characteristics of a curriculum.

1. A curriculum is an educational proposal. This means that it is a plan of an educational programme. Most people would see it as a written document of some sort.
2. A curriculum contains a programme of studies (the syllabus or a list of subject matter to be learnt), a programme of activities (what learners would in order to acquire knowledge or develop skills, etc) and a programme of guidance (what teachers would do to help learners become useful to themselves and the society).
3. A curriculum is rooted in a given society. That means that the learning programme reflects the needs of society and many factors in the society have to be considered in drawing up the programme.
4. A curriculum is the responsibilities of the school. This means that although there can be other agents in the society that contribute to the making of a

curriculum, the school is held responsible for the outcome of the programme.

5. A curriculum takes into account the total environment of the learner - physical, psychological, social, and home, etc

Exercise

1 What is a curriculum?

2 what are the common misconceptions of curriculum?

3 List some characteristics of curriculum.

4.0 CONCLUSION

Curriculum has numerous definitions, which can be slightly confusing. There is no generally agreed upon definition of curriculum although certain elements are common to the various definitions.

5.0 SUMMARY

In this unit we have learnt:

1. Various definitions of curriculum

2. Common misconceptions of what curriculum is

3. Characteristics of curriculum

6.0 TUTOR MARKED ASSIGNMENT

List some definitions of curriculum according to various scholars and attempt a personal definition of curriculum.

7.0 REFERENCES / FURTHER READINGS

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Unit 2

CONCEPT OF INTEGRATED SCIENCE

CONTENTS

4.0 INTRODUCTION

Children generally are full of challenging questions about the natural world. Things concrete and abstract in nature, animate or inanimate, attract their attention and affect their thinking. They would want to be well equipped with the knowledge of all these. They have holistic view of their natural world. Knowledge in isolation or different compartments will not satisfy their curiosity but may leave them more confused than ever before. So, in this unit you will learn a new way of presenting science (Integrated Science) to the learners, brief history of this subject and problems associated with the idea of Integrated Science.

5.0 OBJECTIVES

At the end of this unit, you should be able to:
Define Integrated Science

Discuss briefly the history of Integrated Science

State problems associated with the idea of Integrated Science.

3.0 MAIN BODY

3.1 What is Integrated Science?

In our study of science, one needs to face up to the challenges of doing science in a new way, doing it in connection with other disciplines and doing it more holistically. This is an integrated approach to the study of science. Integrated Science is a kind of science that is modified in such a way that science is presented as 'one' but not in parts. Some non-professional teachers of Integrated Science respond to such a question like this: 'How far have you gone concerning the content coverage?' Their response usually is 'I've taught Physics aspect, Chemistry aspect; it remains Biology aspect.' They view science in parts but not as an entity.

Integrated Science is a way to study science. If the approach given to the study of science is such a way that we do not distinguish between the various sciences, we are said to have integrated or put together the various science disciplines. So that in our study of Integrated Science, we are not studying Physics, Chemistry, or Biology separately (Institute of Education, University of Ibadan, 2004).

In a simple and in general terms, Bajah (1983) sees integrated science as only a way of teaching science. When science is taught in such a way as to present scientific ideas as a unified whole, then we say that the ideas have been integrated. Integrated science is defined as a cumulative approach of scientific study that synthesizes the perspectives of the individual disciplines, and integrates them during all phases of the approach to a question or problem, with the results having an influence on policy and management decisions (Gallagher et. al. 2008).

Integrated Science emphasizes the fundamental unity of science. It is a practical approach to the study of science. It is completely activity-based and student-centred. Integrated science provides students sound basis for further science education study, hence a child that is not well grounded in integrated science at this level would not show interest in offering core science subjects (biology, chemistry and physics) at the SSS (Senior Secondary School) level which are the prerequisites for studying science-oriented courses at the Nation's tertiary Institutions.

3.2 Brief History of Integrated Science in Nigeria

In Nigeria, General Science has been stressed over the years. General Science was introduced to Nigerian Schools in 1878 (Duyilemi, 1991). The name,

Integrated Science became popular only between 1957 and 1969 (Abdullahi, 1982).

The first International Conference on Integrated Science teaching took place in Warna (Bulgaria) in 1968. The first publication of the Nigerian Integrated Science Project (N.I.S.P) was in 1970. The objectives of Integrated Science were well highlighted and since that time Integrated Science has become so popular that it is offered at both primary and secondary levels of education.

3.4 INITIAL PROBLEMS ASSOCIATED WITH THE IDEA OF INTEGRATED SCIENCE

1 Lack of trial testing of the material for teaching integrated science
2 Inability of the teachers to effectively cope with the materials
3 Lack of interest of teachers in all aspects of Integrated Science
4 Continued existence of general science with integrated science.
5 Misconception that Integrated Science may lead to having shallow knowledge in science.
6 Reluctant attitude among the nation's tertiary institutions to run Integrated Science courses.

Exercise

What is Integrated Science?

Briefly trace the history of Integrated Science in Nigeria

State problems associated with the idea of Integrated Science in Nigeria

4.0 CONCLUSION

Integrated Science should not be viewed as Physics, Chemistry or Biology but, as science that presents fundamental unity of science

5.0 SUMMARY

In this unit you have learnt:

1 What Integrated Science is?

2 Brief history of Integrated Science in Nigeria

3 problems associated with the idea of Integrated Science in Nigeria

6.0 TUTOR MARKED ASSIGNMENT

Is Integrated Science Physics, Chemistry or Biology? Justify your answer.

7.0 REFERENCES / FURTHER READINGS

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Unit 3

THE CONCEPT OF CURRICULIUM DESIGNS

CONTENTS

1.0 INTRODUCTION

There are diverse problems facing education in modern times. A study of the design of curriculum is a good way to solve many, if not all of the problems confronting education cycle. Therefore, in this unit you will be exposed to the concept of curriculum design and the decisions that determine the design of the curriculum.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

Define curriculum design.

Examine various categories of curriculum design.

Discuss concisely decisions that determine curriculum design.

3.0 MAIN BODY

3.1 Concept of curriculum design

Curriculum design is the organizational pattern of structure of a curriculum. It is concerned with the nature and arrangement of the four basis curriculum component: aims, goals, and objectives; content; learning experiences; and evaluation. It is the methods of achieving appropriate scope and of establishing desirable sequence, cumulative continuity, and integration of learning. Thus, the central problems of curriculum design are scope, sequence, continuity, and integration (Taba, 1962).

Again, curriculum design can be explained along two basic dimension organization; horizontal and vertical. Horizontal organization, which subsumed scope and integration, is concerned with the side-by-side arrangement of curriculum components. In contrast, vertical organization, which also subsumed sequence and continuity, is concerned with the longitudinal arrangement of curriculum elements (Zais, 1976).

In the recent past, little attention is paid to organization and design of a curriculum, the episode which has resulted in a kind of disjointed cluster of specialized subjects which often operates to impede, rather than to foster, education. Needless to say, this has exerted disproportionate influence on curriculum offerings, which is often lopsided.

To combat this, it has now been the challenge to curriculum developers to make the necessary decisions so that the curriculum which is created has a high degree of internal consistency (Hunkins, 1980). This results from a careful consideration of the elements involved in curriculum design. If the decisions made about each of the data sources and curricular elements are compatible, the curriculum will have internal consistency, it will have a greater potential for having the desired impact upon the students. If the data sources and curriculum elements are not treated in a consistency manner and have no clearly defined relationship to each other, the design of the curriculum will be confused and the potential impact upon students will be lessened. This leads us to the decision that determined curriculum design as highlighted by Ayodele (2002).

3.2 DECISIONS THAT DETERMINE INTEGRATED SCIENCE CURRICULUM DESIGN

SCOPE

The selecting and organizing of content requires contemplating several key problems. One such problem is that of scope, the breadth and depth of content.

What content from the disciplined, from the non-disciplines, from the occupational activities should be included in the curriculum? What content should be made mandatory for all the students? What content should be considered as elective? Scope is a continuous issue, for knowledge production is dynamic. Certain content areas because of increased information can become unmanageable. People are now reacting to the expansion of knowledge by advocating that the schools redefine, usually in a hitting fashion, its purpose, that it narrows its curricular scope. How much detail and how much emphasis should be given particular curriculum content have to be answered. Our schools function within a finite time period. Again, students can learn only so much during any particular interim. How much detail does a student require at various levels of schooling? The scope of curricular content is regulated in parts by the goals and objectives generated during the diagnose stage in curriculum planning.

INTEGRATION

Another concept relating to incorporating content into particular design is that of integration. Those confronted with designing curricular hopefully realize that learning is more effective when content from one field is related meaningfully to content in another field. Integration is usually seen as emphasizing horizontal relationships among various curricular areas, attempts to interrelate content themes, ideas, and facts in order to assure students perceiving a unity of knowledge. This is what is learned in language study may be related to study within a social studies unit on communication in modern times. What is learned in science may be further interpreted within the realm of mathematics (Taba, 1962).

SEQUENCE

Content selected must be arranged in time. Sequence deals with the question of, what content and experiences are to follow what content and experiences? Sequence addresses the problem of ordering the curricular offerings so as to optimize students' learning. Sequence based on psychological principles draws on our understanding of and research on human growth, development and learning. Piaget's (1960) research has provided a frame work for sequencing content and activities and relating expectations to what we know about how individuals function at various cognitive levels.

Also, one can organize and sequence content drawing on the substantive structure of the content and logic of the discipline. Here content is arranged on the basis of key concepts and the order of learning and comprehending of other concepts.

Regarding sequence, questions like these are to be answered – what subject matter can be handled by students at this particular level of schooling?. What subject should be moved down the school grade scale? What subjects should be postponed until students are more mature?

Smith, Stanley and Shores (1957) introduced four principles simple to complex, Prerequisites learning, whole to parts, and chronology. The first, simple – to complex indicated that content is optimally organized in a sequence going from simple subordinate components or elements to complex components depicting inter-relationship of components. It draws on the idea that optimal learning can proceed when individuals deal with the easy materials, often in concrete form, and proceed to the more difficult materials which are often abstract.

Some curricularists comment that optimal sequence is that which presents the content in an overview (whole) fashion initially, thus furnishing students with a general idea of the information. After such a global encounter, students can learn the particular (part).

Prerequisites learning work on the assumption that there exist bits of learning that must be comprehended before other bits of learning can be apprehended. In learning to read, one masters the sounds of the letters of the alphabet prior to processing initial blends of words. After learning blends, one can tackle word pronunciation. Learning to pronounce words leads to the act of reading.

Chronology is another organizer for sequencing content. Frequently, history, political science and world events are so organized. At times, one may employ a reverse chronology, suggesting that students study present content, and then ring "flash back" techniques investigate prior events that led to the current event (Hunkins, 1980). This type of sequence is defended on the basis that it facilitates understanding the causality of wants.

CONTINUITY

Continuity refers to the continuousness with which individuals will experience content at various levels within an educational system. It deals with vertical manipulation of curriculum elements. Curricularists often extend themes vertically throughout an entire curriculum. The spiral curriculum organization exemplifies continuity in that the key concepts are experienced successively by students' throughout the curriculum. Continuity deals with the continued presence of curriculum elements (content topics or concepts or issues) and relates very closely with the concept of articulation.

3.3 CATEGORIES OF CURRICULUM DESIGN

Academic curriculum design. This design usually focuses on a body of knowledge grouped into disciplines, subject matter, or broad areas. It is commonly used for school models.

Technical curriculum design. The curriculum is organized around the analysis of performance task and process sequencing rather than content.

Intellectual process curriculum design. The goal of this design is to increase learning efficiency and the transfer of problem-solving skills to other content areas and life experiences. The focus is on the development of cognitive processes.

Social curriculum design. The focus is on application of knowledge in real-world situations. The curriculum provides opportunities for students to work on projects in which they can change the environment. It provides information to help students learn what they will need to fit into adult society.

Personal curriculum design. This model is learner centered with a focus on the individual student and his/her needs and interests.

Exercise

What do you understand by curriculum design?

Examine various categories of curriculum design

Discuss decisions that determine curriculum design.

4.0 CONCLUSION

Decisions such as scope, integration, sequence and continuity are necessary in curriculum design, for all of these determine the design of a good curriculum for learners.

5.0 SUMMARY

In this unit you have learnt:

1 The concept of curriculum design

2 Various categories of curriculum design

3 Decisions that determine curriculum design

6.0 TUTOR MARKED ASSIGNMENT

Summarize in the decisions that determine curriculum design

7.0 REFERENCES / FURTHER READINGS

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Unit 4

DESIGNING INTEGRATED SCIENCE CURRICULUM

CONTENTS

1.0 INTRODUCTION

A number of important principles emerge from literature on curriculum. These principles apply both to almost all levels of educational settings including Primary and Secondary Schools. Listed in this unit are a number of key questions to ask when designing curricula. Most of them are germane. Many of these questions can be helpful when beginning to design a new curriculum.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

State the principles for designing Integrated Science curriculum

List the prerequisites for designing Integrated Science curriculum

Mention reasons for defining curricular outcomes

3.0 MAIN BODY

3.1 PRINCIPLES OF DESIGNING INTEGRATED SCIENCE CURRICULUM

The following principles are essential in designing integrated science curriculum :

1. Philosophy.

Integrated Science curriculum should be founded on a carefully thought-out philosophy of education (and should be clearly connected to an institution's mission statement).

2. Clear purposes and goals.

A curricular mission statement and written curricular goals (intended student development outcomes or intended results) articulate curricular purpose – what learners should know and be able to do and those attitudes and values the society believes are appropriate to well-educated men and women. These goals and their objectives are specified in considerable detail and in behavioural language that will permit assessment of their degree of achievement (the curriculum's actual outcomes).

3. A theoretically sound process.

Student activities are chosen that are capable of developing the desired outcomes, as indicated by empirical research. Curriculum has its desired effect primarily through instruction. Therefore, the choice of learning experiences and the specific quality and efficacy of these experiences in producing the stated intended outcomes for all students is fundamental to the quality of Integrated Science curriculum. Current empirically based education theory is essential to effective instruction and thus the improvement of curricular quality. For example, there is little evidence that using traditional lectures will develop in students the higher-order cognitive abilities a faculty may value. Nevertheless, lecturing is still, by far, the predominant method of instruction in most schools/institutions today.

3. A rational sequence.

Educational activities are carefully ordered in a developmental sequence to form a coherent curriculum based on the stated intended outcomes of both the curriculum and its constituent courses.

4. Continuous assessment and improvement of quality.

Valid and reliable assessment is pre-planned to monitor on a continuing basis the effectiveness of the curriculum in fostering student development and also the actual achievement of defined institutional and curricular outcome goals.

5. High-quality academic advising.

An effective curriculum – one that produces the results it claims in all of diverse students – depends for its success upon a high-quality program of academic advising. Modern academic advising is developmental, starting with each student's values and goals, and helps all students design curricular and non-curricular experiences that can help them achieve their own goals and the institution's intended learning outcomes.

3.2 PREREQUISITES FOR DESIGNING AN INTEGRATED SCIENCE CURRICULUM

The prerequisites for designing an Integrated Science Curriculum are as stated below.

A. *Being clear about purpose and desired results: Mission statements, goals, and objectives*

1. Is the curriculum consistent with, and does it naturally flows from the institution's or unit's mission statement?

2. What assumptions have been made about entering students' developmental levels, knowledge, skills, and affective characteristics – all important inputs for the curriculum and each course? Have entering students been carefully assessed to ensure these assumptions are correct?

3. Does the curriculum have a formal set of intended learning outcomes that articulate the knowledge, skills, attitudes, and values it proposes to introduce or reinforce and that every student should have achieved upon graduation?

4. Are these intended outcomes written in specific language that is understandable in the same way to students, faculty members, and all other users?

5. Are the intended outcomes stated in terms of effective goals and objectives that permit assessment of students' success in achieving them?

6. When identifying and developing these intended outcomes, was there appropriate input from all concerned stakeholders, depending on the type of curriculum, such as faculty members, professionals in various fields, employers, and alumni?

7. Have agreed-upon intended learning outcomes been identified for each of the major areas within the curriculum – for the humanities, natural and social sciences, and fine arts within general education or for a major field curriculum within the disciplines?

8. Does each course have a set of clearly stated intended outcomes derived from the intended outcomes of the curriculum?

9. Do these outcome goals and objectives prominently include higher-order cognitive and other complex behaviours as appropriate?

10. Will achieving each course's intended outcomes materially contribute to learners achieving the outcomes of the curriculum in a deliberate and predetermined way?

11. When the intended outcomes of all the curriculum's courses are considered together, will every student have ample opportunity to achieve each of the specific intended outcomes of the curriculum itself?

12. For a major field in which certification or accreditation exists, are all of the outcome goals and objectives required for certification built into the curriculum's intended outcomes; or if requirements are stated in terms of courses, are all of these courses part of the curriculum?

13. Is the curriculum carefully sequenced such that the learning outcomes of prerequisite courses provide all required inputs for successive courses?

B. *Monitoring program quality: Knowing and improving actual results*

1. Is there an assessment plan that can ensure graduates of the program have the knowledge, skills, attitudes, and values described as intended outcomes of the curriculum?

2. Is the curricular program being assessed as a whole and not merely by assessment of the intended outcomes of each of its individual courses?
3. Are diverse methods of assessment being used as appropriate for each type of learning engaged in and outcome desired?
4. Is there a close alignment between the intended outcomes of each course and the ways in which students are assessed in the course? Are a variety of assessment techniques being used?
5. Are intended outcomes being measured directly in both curriculum and courses – as opposed to surveying students' opinions about their learning – to reveal clearly what graduates know and can do, including their important affective qualities?
6. Are the findings of assessment made public and effectively communicated, as appropriate, to all interested stakeholders in a timely manner and in language they can understand?

C. *The education process: Producing learning*

1. Are the educational processes employed to help students learn in each course or activity fully consistent with research on learning and student development and thus appropriate for reaching both the course's or activity's specified outcomes and those of the curriculum?
2. Has the curriculum been designed such that each student has the sustained opportunity to apply to important issues, situations, and problems the knowledge, skills, attitudes, and values that have been identified as intended outcomes?
3. What percentage of class time do students spend passively listening to traditional lectures?
4. Are students consistently actively involved in learning, not only in their courses but also through such methods as participating in internships, practical, and work-study and study-abroad programs?
5. Do students understand the purpose, structure, and processes of the curriculum, their responsibilities for learning, and how their progress will be assessed? Is each student helped to understand these things at the beginning of the curriculum and throughout every course?
6. Is the formal academic curriculum specifically linked to non-course-based opportunities for learning on campus such as orientation, developmental academic advising, the co-curriculum, residence life, and employment?

Other important considerations

1. Are the students completing the curriculum in a timely manner? If not, specifically why not?
2. Is the program attracting an adequate number of students to support accomplishment of the institution's or unit's mission and to make it cost-efficient? If not, specifically why not?
3. Are students completing the program and each of its topics at a high rate? If not, specifically why not?
4. Do the dropout or failure rates in the curriculum as a whole and in each of its courses indicate a problem and, if so, has the problem been identified and is it being appropriately addressed?
5. Do graduates find appropriate employment in their major fields after graduation? If not, specifically why not?

3.3 DEFINING CURRICULAR OUTCOMES

Specifically, curricular outcome goals and objectives help to:

1. Provide the solid foundation of intended outcomes.

2. Provide specific direction for the continuous monitoring, assessment and evaluation of the actual outcomes the curriculum produces.

3. Reduce the potential for untoward teaching to the test – the corruption of the curriculum by instruction directed toward chosen assessment indicators; rather, both the instruction and the indicators are aimed at the outcomes previously defined.

4. Provide firm, clearly identified outcome standards and by requiring the educational process to change in response to altered student needs.

5. Guard against grade inflation and the consequent reduction in student, and perhaps faculty, quality of effort and the devaluation of degrees.

6. Enable to resist academic drift, where a college or program with one mission or curricular purpose gradually and unconsciously drifts away to some other purpose or purposes.

7. Enable to deal more straightforwardly and rationally with conflict over curricular content, such as disputes related to departmental turf.

8. Help everyone involved–Teachers, students, administrators, trustees, parents, legislators–understand the institution or program and the results it claims to produce.

9. Increase the perception of institutional openness, candour, and integrity among all of the institution's customers and stakeholders.

Exercise

State the principles for designing Integrated Science curriculum.

List some prerequisites for designing Integrated Science curriculum.

Mention reasons for defining curricular outcomes.

4.0 CONCLUSION

Principles and prerequisites for designing Integrated Science curriculum are very paramount to achieving curriculum design success. Also, clearly defined intended curricular outcomes helps to understand, communicate about, and control – manage – learning through the curriculum more effectively. Today, clearly stated, written outcomes are essential to good Integrated Science curriculum design, implementation, and assessment.

5.0 SUMMARY

This unit has presented:

1 Principles for designing Integrated Science curriculum

2 Prerequisites for designing Integrated Science curriculum

3 Reasons for having good curricular outcome goals and objectives

6.0 TUTOR MARKED ASSIGNMENT

Highlight principles and prerequisites for designing an Integrated Science curriculum. Suggest reasons for defining clearly curricular outcomes

7.0 REFERENCES / FURTHER READINGS

Diamond, Robert M. 1998. Designing and Assessing Courses and Curricula: A Practical Guide. San Francisco: Jossey-Bass. [321 pp.]
http://www.thenationalacademy.org/readings/designing.html

Unit 5

MAKING HEADWAY IN INTEGRATED SCIENCE CURRICULUM DESIGN AND CONSTRAINTS

CONTENTS

1.0 INTRODUCTION

To make headway in curriculum design, however, it is necessary to concentrate intensely on the issue of learning goals, identifying those that are credible and usable. To do this properly requires dealing with difficult questions involving what may be termed:

- Investment (what does it cost in time and other resources to come up with a coherent set of learning goals?)
- Rationale (what is the basis for particular sets of goals?)
- Specificity (how detailed do the goals have to be?)
- Feasibility (what will students be able to learn?).

Wrestling with these questions is worth the time it takes because it will help everyone involved focus on fundamental issues at the very beginning of the effort and maybe even save time in the long run.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

Discuss factors to consider in making headway in Integrated Science curriculum design

Itemize Constraints to Curriculum Design

3.0 MAIN BODY

3.1 MAKING HEADWAY IN INTEGRATED SCIENCE CURRICULUM DESIGN

1 Investment

A decade of experience has shown that the meticulous specification of valid learning goals is far different from and vastly more difficult than merely creating one more list of topics to be studied. These observations are not meant to discourage schools from specifying what they want a new curriculum to accomplish. Trying to design or redesign a curriculum without clarifying one's goals is folly, for it leaves a school without a clear basis for making design decisions. The familiarity with goals that comes from clarifying each one of them is a significant advantage when the time comes to choose. Let us now consider fundamental questions asked by Tyler:

- What educational purposes should the school seek to attain?
- What educational experiences are likely to attain these purposes?
- How can these educational experiences be effectively organized?
- How can we assess whether these purposes are being attained?

According to Tyler, purposes should be derived from the needs and interests of learners, features of contemporary life (outside the school), and what subject disciplines have to offer (to students outside of specialties). This overly large set of possible purposes so derived would then be screened by philosophy of education and psychology of learning. Philosophy would settle questions such as what values are essential to a satisfying and effective life, whether there should be a different education for "different classes of society," and whether efforts should be aimed at the general education of the citizen or at specific vocational preparation. Psychology would settle questions about whether something could be learned at all, at what age it might best be learned, how long it might take, what multiple purposes might be served by the same learning experiences, and how emphasizing relationships among purposes might lend greater coherence to learning.

Although some curriculum theorists since Tyler have doubted that goals are a good place to begin (or even that they are helpful), their objections seem to be

based largely on the difficulty of the task. Mechanical use of unstudied goals, however good they are, will be unlikely to produce good curriculum. Designs for Science focuses chiefly on the organization of the curriculum, assuming that appropriate educational purposes, experiences, and assessment are in place.

Curriculum materials or assessments and local adaptation of particular goals are more successful when their intent is clear. Moreover, the sense of ownership that develops from the effort to define goals may have important motivational benefits in the hard work that will follow.

Clarification, however, does not require starting from scratch. The popular precept that "all stakeholders should have a hand in setting goals" sometimes is interpreted to mean that goals should actually be formulated locally. But in truth, most schools simply lack the time and financial resources to do a credible job of creating goals on their own, whereas national groups—and to a lesser degree, state groups—have both. Limited local resources are better employed in modifying already credible sets of goals than in trying to do the work all over again. School curriculum designers should therefore draw heavily on the work done by national and state groups, and even consider adopting such recommendations in their entirety. The design team should study the recommendations of those groups carefully, making sure they understand the recommendations and the premises underlying them. Then the team can decide whether to adopt them as they are, adopt them with modifications, or do the job themselves. But they should keep in mind that the credibility of a set of goals rests in some large measure on the perceived competence of those who formulated them and on the care that went into their formulation.

2 Rationale

Whether goals are created locally or drawn from external sources, their credibility depends partly on the rationale offered for the entire set of goals. For example, the rationale used in arriving at the learning goals recommended in Science for All Americans was that meeting those goals would benefit graduates by:

- Improving their long-term employment prospects, along with the quality of the nation's workforce, and providing a base for some students to go on to specialize in science, mathematics, or technology or in related fields.
- Assisting them in making personal, social, and political decisions.
- Acquainting them with ideas that are so significant in the history of ideas or so pervasive in our culture as to be necessary for understanding that history and culture.
- Enabling them to ponder the enduring questions of human existence, such as life and death, perception and reality, individual good versus the collective welfare, certainty and doubt.

- Enhancing the experiences of their student years, a time in life that is important in its own right.

Of course, that is not the only possible rationale for the selection of learning goals. Often, only economic or civic purposes are emphasized. And sometimes educators include such purposes as helping students to score well on crucial examinations, secure employment, or qualify for admission to college; fostering general study habits that have lifelong value; or producing graduates with the knowledge and skills that educated adults have had in the past. Some goals may focus not on long-term ends but on short-term means such as lowering the dropout rate or improving the image of the community.

Whatever there is to be said for each of these, the only point here is that the rationale for curriculum learning goals ought to consist of a statement of purposes to be served. Establishing a clear rationale fosters a more thoughtful process of goal selection than arguing each proposed goal ad hoc. First, it requires a discussion of how, in principle, goals will be decided. Second, it limits the kinds of arguments that can be made in behalf of a particular goal. Even so, there is not a strict deductive logic linking a proposed goal to one or more rationale statements. Rather, requiring that justification be referenced to an explicit rationale promotes healthful debate by requiring curriculum designers to defend a claim for adopting a particular goal by completing "Everyone should learn this because..." using certain kinds of arguments and not others.

3 Specificity

Expressing curriculum goals in terms of what is to be learned turns out not to be as simple as one might expect. Leaving aside the matter of how to go about deciding on curriculum goals, there is the question of what kind of language to use in characterizing the knowledge and skills that are intended to be acquired, and there is also the question of how specific to be in stating those goals. The greater the grade span of the curriculum, the more difficult it becomes to answer these questions, since the language and specificity appropriate to one level may not be suitable for another. Learning goals can be expressed at many different levels, ranging from very general propositions to very specific ones.

Most everyone concerned with curriculum believes that students learn too little science. (Some educators would claim that students know even less than we think they do.) One approach to solving the problem is to set expectations for student learning higher and higher, in the hope that they will inspire or coerce teachers and students toward higher achievement. Often, this high-expectations approach not only applies to eventual achievement, but also involves pushing expectations to lower and lower grade levels. (For example, third graders may be assigned to study atoms, which are three years before the age when, according to extensive research on learning, children are first able to understand anything important about atoms.)

A different response to lack of student learning is to reduce the shallowness and confusion of an already unlearnably overstuffed curriculum, to make time for better learning of the most important facts, principles, and applications. To the higher-expectations proponents, this approach is “watering down” or “dumbing down” the curriculum. To the better-understanding advocates, the higher-expectations advocates are “elitists” who care mostly about preparing future scientists rather than making sure that all students achieve basic science literacy.

Although often overshadowed by partisan philosophical convictions, the debate requires some underlying facts. What are students currently learning in science? What could they learn under the best conditions? To what extent do expectations that are over students’ heads motivate them to learn more than they would otherwise? To what extent will unreachably high demands breed confusion, withdrawal, and learning less than before? Better knowledge about these issues would help to locate the best trade-off between quantity and quality, to maximize student motivation and minimize confusion. It would be helpful if advocates of both approaches could cooperate on seeking empirical answers to these questions.

4 Feasibility

No matter what resource, rationale, or format is used to solicit suggestions for curriculum goals; it is unlikely that all the goals suggested should be adopted. Almost certainly, there will be too many goals for students to achieve, especially if the main purpose is to design a basic core to be achieved by all students. Priorities must be set by considering what is feasible in the time available for teaching. There is little to be gained, and much to be lost, by expecting more of students than they can possibly learn. A few may be stretched to greater learning, but more will likely just give up or learn to complete assignments mechanically without understanding (or even expecting to understand). But the feasibility line can hardly be set just at levels known to be safely low, for expecting too little will inevitably result in too little learning. On what basis can learning goals are identified that makes sense developmentally as well as conceptually? Teachers and cognitive researchers are the two main sources of pertinent knowledge.

The single most important source of knowledge on student learning comes from thoughtful teachers. They have firsthand experience in helping students acquire science, mathematics, and technology knowledge and skills. Their input is limited, however, by the realities of the usual teaching situation. Teachers have little time to conduct careful assessments of student learning; lack instruments for assessing richly connected learning and higher-order thinking skills, and rarely have opportunities to compare their experiences with others who teach the same concepts and skills.

3.2 CONSTRAINTS TO CURRICULUM DESIGN

The other side of setting curriculum-design specifications is identifying the constraints placed on what the design can be like. These constraints are:

1. Lack of Sufficient Time for Instruction

2. Discomfort with Certain Topics

3. State policies

4. State and federal legislation

5 Court orders

6. Cost

7. Lack of suitable instructional materials

8. Standardized tests inadequately aligned to learning goals

9. College admission requirements

10. Union contracts

11. Longstanding traditions

12. The limitation of not knowing enough about student learning—what students can and cannot learn under various circumstances.

Exercise

Discuss factors to consider in making headway in Integrated Science curriculum design

What are the Constraints to Curriculum Design?

4.0 CONCLUSION

There are always constraints on design. They may take the form of what will not be permitted and what conditions must be taken into account. As with goals, constraints need to be made explicit if they are to influence curriculum design.

5.0 SUMMARY

Presented in this unit are:

1 Making headway in integrated science curriculum design

2 Constraints to Curriculum Design

6.0 TUTOR MARKED ASSIGNMENT

List and discuss at least five constraints to Integrated Science curriculum design

7.0 REFERENCES / FURTHER READINGS

Diamond, Robert M. (1998). *Designing and Assessing Courses and Curricula: A Practical Guide*. San Francisco: Jossey-Bass. [321 pp.]

Stark, J. S., and L. R. Lattuca. (1997). *Shaping the College Curriculum:*

Academic Plans in Action. Needham Heights, Mass.: Allyn and Bacon. [460 pp.]

See also: Curriculum Review.
http://www.thenationalacademy.org/readings/curriculum.html

http://www.project2061.org/publications/designs/online/pdfs/designs/chapter1.pdf

Unit 6

ELEMENTS OF A GOOD INTEGRATED SCIENCE CURRICULUM AND INTEGRATED SCIENCE CURRICULUM SAMPLE UNIT

CONTENTS

1.0 INTRODUCTION

The term curriculum design connotes a written document or plan of action (Dada, 1999). What should be the essential component parts of this design? A search in the literature does not yield any assurance of the exact contents of a curriculum design. Perhaps one should say that what a curriculum design contains would depend on our definition of the curriculum. Taba says for instance:

Curriculum design is a statement which identifies the elements of a curriculum, states what their relationships are to each other and indicates the principles of organization and the requirements of that organization for the administrative condition under which it is to operate.

As we have seen, for some authors, curriculum involves all that happens in school for which the school is responsible, which would embrace a programme of studies, a programme of activities and a programme of guidance. For others, it consists of just a collection of learning outcomes, while others see it as a programme of learning experiences. Some people regard instruction strictly as part of implementation.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

Identify the major elements of Integrated Science curriculum design

Differentiate between aims and objectives

Discuss classes of objectives

List criteria for the selection of learning experiences

Design a sample of Integrated Science curriculum

3.0 MAIN BODY

3.1 ELEMENTS OF A GOOD INTEGRATED SCIENCE CURRICULUM

The term curriculum design connotes a written document or plan of action (Dada, 1999). What should be the essential / component parts of this design? A search in the literature does not yield any assurance of the exact contents of a curriculum design. Perhaps one should say that what a curriculum design contains would depend on our definition of the curriculum, for Taba says for instance:

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There is some agreement however among certain others among who are Wheeler, Nichols and Nichols, and Taba to include the following components:

1 Objectives

2 Content

3 Learning experiences, and

4 Evaluation.

Where disagreement sets in is in the kind of relationship that should exist among the various elements. There is also controversy about the culture content with respect to how it should be presented. Some people believe in organizing centres e.g organizing the curriculum around the objectives or the content or the learning experiences.

Conscious of the amount of controversy that exists in the field of curriculum, specialists have suggested the need to have an adequate theory upon which curriculum designs will be based. Such a theory will include an adequate definition of terms like curriculum, evaluation, aims and objectives, learning experiences etc. it will include the elements of a curriculum and will indicate how each of these elements relates to the others, the criteria and sources of decision making with respect to each element and stage in planning, and how the curriculum process should be elevated and reviewed for the purpose of modification, change or innovation. J.F Kerr has proposed one such model for a curriculum theory. The model is further expatiated by Dada (1999).

This model indicates the essential elements of a curriculum design viz: Aims and objectives, content (knowledge), learning experiences and evaluation. It also indicates the kind of relationship that should exist among the elements.

Evaluation is related to objectives in two directional manners. Information at the pre-design level, obtained from a situation analysis (a form of evaluation) is used in deciding the kinds of objectives to formulate. The information will be in respect of learner needs and characteristics, societal needs and requirements from the disciplines. On the other hand, objectives are related to evaluation in that the latter is to be used to ascertain the extent to which the objectives are attained. This two way relationship exists between any two of the elements. For another example, knowledge is related to learning experiences because; sometimes the content might determine the kinds of activities to provide in the classroom in order to bring about the required type of learning in the cognitive domain. On the other hand, we might want to develop certain kinds of behaviour in learners, e.g. expressing one’s opinions and supporting such opinions. In this case, the content areas are used as instruments to develop the required behaviour.

The model also indicates the sources from which we can derive each element and the criteria to be used in taking decisions with respect to each element. Furthermore, the model does not indicate any particular starting point in the design; neither is there an end point. Wherever one starts, there will be need to refer back and forth to the other areas in other to establish logical relationships among the elements. For instance, if we formulate one objective making use of our sources, then we need to look for the appropriate content that will help in achieving this objective. In this same way, we have to consider the nature of learning experiences that would lead to terminal behaviour stated in the objective. At the same time, we need to design appropriate evaluation instruments that will

help us ascertain the objectives are attained. The new programme in the 6-3-3-4 system has included in them all the essential elements:

- Objectives
- Content
- Pupil activities (also, teacher activities)
- Evaluation and
- Materials to be used in executing the programme

3.2 INTRODUCTION TO AIMS AND OBJECTIVES

Aims refer to the broad statement of purpose and intention. In education it helps to guide educational activities to its long term ends. However, before the aims can be achieved there would be the need to break them down to short-term ends. These short term ends are referred to as objectives.

A lot of confusion exists in literature about the terms aims, objectives and goals. It should be noted that aims and goals are more or less synonyms referring to long term ends. Objectives as stated earlier are short term ends.

Generally however, aims are stated in terms of what the educational system intends to achieve with respect to the learner while objectives indicate what the learner would achieve.

The National Policy on Education (2004) states the aims of our educational system as:

i. the inculcation of national consciousness and national unity.
ii. the inculcation of the right type of values and attitudes for the survival of the individual and the Nigerian Society.
iii. The training of the mind in the understanding of the world around and
iv. The acquisition of appropriate skills abilities and competencies both mental and physical as equipment for the individual to live and contribute to the development of his society.

In respect of primary school level, the aims are specifically stated as follows:

i. The inculcation of permanent literacy and numeracy and the ability to communicate effectively.
ii. The laying of a sound basis for scientific and reflective thinking.
iii. Citizenship education as a basis for effective participation in and contribution to the life of the society.
iv. Character and moral training and the development of sound attitudes.
v. Developing in the child the ability to adapt to his changing environment.
vi. Giving the child the opportunities for developing manipulative skills that will enable him to function effectively in the society within the limits of his capacity.
vii. Providing basic tools for further educational advancement including preparation for trades and crafts of the locality.

3.3 SOURCES OF AIMS AND OBJECTIVES

The main sources of aims and objectives are:

i. The learner – Aims and Objectives should be formulated based on the needs of the learner to ensure the development of his physical, mental and emotional potentials.

ii. The society – Aims and Objectives can also be derived through the study of the nature of the society. In the national policy, the need for the learner to develop a sense of togetherness as a nation in spite of our ethnic and religious differences informed the inclusion of the development of national consciousness and national unity.

iii. The subject matter – Objectives are also derived from available learning experiences within subject area. In fact, most teachers concentrate their objectives on "learning" the subject matter. It is however important that teachers should incorporate and utilize all the three sources to arrive at their objectives.

3.4 CLASSES OF OBJECTIVES

Objectives can be classified according to the kinds of learning that they lead to. Bloom (1956) and his associate referred to these classes as Taxonomies of objectives. They are placed into three domains – cognitive, affective and psychomotor.

i. Cognitive domain – It is the domain of intellectual development involving reasoning, understanding, memory etc. six levels of cognition have been identified and include knowledge, comprehension, application, analysis, synthesis and evaluation starting from the simple to the complex.

ii. Affective domain – It is the domain of interest, attitude, feelings, appreciation etc. It could be in five levels: receiving, responding, valuing, organization of values and characterizing values when arranged from the lowest to the highest.

iii. Psychomotor domain: This domain is reflected in five levels of human activity, namely: physical movement, showing conceptual ability of the human senses, showing abilities related to physical actions such as strength, endurance, dexterity etc. making skilled movements in games, sports and art and lastly communicating non-verbally.

3.5 CONTENT

The content or subject matter is usually organized in disciplines. Each discipline has its own structure built up over the years by experts in that area. It consists of what is known and believed in various disciplines. The choice of content is a dynamic one because of knowledge explosion and the fact that it is rapidly changing as the society itself changes. It is therefore imperative that certain criteria must be established for the inclusion of some areas of learning and exclusion of others.

Criteria for Selection of Content

i. Significant of the content: Only important aspects of content that would contribute significantly to the body of knowledge and thinking process are selected. Trivial issues are left out.
ii. Balance between scope and depth: Attempt is often made to ensure a balance between coverage of wide area and in-depth study of specific areas.
iii. Appropriates of the Content to the needs and interests of the learner.
iv. Relevance of topics to the needs of the society.
v. The contents should be such that the learner can learn i.e they should not be too difficult for the learner.

3.6 LEARNING EXPERIENCES

These refer to the various activities learner engage in which brings about the desired learning or change. The changes could be mental, physical and behavioural.

Criteria for Selection of Learning Experiences

i. Nature of subject matter – The nature of Agricultural Science is different from that of History. Ditto other subjects. The activities that are relevant to the subject matters would also be different.

ii. Nature of learning – While some learning activities require only memorization, others may require understanding and analysis.

iii. Nature of learners – It is easier for some learners to understand simple information but others require stress and emphasis.

iv. Nature of interest and capabilities of teacher – Learning experiences to be selected should be those that an average teacher in that area would be able to handle, otherwise he would attempt to avoid it.

v. Nature of the objectives – The intended objectives could also be selection of learning experiences. For instance, some objectives may include ability to solve some practical problems and this will require solving the problems together in the class.

vi. Available learning resources – The instructional materials available to the teacher and learner will directly influence the selection of learning activities.

3.7 INTEGRATED SCIENCE CURRICULUM SAMPLE UNIT

Let us try to see a sample unit of Integrated Science Curriculum for JSS III.

CONTENT	OBJECTIVES	LEARNING ACTIVITIES	MATERIALS	EVALUATION
Light Energy -Reflection -Refraction -Vision -Dispersion and Rainbow	Explain the meaning of reflection and refraction. Illustrate apparent depth and explain its danger to swimmers. Describe how we see things. Explain the meaning of dispersion and use it to interpret rainbow.	Allowing light from the sun to strike the surface of plane mirror (made available to the learners) and reporting observation. Putting a straight stick half in water and stating observation. Observing the coin and use it to recognize apparent depth. Identifying parts of the eye and relate	Mirror or reflecting surface of a metallic sheet. Water, beaker, straight stick. Coin. Chart or model of the eye. Source of light. Prism.	Explain refraction and reflection. Describe apparent depth and state one danger of apparent depth to amateur swimmers. Explain how we see objects. Explain the meaning of dispersion and describe how rainbow is formed. Name three important parts of the eye.

		vision to refraction. Observing colours of light separated by prism and interpreting rainbow as raindrops causing dispersion.		

Exercise

1 What are the elements (components) of a good Integrated Science curriculum design?

2 Differentiate between aims and objectives

3 Discuss classes of objectives

4 List criteria for the selection of learning experiences

4.0 CONCLUSION

A good curriculum is a product of well formulated objectives, carefully selected learning experiences, relevant learning resources and workable evaluation procedures.

5.0 SUMMARY

In this unit, you have learnt:

1 Elements of a Good Integrated Science Curriculum

2 Introduction to Aims and Objectives

3 Sources of Aims and Objectives

4 Classes of Objectives

5 Content

6 Learning Experiences

7 Integrated Science Curriculum Sample Unit

6.0 TUTOR MARKED ASSIGNMENT

Select five topics in Integrated Science for JSS 1 students. Prepare a sample of curriculum for this target population

7.0 REFERENCES / FURTHER READINGS

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MODULE 2: INPUTS IN INTEGRATED SCIENCE CURRICULUM DESIGN AND DEVELOPMENT

Unit 1

MEANING, SCHOOLS OF THOUGHT AND STEPS IN CURRICULUM DEVELOPMENT

CONTENTS

1.0 INTRODUCTION

This unit presents fundamental issues around which a good curriculum can be developed. As you carefully read through, curriculum development should no longer be a problem of concern.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

Explain curriculum development

Discuss the various views of schools of thought on curriculum development

List Steps in Integrated Science curriculum development

Discuss rationale for curriculum development

State factors to consider in curriculum development

3.0 MAIN BODY

3.1 WHAT IS CURRICULUM DEVELOPMENT?

When a planned curriculum has been used for a reasonable period of time and all the phases are continually implemented, there is the likelihood for a need to revise such curriculum. Curriculum development, therefore, means a revision of an existing curriculum for the purpose of making necessary adjustment in all aspects of the school curriculum to meet the demands of changing times, that is, making regular review of the objectives, the content, the instructional and evaluation strategies to ensure that each aspect continues to meet the need of the individual learners and the need of the society as a whole (Adelodun, 1998). It is a process of improving the curriculum.

Curriculum development refers to changes and improvements made to the overall plan of studies that a school or school-system is making use of in its education of students. It is the process of selecting, organizing, executing, and evaluating learning experiences on the basis of the needs, abilities and interests of the learners and the nature of the society or community. Development might take place in respect to texts read, the lesson-plans used, and in many other ways.

3.2 SCHOOLS OF THOUGHT ON CURRICULUM DEVELOPMENT

From the history of curriculum development, two schools of thought are predominated (Pasigui, 2012). They are: The Essentialist School and The Progressive School.

The Essentialist School:

- It considers the curriculum as something rigid consisting of discipline subjects.
- It considers all learners as much as the same and it aims to fit the learner into the existing social order and thereby maintain the status quo
- Its major motivation is discipline and considers freedom as an outcome and not a means of education.
- Its approach is authoritative and the teacher's role is to assign lessons and to recite recitations.
- It is book-centred and the methods recommended are memory work, mastery of facts and skills, and development of abstract intelligence.
- It has no interest in social action and life activities.
- Its measurement of outcomes is standard tests based on subject matter mastery.

The Essentialists School view curriculum as:

- Body of subjects or subject matter prepared by the teachers for the students to learn.

- Synonymous to “course study”.
- “Permanent studies” where the rule of grammar, reading, rhetoric, logic and mathematics for basic education emphasized.
- Most of the traditional ideas view curriculum as written documents or plan of action in accomplishing goals.

The Progressive School

- It conceives of the curriculum as something flexible based on areas of interest.
- It is learner-centred, having in mind that no two persons are alike.
- Its factor of motivation is individual achievement believing that persons are naturally good.
- The Role of the teacher is to stimulate direct learning process.
- It uses a life experience approach to fit the student for future social life.
- Constant revision of aims and experimental techniques of teaching and learning are imperatives in curriculum development in order to create independent thinking, initiative, self-reliance, individuality, self-expression and activity in the learner.
- Its measurement of outcomes is now devices taking into consideration subject matter and personality values.
  Progressive Points of View of Curriculum
- Listing of subjects, syllabi, course of study and list of courses or specific discipline can only be called curriculum if these written materials are actualized by the learner.
- Total learning experiences of the individual.
- All experiences children have under the guidance of teachers.

3.3 STEPS IN INTEGRATED SCIENCE CURRICULUM DEVELOPMENT

a) Organisation of workshops, seminars etc, for teachers and officials who will interpret the programme and try it out on a small scale to determine its workability.
b) Production of materials e.g. Textbooks, visual aids, etc.
c) Try-out stage where the new curriculum and materials are tried out in a few schools for instance in order to appraise their potentialities and suitability.
d) Monitoring process (and concurrent with the try-out) during which all aspects of the programme are evaluated.
e) Revision in light of field experience in c and d.
f) Training of teachers at a wider level, i.e. before implementation

3.4 RATIONALE FOR CURRICULUM DEVELOPMENT

i) When a curriculum is not achieving what it is expected to achieve. Such a curriculum might be said to become ineffective.

ii) When conditions for which a curriculum was established have changed considerably, there is need for development. For instance, during the colonial period, Nigerians were needed only as low level manpower in offices, churches, commercial houses etc. and the curriculum was designed to cater for this need. At independence, conditions changed and there were now needs in society. The old curriculum was no more adequate to deal with the new situation.

iii) When there is a change in the kind of the learners for whom a curriculum is designed. For, example, a curriculum that was designed for primary one pupil may have to be altered to suit beginning adult functional literacy classes. In the same manner, a curriculum successfully used in an urban centre may have to be changed to suit rural communities.

iv) When there is a change in the kinds of materials used in implementing the curriculum. For instance, the introduction of a new Integrated Science textbook may necessitate a new curriculum with altered objectives and approaches.

v) When there is a change in educational thinking. For instance, the new 6-3-3-4 education system came into being as a result of a re-thinking process whereby emphasis is placed on utilitarian values of Education especially in the areas of technology.

vi) When there is a crisis e.g. if a programme consistently produces mass failure

3.5 FACTORS TO CONSIDER IN CURRICULUM DEVELOPMENT

a) Cultural and social changes and expectations including parental expectations, employer requirements, community assumption and value, changing relationships (e.g. between adults and children) and ideology.

b) Educational system requirements and challenges, e.g. policy statements, examinations, local authority expirations or demands or pressures, curriculum projects, education research.

c) The Changing nature of the subject matter to be taught.

d) The potential contribution of teacher-support system, e.g. teacher training college, research institutes.

e) Flow of resources into the school.

f) Pupils: aptitudes, abilities and defined education needs.

g) Teachers: value, attitudes, skills knowledge, experience, social strengths and weaknesses, roles.

h) School ethos and political structure: Common assumptions and expectations including power conformity to norms and dealing with deviance.

i) Material resources including plant, equipment, and potential for enhancing these.

j) Perceived and felt problems and shortcomings in existing curriculum.

Exercise

Explain curriculum development

Discuss the various views of schools of thought on curriculum development

List Steps in Integrated Science curriculum development

Discuss rationale for curriculum development

State factors to consider in curriculum development

4.0 CONCLUSION

The dynamic nature of curriculum phases will normally lead to a revision to include innovations or remove redundancy thereby creating a change in the existing curriculum.

5.0 SUMMARY

In this unit, you have learnt:

1 The meaning of curriculum development

2 The various views of schools of thought on curriculum development

3 Steps in Integrated Science curriculum development

4 Rationale for (reasons for) curriculum development

5 Factors to consider in curriculum development

6.0 TUTOR MARKED ASSIGNMENT

In your own word, what is curriculum development? State at least five rationales for curriculum development.

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Unit 2

CURRICULUM DEVELOPMENT AGENCIES IN NIGERIA

CONTENTS

1.0 INTRODUCTION

Nigeria, like many other nations of the world has realized the need for constant modifications or change in teaching theories, principles, materials and methods. This is because Nigeria has always been concerned with the qualitative expectation of the country's educational provisions. Nigeria has been trying to gear towards ensuring.

i. Social equity
ii. Development of the internal and external efficiencies of the school system.
iii. Relevance of education to national needs.
iv. Building national capacity for management and research in education.

To facilitate the implementation of the above, the government needs to set up special bodies that will be charged with the responsibility of working towards the attainment of the above national development ideals. So, in this unit, you will learn about such special bodies, functions and activities.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

Define curriculum development agency?

Give examples of curriculum development agencies in Nigeria

State functions and activities of some curriculum development agencies

3.0 MAIN BODY

3.1 WHAT IS CURRICULUM DEVELOPMENT AGENCY?

Any statutory body or organization charged with the responsibility of monitoring the progress of curriculum for the purpose of making constant modification in teaching theories, principles, materials and methods to meet the changing needs of society is a curriculum development agency.

3.2 curriculum agencies in Nigeria

Some curriculum agencies in Nigeria are:

i. The Nigeria Education Research and Development Council (NERDC).
ii. National Teachers Institute (NTI)
iii. Nigerian Educational Technology Centre (NETC)
iv. National Board for Technical Education (NBTE)
v. National Commission for Colleges of Education (NCCE)

3.3 FUNCTIONS AND ACTIVITIES OF SOME CURRICULUM DEVELOPMENT AGENCIES

1. Nigeria Educational Research and Development Council (NERDC)

The functions and activities of NERDC are:

i) To encourage, promote and co-ordinate educational research programmes carried out in Nigeria.

ii) To identify such educational problems in need of research and to establish the order of priority of the research activities

iii) To encourage research into educational problems and for that purpose to undertake commission, co-operate in and finance such projects as it thinks appropriate.

iv) To compile and publish or sponsor the publication of the result of educational research particularly in relation to Nigerian problems and to

popularize such results where their general recognition is, in the councils' opinion of national importance.

v) To sponsor such national or international educational conferences as may be relevant to its functions under the Decree which establishes it.

vi) To maintain relationship with corresponding educational research bodies in Nigeria and in other countries.

vii) To assemble, maintain, and extend a collection of books and publications (including such publications as may be deposited with the council pursuant to the provisions of this section) and maintain such facilities, including facilities for reading microfilm reading and micro-coping as it considers appropriate for an educational research library of the highest standing and make the library accessible to such categories of persons as it thinks fit and upon such terms and conditions as it considers necessary and

viii) To carry out such other activities as are likely to assist in the performance of the functions imposed on it under the decree.

2 National Teachers Institute (NTI)

Functions of the NTI include:

i) Ensuring the improvement of the quality of professional untrained teachers of all categories teaching in our schools. Particularly upgrading the Sub-Grade Two teachers to Proper Grade Two teachers.

ii) Administration of centrally set papers for Teacher's Grade Two examination.

iii) Adapting and adopting the curriculum guide lines produced by the NERDC for its teacher's grade two examinations.

iv) Developing the syllabuses and other materials for the teachers colleges and primary schools.

NTI major activities are seen in its responsibility of updating by distance – learning techniques of unqualified and under qualified primary school teachers through its Grade Two and NCE part time courses there by providing in service training for all categories of teachers.

3 National Educational Technology Centre, Kaduna.

i) It has the major function as the development of instructional materials for schools.

ii) Its activities include research on teaching learning and offering evaluation services to schools.

iii) It also organizes workshops and seminars on teaching learning aids. It services cut across all levels of educational system.

4 The National Board for Technical Education

i) Ensuring minimum standard for the establishment of Polytechnics and Technical Colleges in Nigeria.

ii) Setting minimum standard for all aspects of the curriculum for polytechnics and technical colleges.

iii) Encouraging the diversity in our post-secondary, technical institutions and yet ensuring minimum standard education and training for the national award.

iv) Establishing a system of accreditation for all programmes offered in polytechnics and similar post secondary technical institutions leading to awards of National Diploma and Higher Diploma.

v) Highlighting the purpose and process of accreditation, the criteria for accreditation programme, composition of visitation team members and details to self study questionnaire which must be completed in respect of each programme by the institution seeking accreditation status for its programme.

On the whole, the activities of the Board revolve around the establishment of validating a system for technical education and training in Nigerian polytechnics and technical colleges.

5 The National Commission for Colleges of Education

The National Commission for Colleges of Education was established to:

i) Lay down minimum standards for all programnes of teacher education.

ii) Accredit the certificates and other academic awards after obtaining there of prior approval of the minister.

iii) Approve guidelines setting out criteria for accreditation of all Colleges of Education in Nigeria.

iv) Harmonise the different standards in all colleges of education since they are producing for the same market.

Exercise

Define curriculum development agency?

Give examples of curriculum development agencies in Nigeria

State functions and activities of the following curriculum development agencies:

i. The Nigeria Education Research and Development Council
ii. National Teachers Institute
iii. Nigerian Educational Technology Centre
iv. National Board for Technical Education
v. National Commission for Colleges of Education

4.0 CONCLUSION

In developing curriculum, inputs come from a variety of sources such as Ministries of Education, special educational organizations, professional organizations and governmental bodies. These agencies have their functions and activities which have been highlighted in this unit.

5.0 SUMMARY

In this unit, you have learnt:

1 what curriculum development agency is

2 Examples of curriculum development agencies in Nigeria

3 Functions and activities of some curriculum development agencies

6.0 TUTOR MARKED ASSIGNMENT

1 Discuss the functions and activities of three curriculum development agencies in Nigeria.

2 write the following abbreviations in full:

i) NERDC
ii) NTI
iii) NETC
iv) NBTE
v) NCCE

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Unit 3

SUBJECT ASSOCIATIONS

CONTENTS

1.0 INTRODUCTION

Since science holds the key to sustainable development, the corollary is that prominence must be given to science education in schools. That is why in recent years attempts have been made to improve the quality of delivery of science, technology and mathematics education (STME). In the pursuit of this goal, several agencies have played notable roles. In many countries, one such agency is the national science teacher association (STA).

What are STAs? Generally, Science Teacher Associations (STAs) are non-political, non-religious and not-for-profit professional organizations whose goal is to improve teacher effectiveness in science, technology, and in some cases, engineering and mathematics. The following is an example: Science Teachers Association of Nigeria (STAN) which was established on 21 June 1957.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

Give examples of subject associations and their functions

Discuss aims and functions of Science Teachers Association of Nigeria

3.0 MAIN BODY

3.1 DIFFERENT SUBJECT (PROFESSIONAL) ASSOCIATIONS AND THEIR FUNCTIONS

Subject associations refer to a group of experts teaching specific subjects in Nigerian schools. Examples of subject association include:

a Science Teachers Association of Nigeria (STAN)

b Social Studies Association of Nigeria (SOSAN)

c Nigeria English Studies Association (NESA)

d Nigeria Association of French Teachers (NAFT)

e Nigeria Geographical Association (NGA)

f Association of Bible Knowledge Teachers of Nigeria

g Mathematics Teachers Association of Nigeria (MAN), etc.

3.2 FUNCTIONS OF SUBJECT ASSOCIATIONS

Outline of the activities of the subject Association include:

i Development of textbook

ii Conduction of research projects

iii Preparation of subject syllabus

iv Organization of seminars and workshops

v Holding regular meetings to discuss the quality of teaching in schools; the best method for teaching various concepts; the root causes of learners and teacher's problems; the attitudes of teachers and learners to new texts and

aids; other conditions necessary for improvement and development of teachers.

3.3 SCIENCE TEACHERS ASSOCIATION OF NIGERIA (STAN)

In fact, in Africa, STAN has tremendous influenced on STM education not only in its country but also in foreign nations. Bajah and Yoloye (1981:27) while evaluating Science Education Programme for Africa had this to say:

A powerful kind of organization that stimulated development in science education in practically all the countries was the association of science teachers. Every one of the countries studied had such an association in one form or another. There were variations in the magnitude of contributions made by these organizations from country to country. Gambia, Liberia and Lesotho report negligible contribution. At the other end, the Ghanaian and Nigerian associations have exerted tremendous influence on the training of science teachers, the curriculum, and educational policies. STAN in Nigeria produced its own books in integrated science for the first two years of secondary schools. Others (Dienye and Gbamanja, 1990; King, 1991) are in general agreement with the above assertion. According to King, the achievement of STAN in the pursuit of quality education in science in Nigeria is a noteworthy record. This is because STAN has produced curriculum materials and support textbooks which have gone a long way towards the development of STM Education.

STAN is administered by three separate, but mutually supportive organs: the Annual General Meeting, The Governing Council, and the National Executive Board. It has fifteen-subject panels: Agricultural Science, Basic Science, Basic Science and Technology, Biology, Chemistry, Environmental Education, Gender and STEM Education, Home Economics, Information and Communications Technology, Mathematics, Physical and Health Education, Physics, Science-Technology-Society, Teacher Education, and Technology Education. There is a branch in each of the nation's 36 States as well as a Federal Capital Territory branch in Abuja, which also hosts the National Headquarters at The STAN Place.

At this time, STAN is the only STA in Africa "with a permanent Secretariat and vehicles, and it's been a leading light in the various attempts to develop an African super-association, its publications, courses and conferences being highly regarded" (Deeson, 1993:1). The African Forum for Children's Literacy in Science and Technology, in the May 1992 edition of its newsletter also describes STAN as a 'successful model'.

STAN, a professional association that has contributed much to curriculum development in Nigeria is here regarded as a curriculum development agency. It is

a very typical and foremost example of such professional association in Nigeria. Today STAN continues to be involved in:

1. Curriculum development projects.

2. Production of Textbooks

By far the greatest and most remarkable innovation in the area of textbook production by STAs in Africa is by the Science Teachers Association of Nigeria (STAN). Following the successful production of an Integrated Science Curriculum by STAN, a panel of authors was constituted to write Integrated Science textbooks for students and teachers. According to STAN (1971b:iv) 'the seminars which preceded the actual writing should be properly recorded and studied as a successful model for achieving an integration of knowledge and methodology.' It is worth noting that the STAN Integrated Science writing team combined the basic requirement for expertise, with broad geographical representation. A two-year course comprising Pupils' Textbooks, Pupils' workbooks (for practical work) Teachers' Guides was produced. First published in 1971, the books have since been revised and restructured into a three – year course comprising Pupils' Textbooks, Pupils' Workbooks and
Teachers' Guides. Between 1971 and 2005, several other titles were also
published by the Association.

Today, textbooks are published by STAN in Agricultural Science, Basic Science, Basic Science and Technology, Biology, Chemistry, Home Economics, Mathematics for Junior Secondary, Mathematics for Senior Secondary, and Physics. Such has been the impact of book writing by one Science Teacher Associations (STA) in Africa. The multiplier effect has indeed been remarkable and other STAs have followed this practice.

Elsewhere, Ivowi (1984) has elaborated on the Prospect from writing projects. According to him, the sale of project materials (textbooks) could result in financial returns as STAN has, for example, been able to raise some revenue through royalties from books to organize conferences, seminars and courses, and sponsor its members to activities of similar professional bodies. Even so, the Association has often found itself in very difficult financial situations as royalties from its titles are sometimes not sufficient for its pressing needs. This is so because the books are sold at moderate prices to ensure 'grassroots' patronage and to achieve the goals of the Association. Innovations in Science and Technology Education through Science Teacher Associations

Textbook production continues to evolve, but STAN has seen the need to go beyond textbooks for students and has embarked on a wider range of publications geared to professional development of teachers and teaching support materials. In so doing STAN recognizes this move has, in part, been due to the success of prior STAN training of textbooks writers over the years who are now engaged as key authors by other publishers. This is a situation in which STAN

takes much pride as it allows the publication of a wider range of 'good' textbook publications from which schools can choose.

3. Organization of In-service Training for Teachers.

In Africa, the organization of in-service training has been one of the major functions of STAs. This is usually done through conferences, workshops, and seminars. These provide avenues for the exchange of information and interaction between designers and implementers of curriculum projects thereby leading to the professional growth of teachers and school administrators. Virtually all STAs in Africa have been involved in teacher training. In Nigeria, STAN has been holding annual conferences at the end of August. Apart from the workshops organized by the 37 branches of the Association, 15 national workshops are conducted each year. STAN spends a substantial percentage of its revenue annually on in-service teacher training.

The major in-service provision by STAN today is undertaken in liaison with partners such as UNESCO and the Federal Ministry of Education. The year 2010 sees the opening of a purpose built STAN building – STAN place – which will be a focal point for STAN teacher in-service programmes and especially for the 15 national workshops conducted each year. The STAN place will also house the STAN secretariat and, being well placed near other educational establishments such as NERDC (Nigerian Educational Research and Development Council), this will enable STAN to cooperate more closely with others in the field of science, technology and mathematics education.

A Aims of Science Teachers Association of Nigeria (STAN)

Aims of Science Teachers Association of Nigeria (STAN) as a professional association has the following aims:

1. To promote co-operation among science teachers in Nigeria with a view to raising the standard of science education in the country.

2. To provide a forum for discussion by science teachers on matters of common interest.

3. To help science teachers keep in touch with developments in science and its applications to industry and commerce.

4. To popularize science.

5. To co-operate with and affiliate to other societies and bodies with related interest.

B Functions of Science Teachers Association of Nigeria (STAN)

The major functions of the Association (Silber as cited in King 1991:47) include the following:

1 Communications – this is done through Journals, conferences, publications.

2 Representation - To teachers and government, liaison with other groups and participation in international activities. Innovations in Science and Technology Education through Science Teacher Associations

3 Services - continuing education, employment, low cost equipment and out-of-school activities.

4 Leadership - Curriculum development, teacher benefit, guidance on new development in science education.

Exercise

Give examples of subject associations. What are the specific functions of these associations?

Discuss aims and functions of Science Teachers Association of Nigeria

4.0 CONCLUSION

Our discussion of the functions and activities of statutory bodies shall not be complete without touching the subject associations. This unit presented a list of subject (professional) associations and specifically discussed the aims and functions of Science Teachers Association of Nigeria (STAN).

5.0 SUMMARY

In this unit, you have learnt:

1 Subject associations and their functions

2 Aims and functions of Science Teachers Association of Nigeria

6.0 TUTOR MARKED ASSIGNMENT

Discuss the contribution of Science Teachers Association of Nigeria to the development of Integrated Science curriculum

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Unit 4

PARTICIPANTS IN CURRICULUM DEVELOPMENT PROCESS

CONTENTS

1.0 INTRODUCTION

What is being practiced as education in a society involves all segments of that society. Take for instance, a planned curriculum is implemented in school. To support the implementation, it is the role of the government to make available all necessary and relevant materials/resources. The teacher translates the curriculum into learning experiences to be passed across to learners. So, in this unit, you will learn the participants in curriculum development process.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

Identify the participants in the development of curriculum.

Explain the role of each participant in the development of curriculum.

3.0 MAIN BODY

3.1 TEACHERS

The teachers occupy a major position in curriculum decision making. It is he who decides what aspects of the curriculum, newly developed or ongoing, to implement or stress in a particular class. The current school organization has to be altered to allow teachers more meaningful participation. Quite a number of teachers are unable to deviate from rigid curriculum-related specifications developed at the national level. Teachers are charged with three major tasks related to curriculum

(a) working and planning with pupils;
(b) Engaging student in individual study; and
(c) Communicating curriculum-related experiences with their colleagues.

Because the teachers' primary role is implementing the curriculum, they need effective participation in those activities that ultimately result in new curricula or curricular materials. Presently, many teachers are not prepared for seen involvement. Teachers' deficiencies in curriculum decision-making result enlarge part because their prior training in colleges of education stresses only methods of teaching, neglecting curriculum as realm for concern. A new role for teachers in relations to curriculum is becoming a member of educational research teams addressing curriculum concerns. Teachers can contribute knowledge about learners and learning processes needed to guide the selection of learning activities and their sequencing. They can assist educational researchers who are searching for optional ways to sequence particular curriculum elements such as contents and materials to meet of the needs of unique student populations.

In many schools, teachers participate in curriculum mostly when implementing the curriculum in their classrooms. The other most common locus of teacher involvement in the curriculum is the curriculum committee, whether standing or ad hoc. Such committees can be organized by grade level such as the primary or secondary curriculum committee or by subject, such as the mathematics curriculum for or history curriculum committee. Often committees are by both subject and grade level, the primary mathematics committee or the teachers involvement will be in ad hoc committee, or in informal group or even in casual dialogue with colleagues. However, for teachers to be contributing members to the curriculum decision-making effort, they require a broadening of their professional backgrounds.

3.2 STUDENTS

Giant strides have occurred regarding student involvement in curriculum decision-making (Hunkins, 1980). Presently, students do not just receive curricula created by the persons in the systems. Students, especially at the secondary and tertiary education levels, are taking an increasingly greater and more meaningful

share of responsibilities for educational programming. Increasing numbers of educators are considering the decision-making by students relating to their programme an essential element of their total learning. Currently, the most common type of student participating in curriculum planning occurs at the classroom level. Usually students assume advisory roles informing teachers as to the interest levels, relevance and usefulness of the curriculum being proposed. Many teachers are inviting student to join in planning various curriculum projects such as field trips and he use of community resources persons. Student can contribute in many ways other than sitting on committee. Students can conduct parent surveys, participate in public relation work, and write position papers on aspects of the curriculum. Today students are much more sophisticated than their counterparts of 15 or 30years ago. Hence, teachers and curriculum specialists must ascertain that students have the ability to gain he necessary skills for meaningful involvement in curriculum matters. Doll (Hunkins, 1980) notes that schools choosing to ignore what learners think and feel are indeed acting nonproductively. Ignoring the clients of the school causes angers and neglects opportunities for making the learning experience optimal for the greatest number of student.

Educators must be certain that the tasks in which they invite students to engage are appropriate for their abilities and experience. While some school will be able to make maximum use of their students' views and expertise, others may only be able to use their students in most general ways such as "what do you think we should focus on this study"?

3.3 CURRICULUM SPECIALIST

There are the major curriculum leaders. The quality of the programme development in school rests largely on the shoulders of these persons. The degree of skill and level of understanding curriculum specialists bring to their jobs are critical factors in determining the total quality of the curriculum. They can facilitate the development of programme responsive to changing student needs specifically and public needs generally. Curriculum specialists armed with knowledge of curriculum history, curriculum development, curriculum theory, curriculum evolution and evaluation will be able to confront the challenges of designing and implementing optimal curriculum. Unruh (1975) notes that the curriculum specialists must be versatile, perceptive, sensitive, patient, and skilled in human relations. Additionally they need competence in decision-making and leadership. In brief, they need to be able to meld scholarship with practical actions. Their roles and responsibilities are the following.

1. Define goals and objectives at various levels of decision-making;
2. Conducting needs analysis utilizing subjective and objective means.
3. Conceptualizing and implementing models for curriculum development.
4. Generating plans, strategies and procedures that encourage people to participate and trust each other in curriculum activities;

5. Synthesizing information from field such as curriculum subject fields, learning theory, media and materials development in order to facilitate the total development process;
6. Involving people of different interests, ages and backgrounds in discussing issue, developing plans and working toward meaningful programme;
7. Coordinating of information networks for the dissemination of information regarding curriculum.
8. Providing opportunities for staff to develop greater understanding and sophistication of the realm of curriculum.

3.4 SCHOOL ADMINISTRATOR

The principal is at the nerve centre of the curriculum activity. This educator is the gatekeeper of the curriculum as well as the crucial administrator in the school system. He or She is in daily contact with teachers and knows their needs and their reactions both positive and negative, to the existing or developing curriculum. He or She is the exemplar o the educator striving to bring to teachers the latest in educational thinking regarding all matter of education including the curriculum. He or She not only sets the stage and provides support for the curriculum element, but in addition serves as the crucial person in assuming that the instruction component of education is viable. The main functions of administrators are:

1. Serving on the curriculum council.
2. Serving on various ad hoc and/or standing committees related to the running of he total school systems;
3. Managing the teachers, determining teachers loads, class schedules and support personnel required for effective implementation and management of curriculums.
4. Keeping abreast of current curriculum trends.
5. Interpreting general school goals to the staff.
6. Coordinating or working with the curriculum director or specialist in planning and carrying out in service related to the curriculum.
7. Serving as a spokesperson to the community recording the essential thrusts of the school’s curriculum.
8. Assume responsibility for implementing and monitoring adopted curricula.

3.5 THE SCHOOL BOARD

School boards are the legal agents for the schools. They have receive their power directly from the state legislature. These boards comprised of lay person, elected, as representatives of the general public are responsible for the overall management of the school. With regard to curriculum, school boards hold the final accountability for what occurs. Their primary responsibility is to be cognizant of the scope and content of the curriculum others responsibilities are to be knowledgeable of state guidelines and regulations regarding all curriculum and instructional matters (textbook adoption procedures).

a. to support and extend the value of the total school system;
b. to serve as the main body for processing of community value, attitudes and curricular activities.
c. to investigate those trends relative to innovations in the curriculum fields;
d. to provide communication channels to the public regarding curriculum matters;
e. to determined and administer general policies affecting total area; and
f. to be involved actively in the curriculum planning process by voting funds requisite for putting programme and policies into action, and ensuring that all groups to be affected by the curriculum are meaningfully involved.

3.6 LAY CITIZENS

There is no doubt that the schools belong to the public. Lay individuals in recent years have become increasingly active and visible in determining curricular directions and emphases (Hunkins, 1980).

Today, few educators challenge the efficiency of lay citizens involvement in curriculum decision-making. Rather the question is how to involve such individual optimally citizen involvement should occur at three levels.

Societies, institutional and instructional. Citizens and this course includes parents, can assist in long-range curriculum planning, in delineating programme goals. Additionally, citizen can participate in long-range planning regarding physical plants, educational environments, materials production and purchase and financing of school programmes, both curriculum and extra-curricular. The school board is the official policy-making body, but individuals and organizations can contribute to policy development. An individual who holds power in the community can speaks out against some educational practice or use of materials and the practice and material are adjusted or discontinued. Lay persons may participate both formally and informally in curriculum decision-making. Frequently, action by community members is informal and is largely just passive listening and watching what the schools do. The quality of the information the citizens get via the informal means is largely dependent upon the effectiveness of the communication avenues established by the school or available in the community, such as the local radio and television stations i.e OSBC, BCOS, Galaxy T.V etc. Informal participation often is on an individual basis in response to particular and transitory needs that arise. Formal involvement usually occurs in group form. The PTA of the school can appoint formal groups or the school board or they can be self-organized, such as various pressure groups, or community groups interested in education, Lions Club, Rotary Club.

Exercise

Identify the participants in the development of curriculum.

Explain the role of each participant in the development of curriculum.

4.0 CONCLUSION

It is clear from this unit that there are web of forces with their specific roles influencing curriculum development process called 'participants in curriculum development'.

5.0 SUMMARY

In this unit, you have learnt:

1 The participants in the development of curriculum.

2 The role of each participant in the development of curriculum.

6.0 TUTOR MARKED ASSIGNMENT

Point out the roles of parents and the general public in the development of curriculum.

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Unit 5

SCIENCE CURRICULUM DEVELOPMENT IN NIGERIA

CONTENTS

1.0 INTRODUCTION

Between 1842 when the first missionary school was established in Nigeria and 1960 when Nigeria attained political independence, there were no systemic science curriculum development efforts in the country. During this period, Nigeria educational system experimented with the wholesale importation of the science curriculum of the British Grammar school. Thus, the science curricula of Nigerian schools in this period lacked realistic and relevant objectives. The methodology of implementation of the curriculum content failed in most cases to meet the requirement of the British authorities. Consequently, the level of achievement of the colonial science curriculum in Nigeria was very low.

Some remarkable curriculum development initiatives occurred in Nigeria soon after political independence in 1960.these initiatives were catalyzed by the presence of favorable conditions which included:

1. The establishment of the University College, Ibadan, in 1948, which had become too small to accommodate the large number of students who sought admission to science based course in the 1960's.
2. The rising number of science graduates in teaching careers during the early 1950's.
3. The formation of the science Teachers Association of Nigeria in 1957.
4. The success of the national curriculum conference of 1969.

The interaction of these condition together with the national aspiration for technological growth gave impetus to the development of a number of science curricula programmes. A few examples of these programmes which have already been replaced by more virile ones include:

2.0 OBJECTIVES

At the end of this unit, you should be able to:
Discuss some Initial science curriculum development efforts in Nigeria

List problems of the early curricula programmes

Discuss national science curricula programmes

Identify problems of the Nigerian Secondary Science Project (NSSSP) Projects

3.0 MAIN BODY

3.1 SOME INITIAL SCIENCE CURRICULUM DEVELOPMENT EFFORTS IN NIGERIA:

1 General Science for the Comprehensive Secondary School. Developed at Aiyetoro, Nigeria, 1968.

The philosophy of this project was to provide a course which is practical in approach and familiar to the background of the learners. The programme was designed by the science teachers at Aiyetoro comprehensive High school, representatives from the western state ministry education, specialist in science Education from Havard University and Professor Fletcher Watson. The trial edition of the curriculum materials in form of Books I and II and their Teachers Guides, were produced and distributed free of charge in 1967. The programme was supported by the United State Agency for international Development and Havard Graduate School. Gord Foundation provided the grants for printing.

2 Primary Education Improvement Project (PEIP), 1968

This was a primary science curriculum project which adopted the process approach to curriculum planning. The basic philosophy of the project was that primary education ought to be functional in making the education literate.

The initial version was titled. “The First Two Years of Primary School”. The curriculum materials were published by the Institute of Education, Ahmadu Bello University, Zaria, together with a panel of science teachers as well as UNESCO and UNICEF consultants.

The aims and objectives include the creation of a more modern curriculum and one that is fit for Nigerians in Nigeria; to encourage the utilization of the

environment and accept primary education is terminal for more than ninety percent of children in the North.

The curriculum materials which were in the form of books and equipment packages, published in 1968, test-tried and evaluated were widely used in the whole of the northern states.

3. Bendel State of Nigeria Primary Science Project (NPSP)

The philosophy of this science curriculum project was to produce a breed of scientists with early exposure to the processes of science through an activity oriented curriculum. The title of the project was the Nigerian Primary Science Programme (NPSP).

The experimental edition was published in 1974 and the final printed edition was published in 1976. The books which were in six volumes, and materials were for use in the Bendel State. One volume existed for each of primaries one to six. The publishers were Longmans of Nigeria Ltd. The curriculum project had the approval of the Bendel State Government with assistance from UNESCO and UNICEF.

The programme designers were the Bendel State Ministry of Education working jointly with classroom teachers in the state as well as with UNESCO and UNICEF Science Coordinators. A project team produced the final draft through workshops. The curriculum materials were tested and modified in a process which passed through a trail or experimental stage to the final publication stage.

The articulated objectives of the programme included to stimulate team-work; to encourage individual effort and self reliance in arriving at logical and satisfactory solutions. The books were titles “Science is Discovering” and teachers guides existed each volume. There were no special packages indicated as special requirement, although a list of required apparatus and materials exist at the end of each teachers guide. The teachers go through a short in-service course in order to operate the programme. There were no other special training requirement.

Assesment exercises were located at various points I the activity curriculum. The curriculum project was evaluated by the International Centre for Educational Evaluation (ICEE), Institute of Education, University of Ibadan in 1976.

3.2 PROBLEMS OF THE EARLY CURRICULA PROGRAMMES

All the three curricula programmes discussed as examples have been phased out of the educational system. The main reasons are because:

i They all had very limited and localized objectives.
ii They could not be easily adapted or adopted for a national curriculum.
iii Lack of financial resources on the part of the States
iv Lack of trained science personnel to handle these curricula programmes.

v Workshop could no longer hold due to lack of financial resources resulting in gradual death of various programmes.

vi There was a very short trial periods. It was impossible to evaluate long-term effects of the programmes.

3.3 NATIONAL SCIENCE CURRICULA PROGRAMMES

There are two national science curriculum projects which are available at the Nigerian Secondary School Level. These are the Nigerian Integrated Science Project (NISP) and the Nigerian Secondary Schools Science Project (NSSSP). While the NISP is for the junior secondary school, the NSSSP is for the senior secondary school. Both projects are making significant contributions presently towards the national effort of providing scientific literacy to the citizens.

A <u>The Nigerian Integrated Science Project (NISP)</u>

The philosophy of this project is for the beginner to see science as a united, inter-related to nature. The Science Teachers Association of Nigeria took the initiative of curriculum development and in 1969 it published its Newsletter No. 1 on the Nigerian Integrated Science Project for students in forms one and two of the Nigerian Secondary school. The text-book was published in 1972 with the approval of the Federal Ministry of Education. The curriculum and books were produced as a project team work by members of the Science Teachers Association of Nigeria. The books and also the curriculum have been revised and are now available in three volumes for the three junior secondary forms. There are also teachers guides.

The aim of the project is to establish experimental methods as the basis for science education in Nigeria. The content subject matters are organized around the key concepts of living and non-living things, energy and environment.

The continuous assessment type of tests is placed at various points in the activity book for evaluating students' performance and progress. The programme is now offered as a compulsory requirement for obtaining the junior secondary certificate. A terminal examination which is organized by the West African Examination Council (WAEC) is used for the certification of candidates.

The programme is popular with the students although most of the Nigerian Certificate of Education teachers who handle the subject do not do enough credit to the programme. Again, there is reluctance on the part of senior graduate teachers to accept to teach science at this level. Most of the teachers view such a deployment to the junior forms for integrated science teaching as derogatory. Another serious problem which this programme faces is insufficient number of trained integrated science teachers. Most Nigerian Universities do not run courses on integrated science. This production is very low.

B The Nigerian Secondary Science Project (NSSSP) 1969

The philosophy of this curriculum programme is learner centredness, therefore its ability, interest and aptitude form the guiding principle for the programme execution.

The programme has the approval of the Federal Government of Nigeria after a trial period of fifteen years. Most of the trial schools were Federal Government Colleges. The programme designers were the Comparative Education Study and Adaptation Centre (CESAC) of the University of Lagos in partnership with STAN. The programme involved experienced classroom teachers, University Lectures and curriculum experts.

The objectives of the programme include good concept formation, high level thinking, curiosity and creativeness giving adequate and elaborate explanations among others. There are textual materials for each of the three levels of the senior secondary course for the three basic science subjects of Physics, Chemistry, and Biology. There are also teachers' guides as well as laboratory packages.

The curriculum is an activity package in which the conceptual approach is adopted in the study of the various sciences. It is a spiral one in which key concepts subsume subsidiary ones and the key concepts are studied in greater depths at higher levels. The key concepts which run through the programme are cell behavior, energy production, ecology and nutrition for biology; structure, energy and periodicity for chemistry; Motion and energy for physics. The curriculum content arrangement specifies the topics to be covered, performance objectives for each topic and sub-topics, content material and scope, relevant recommended activities and notes for the teachers.

The science curriculum designers of the NSSSP adopted the process model known as CESAC Process Model (Ivowi, 1993). The process is illustrated in Fig. 1

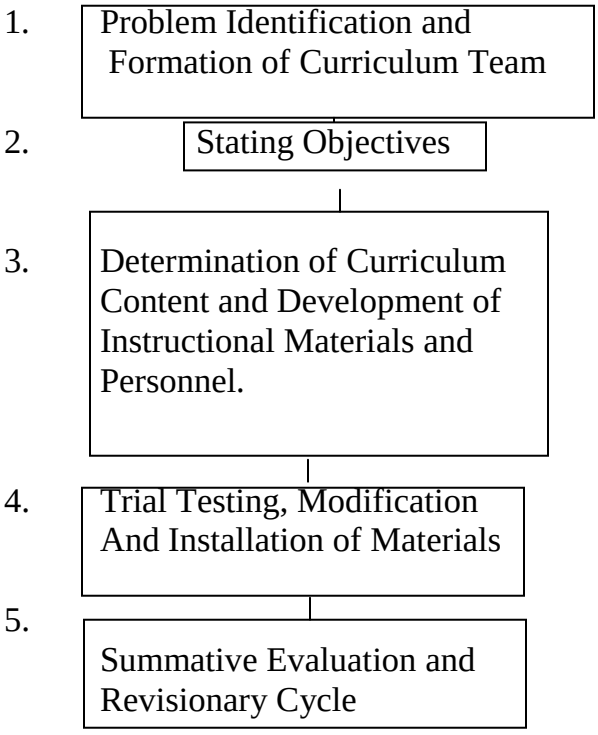

Fig 1: CESAC Process Model

The numerous benefits of this model of the curriculum planning process has been outlined in Ivowi (1993).

3.4 PROBLEMS OF THE NSSSP PROJECTS

1 The curriculum objectives are over ambitious (they have been found difficult to achieve in reality).

2 The contents have been described as being over-loaded.

3 Lack of facilities for carrying out practical work.

4 Most science teachers failed to adopt the prescribed instructional techniques.

5 Majority of students (especially in the senior secondary science classes) were not mentally matured for conceptual understanding.

6 There was limited opportunity for training serving teacher in the schools.

Exercise

Discuss some Initial science curriculum development efforts in Nigeria.

List some of the problems of the early curricula programmes.

Discuss national science curricula programmes.

Identify problems of the Nigerian Secondary Science Project (NSSSP) Projects.

4.0 CONCLUSION

Science education in Nigeria has gone through various developments and changes which have made the curriculum to gradually change from importation of the science curriculum of the British school to meet the need of the Nigerian society.

5.0 SUMMARY

In this unit, you have learnt:

1 Some Initial science curriculum development efforts in Nigeria

2 Problems of the early curricula programmes

3 National science curricula programmes

4 Problems of the Nigerian Secondary Science Project (NSSSP) Projects

6.0 TUTOR MARKED ASSIGNMENT

Discuss in details the shortcomings of the early curricula programmes in Nigeria.

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Unit 6

HISTORY OF INTEGRATED SCIENCE CURRICULUM DEVELOPMENT IN NIGERIA

CONTENTS

1.0 INTRODUCTION

In this unit you are going to learn about the history of Integrated Science curriculum development in Nigeria, the 'birth' of the 9 year basic science and technology curriculum and the reasons for 2012 edition of basic science and technology curriculum. The history will help us to understand the past, present and the need for revision if the need arises to do so.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

1 Discuss the history of Integrated Science curriculum development in Nigeria

2 Discuss the 9 year basic science and technology curriculum development in Nigeria

3 State the objectives and reasons for 2012 Edition (Current Edition) of Basic Science and Technology curriculum in Nigeria

3.0 MAIN BODY

3.1 INTEGRATED SCIENCE CURRICULUM DEVELOPMENT

As long ago as 1968, a request was made to STAN by the West African Examinations Council (WAEC) to make recommendations on the review and improvement of the then GCE 'O' level science syllabuses. A revision was thought necessary due to developments in science education all over the world. Consequently, STAN set up four curriculum development committees, one each in Biology, Chemistry, Physics and Mathematics. The project was funded by the Ford Foundation (through the Comparative Education Study and Adaptation Centre (CESAC), Curriculum Renewal and Educational Development Overseas (CREDO) through the British Council. Support in the form of curriculum materials was received from UNESCO and from Longman (Nigeria) publishing company.

Later, an additional Committee was set up to take care of integrated science. The publication of Curriculum Development Newsletter No.1 (STAN, 1970a) meant that things could not be the same again in Nigeria with respect to science teaching. In a Foreword to the newsletter, the then General Secretary of STAN Rev. P. S. Samuel (STAN 1970a:3) said, inter alia: The need for curriculum Reform in Science Education in Nigeria has been felt by the members of the Association for some time and especially since the great Curriculum Reform movements, such as B.S.C.S., P.S.S.C., and C.B.A. in the United States, the Nuffield Teaching Project in the United Kingdom and the work of Scottish Education Department, began to influence the general education atmosphere everywhere. However, professional associations are seldom strong enough financially or sufficiently strong enough to carry out such important task alone.

The Science Teachers Association of Nigeria nevertheless felt that it was time to do something Innovations in Science and Technology Education through Science Teacher Associations about the development of a new science teaching curriculum for schools…we
hope that this is the beginning of a long and important process in which we invite comments, criticisms and suggestions on the content of our work so that we may improve upon it in future. With this hope and prayer, we present the first fruits of our Curriculum Development work to teachers and other science educators. The document proposed that the integrated science course should enable each Nigerian student to:

- Be actively involved in the learning process;
- Develop the motivation and ability to work and think in an independent fashion;
- Recall information and experiences;
- Devise schemes for solving problems;
- Use and classify given information;

- Apply previous knowledge to new situation;
- Interpret information showing evidence of judgment and assessment.
- Communicate selectively and effectively.
- Relate experiences in each subject area to other areas and to live in the society.

Accordingly, the course envisaged that the following skills would be acquired by the student:

- observe carefully and thoroughly;
- report completely and accurately what is observed;
- organise information acquired by the above process;
- generalise on the basis of acquired information;
- predict as a result of these generalizations;
- designing experiments (including controls where necessary) to check these Predictions;
- use models to explain phenomena, where appropriate; and
- Continue the process of inquiry when new data did not conform to predictions.

The course, initially planned for two years, gave way to a three-year course following the
introduction of the 6-3-3-4 system of education in Nigeria. The present science course has
modified the spiral system themes adopted under :

- You as a living thing.
- You and your home.
- Living components of the environment.
- Saving your energy.
- Controlling the environment.

According to Otuka (1993), at the inception of the 6-3-3-4 system, the Federal Ministry of Education embarked on streamlining the existing curricula in use in all schools so as to produce single national curriculum content in each science subject. It is to the credit of STAN that some of its members served as resource persons during the exercise in 1984 and1985. The Nigerian Educational Research and Development Council (NERDC) has recently renamed ‘Integrated Science’ as ‘Basic Science’ while ‘Primary Science’ has been renamed ‘Basic Science and Technology’.

The work of STAN in curriculum development in Nigeria has been so pervasive that it has usually been regarded as a curriculum development agency. In the words of Ivowi (1993:353): In appraising the performances of the curriculum development agencies (in Nigeria), five such bodies, namely,

- the Nigerian Educational Research and Development Council,

- West African Examinations Council,
- National Teachers Institute,
- National Commission for Colleges of Education,
- And the Science Teachers Association of Nigeria has been singled out.

The Integrated Science curriculum for JSS is meant for the current 6-3-3-4 system of education in Nigeria. It is intended to provide modern integrated science course for three years to all junior secondary school students. By design, it is expected to satisfy the needs of the society through the relevance and functionality of its content, method, processes and application. The objectives of the curriculum were derived from the NPE (NPE, 2004). Structurally, the integrated science curriculum for JSS, as stipulated by the federal ministry of education (1981), consists essentially of six themes: topic(s), performance objective(s), content, activity and notes. By this arrangement, each topic has four aspects across the columns. The fifty-four major topics treated in the curriculum document focus mainly on six themes in integrated science, viz:

1 Concept of living thing.
2 Basic ecological concepts.
3 Living components of the environment.
4 Non-living components of the environment.
5 Energy and machines.
6 Controlling the environment.

The fifty-four topics are expected to be covered over a period of three academic sessions, that is, from JSS 1 to JSS 3. The objectives by convention, curriculum objectives form the focal point of any systematically planned educational programme because without them the achievement, effectiveness, suitability and respectability of the programme cannot be assessed (Bloom, 1974). The cardinal objectives of the curriculum are to prepare pupils to acquire:

1 Adequate laboratory and field skills in Integrated Science;
2 Meaningful and relevant knowledge in Integrated Science;
3. Ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture; and
4 Reasonable and functional scientific attitudes.

These cardinal objectives are appropriate and meaningful because they emphasize:

1 Enquiry and experimentation as vehicle for science Learning/teaching;
2 Relevance of knowledge and skills taught; and
3 Functionality.

These ideals are the pillars of modern science teaching today. Secondly, they cover satisfactorily the cognitive, affective and psychomotor domains of learning. The performance objectives are commendable since their organization would provide the maximum guide to the classroom teacher. It will also help teachers in self- evaluation of their own teaching and the achievement levels of their students. The curriculum starts with the topics of direct relevance to the

community. These include you as a living thing, you and your home and living and non-living components of the environment. The performance objectives are appropriate and are in line with the cardinal objectives of the syllabus. The content in planning the integrated science curriculum, the spiral (or concentric) approach to sequencing a science course was adopted. In the approach, the concepts to be taught
are arranged in such a way that they run throughout the three-year course; in a progression order of depth as the course matures over the years. This approach is worthy of note as it presupposes in the cognitive development skill that a junior secondary school 3 student will comprehend more than a junior secondary school 1 student. The question may be asked, are the contents really spiral? The topic, nervous system and reproductive system which were not introduced in year 2 features in
year 3. The curriculum planners should have introduced them in Year 2 so that the approach to sequencing a science course will be adopted to help the pupils to follow-up in Year 3 when the topics are treated again. All other themes of integrated science, apart from theme one, are arranged in a progression order of depth.

Theme 1: You as a living thing

Year 1

1 Characteristics of living things.
2 Characteristics of animals.
3 Human beings as higher animals.
4 The functioning of the human body-feeding.

Year 2

1 The functioning of the human body-movement
2 Circulatory system
3 Respiratory system
4 Excretory system and
5 Digestive system.

Year 3

1 The functioning of human body, nervous system and reproductive system.
2 Health.
3 Keeping the body fit.

The topics in year 2 should have been repeated in Year 3 for easy understanding of the topics. It is stated in the syllabus that pupils should acquire adequate laboratory and field skills in integrated science; but in the curriculum there is no special time allocated for it and usually the time-table is overcrowded with too many subjects. As such, the objectives are never attained. The curriculum developers provide topics that are of direct relevance to the community. Since there is not enough time to treat all the topics, why put them all in the curriculum?

Theme 2: You and Your Home

Year 1

Health and family-importance of personal cleanness to family health.

Year 2

1 Child's growth and development-Physical growth.
2 Energy and appliance-Types of energy.

Year 3

1 Continuity of family.
2 Child's growth and development-care of child.
3 Energy and appliances-appliances in the home.

From Theme 2, there is correlation in the topics starting from year 1 to year 3.

Theme 3: Living components of the environment

Year 1

1 Classification of matter.
2 Grouping of organisms.
3 Activities of living things.

Year 2

Ecology-specific habitat studies, including land and aquatic.

Year 3

Resources from living components of the environment.

Theme 4: Non-living components of the environment

Year 1

1 Observing non-living components. 139 Int. J. Sci. Technol. Educ. Res.
2 Investigating the properties of matter.
3 Measurement.
4 States of matter.
5 Air.
6 Water.
7 Man in space.

Year 2

1 Pure and impure substances.
2 Further investigation of air and water.
3 Hydrogen.
4 Rusting.
5 Energy.

Year 3

1 Acids, Bases and Salts.
2 Chemical symbols, formulae and equations.
3 Atomic structure.
4 Metals and non-metals.
5 Activity series.

6 Energy conversion and transfer.
7 Energy and work.
8. Kinetic theory.

From Themes 3 and 4 earlier, the classification of matter included in year one theme 3 should not have been included in year one theme 3, it should have been included in year one theme 4 because it will make the learning of properties of matter, states of matter, air and water as they are under year one theme 4 understandable. If a child is taught classification of matter before being taught properties of matter, states of matter, air and water; the learning would progress from known to
Unknown and this would enhance students' learning.

Theme 5: Saving your energy

Year 1
1 Science related occupation.
2 Tools (machines) for work.
3 Force.

Year 2
1 Effect of force.
2 Simple machine.
3 Maintenance of machines.

Year III
1 Energy and work.
2 Energy conversion and transfer.

Theme 6: Controlling the environment

Year 1
1 Environmental sanitation, refuse and sewage.
2 Disease vector.
3 Preventive medicine-clean water and immunization.

Year 2
1 Maintaining balance in the environment.
2 Pollutants in the environment.

Year 3
1 Our disappearing forest.
2 Controlling the water.

From themes one to six, apart from the few observed mistakes in the arrangement of some topics, there is correlation in the topics from Year I to Year III.

3.2 THE 9 YEAR BASIC SCIENCE AND TECHNOLOGY CURRICULUM DEVELOPMENT IN NIGERIA

Following the decision of the Federal Government to introduce the 9-Year Basic Education Programme and the need to attain the Millennium Development Goals

(MDGs) by 2015 and, by extension, the need to implement the National Economic and Empowerment Development Strategies (NEEDS), this can be summarized as:

> Value-reorientation
> Poverty Eradication
> Job Creation
> Wealth Generation
> Using Education to Empower People.

It becomes imperative that the existing curricula for primary and JSS should be reviewed, re-structured and re-aligned to fit into a 9-Year Basic Education Programme. The National Council on Education (NCE) at its meeting in Ibadan in December 2005 directed the NERDC to carry out this assignment. The NCE also approved a new curriculum structure namely:

- Lower Basic Education Curriculum (Primaries 1-3)
- Middle Basic Education Curriculum (Primaries 4-6)
- Upper Basic Education Curriculum (JSS 1-3)

In response to these developments, a High Level Policy Committee on Curriculum Development (HLPC), made up of critical stakeholders and chaired by NERDC took the initiatives to provide the guidelines for re-structuring the curriculum. Between January and March 2006, the NERDC convened a meeting of experts and also organized several workshops to produce the 9-Year Basic Education Curriculum, which would ensure continuity and flow of themes, topics and experiences from primary school to Junior Secondary levels.

The curriculum reflects depth, appropriateness and inter-relatedness of the curricular contents. Also, emerging issues which covered:

- value orientation
- peace and dialogue
- human rights education
- Family Life HIV/AIDS Education
- Entrepreneurial Skills, etc, were infused into the relevant contents of the new 9-Year Basic Education curriculum.

In general, the curriculum pays particular attention to the achievement of the Millennium Development Goals (MDGs) and the critical elements of National Economic Empowerment and Development Strategies (NEEDS). In this new curriculum structure, the contents, performance objectives, activities for both teachers and learners and evaluation guide are provided. The prescriptions represent the minimum content to be taught in the schools to achieve the 9-Year Basic Education. However, teachers are encouraged to enrich the contents with relevant materials and information from their immediate environment, by adapting the curriculum to their needs and aspirations. Thus, the curriculum can be adapted for such special needs as nomadic education, non-formal education and the physically challenged.

The 9 year Basic Science and Technology Curriculum is the production of a re-alignment and restructuring of the revised curricula for primary science and Junior Secondary School Integrated Science (NERDC, 2007). In selecting the contents, three major issues shaping the development of nations worldwide, and influencing the world of knowledge today were identified as:

>Globalisation
>Information and Communication Technology (ICT)
>Entrepreneurship Education

The desire of Nigeria to be identified with contemporary development worldwide, called for the infusion of relevant contents of four approved curriculum innovations in the areas of:

a) Environmental Education (EE)
b) Drug Abuse Education (DAE)
c) Population and Family Life Education (POP/FLE)
d) Sexually Transmitted Infection (STI, HIV/AIDS)

Infusion occurred in every class from Basic 1-9. Also, some introductory technology topics have been introduced at the lower and middle levels, while leaving the upper level with purely science topics. All these prompted the development of Integrated Science Curriculum which brought about the introduction of the name 'Basic Science' instead of 'Integrated Science' at secondary school level.

The overall objectives of this curriculum are to enable the learners to:

i) Develop interest in science and technology
ii) Acquire basic knowledge and skills in science and technology
iii) Apply their scientific and technological knowledge and skills to meet societal needs
iv) Take advantage of the numerous career opportunities offered by science and technology
v) Become prepared for further studies in science and technology

In order to achieve a holistic presentation of science and technology contents to learners, the thematic approach to content organization was adopted. Consequently, four themes were used to cover knowledge, skills and attitudinal requirements. These are:

1. You and Environment
2. Living and Non-Living Things
3. You and Technology
4. You and Energy

These four themes were meant for Lower and Middle Basic Levels. At the Upper Basic Level, however, theme '3' "You and Technology" was changed to "Science and Development." The topics under each theme were sequenced in a spiral form beginning with the simple to the complex across the 9 (nine) years of

Basic Education in order to sustain the interest of learners and promote meaningful learning.

The use of guided inquiry method of teaching and learning is implied in the activities prescribed under each topic in order to promote learning by doing and skills development. The theme "Science and Development" was added to expose students to developments in science and technology alongside skills that will enable them to face challenges, make informed decisions, develop survival strategies and learn to live effectively within the global community.

3.3 2012 EDITION (CURRENT EDITION) OF BASIC SCIENCE AND TECHNOLOGY CURRICULUM

In another development, Basic Science and Technology curriculum developed in 2007 was revised in 2012. It is a product of the restructuring and integration of four Primary and Junior Secondary School (JSS) science curricula namely:

- Basic Science
- Basic Technology
- Physical and Health Education
- Computer Studies/Information and Communication Technology (ICT)

A Reasons for 2012 Revision of Basic Science and Technology Curriculum

The integration of these science curricula became necessary for the following reasons:

1. Recommendations of the presidential summit on Education (2010) to reduce the number of subjects offered in Primary and Junior Secondary Schools.

2. Feedback from the implementation of the curricula in schools that identified repetition and duplication of concepts as the major cause of curriculum loaded.

3. Need to encourage innovative teaching and learning approaches and techniques that promote creativity and critical thinking in learners.

4. Need to promote the holistic view of science at the Basic Education level for better understanding of contemporary and changing world.

5. Need to infuse emergent issues that are of national and global concern such as gender sensitivity, globalization and entrepreneurship.

B The Objectives of Basic Science and Technology Curriculum

The Basic Science and Technology Curriculum (Revised: 2012) is expected to enable the learners:

i) Develop interest in science and technology;

ii) Acquire basic knowledge and skills in science and technology;

iii) Apply scientific and technological knowledge and skills to meet contemporary societal needs;

iv) Take advantage of numerous career opportunities provided by science and technology;

v) Become prepared for further studies in science and technology;

vi) Avoid drug abuse and related vices; and

vii) Be safety and security conscious.

C Structure of the Basic Science and Technology Curriculum

The thematic approach to content organization was adopted in order to achieve a holistic presentation of scientific and technological concepts and skills to learners. The themes and sub-themes that formed the integrating threads for the Basic Science and Technology curriculum are:

THEME	PRIMARY	JSS
	SUB-THEME	SUB-THEME
BASIC SCIENCE	• Exploring Our Environment • Living and Non-Living Things	• Learning About Our Environment • You and Energy • Science and Development

BASIC TECHNOLOGY	• Understanding Basic Technology • You and Energy	• Understanding Basic Technology • Materials and Processing • Drawing Practice • Tools, Machines and Processes • Safety
PHYSICAL AND HEALTH EDUCATION	• Fundamental Movements • Basic Movements • Athletics • Games and Sports • Health Education • Pathogens, Diseases and Prevention • Drug Education • Responsible Parenthood	• Basic Human Movement • Sports and Games • Health Education • Moving Our Body Parts • Athletics • Contact and Non-Contact Games
INFORMATION TECHNOLOGY	• Basic Computer Operations and Concepts • Basic Concepts of Information Technology	• Basic Computer Operations and Concepts • Computer Ethics • Computer Application Packages • Basic Knowledge of Information Technology

(Source: NERDC, 2012)

While selecting the contents, major issues shaping contemporary growth and development of nations and influencing knowledge driven societies were identified and infused into the curriculum content at every level, from primaries one to junior secondary classes one to three; with a progression in infusion of concepts as class advances. These include, but are not limited to:

a) Environmental Education
b) Climatic Change
c) Drug Abuse Education
d) Foods and Drugs Safety Education
e) Disaster Risk Reduction Education
f) Consumer Education
g) Safety and Security

h) Entrepreneurship

The topics in each theme are spirally sequenced, from simple to complex across the 9 (nine) years of schooling in order to sustain the interest of learners and promote meaningful learning and skills development. In addition, the curriculum promotes guided inquiry and activity-based teaching and learning using locally sourced materials. Furthermore, the contents of the adapted curriculum are enriched with examples that are not only indigenous and familiar to learners, but also engender the development of relevant attributes and survival strategies for living successfully in contemporary and global world.

Exercise

1 Discuss the history of Integrated Science curriculum development in Nigeria

2 Discuss the 9 year basic science and technology curriculum development in Nigeria

3 What are the objectives and reasons for 2012 Revision of Basic Science and Technology curriculum?

4.0 CONCLUSION

Integrated Science in Nigeria must live up to the challenges of the present which the curriculum, to a large extent has accommodated.

5.0 SUMMARY

In this unit, you have learnt:

1 Integrated Science curriculum development in Nigeria

2 The 9 year basic science and technology curriculum development in Nigeria

3 2012 Edition (Current Edition) of Basic Science and Technology curriculum

6.0 TUTOR MARKED ASSIGNMENT

Trace the history of Integrated Science curriculum development in Nigeria

7.0 REFERENCES / FURTHER READINGS

NERDC (2007). 9-Year Basic Education Curriculum

NERDC (2012). 9-Year Basic Education Curriculum

Unit 7

THE SCIENCE CURRICULUM AND DELIVERY IN GHANA

CONTENTS

1.0 INTRODUCTION

Science education has always been a part of the Ghanaian (and Sub-Saharan) culture. Prior to the advent of modern education in Ghana, there were both "formal" and "informal" forms of education. Both forms generally took after the apprenticeship model, although direct instruction was prevalent in specific situations. "Informal education" involved working with a close relative to learn a family trade, in a relatively casual climate. In "formal education," a child would generally be sent to learn a trade from a master craftsman, with some type of specific arrangement. This arrangement would then be formalized with some form of symbolic seal, such as a drink. On completing the apprenticeship, there were formal graduation rites and celebrations. Modern education in Ghana came with the advent of European missionary and mercantile enterprises, and has largely become the vehicle for social upward mobility.

The Ghanaian science curriculum follows the "spiral approach," treating the same themes at different times and in greater depths within each educational level. At the primary and JSS levels are environmental studies and integrated science. The curriculum is the modern replacement of what used to be called "nature study." This is a generalist, survey course, which exposes the child to the universe. At this level, the students would get the basic exposure to scientific ideas, and learn about the history of science. They also learn the basic scientific vocabulary at this level.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

Identify general aims of Integrated Science curriculum for high school in Ghana

Describe briefly history of the Ghanaian education system

Describe educational administration in Ghana

Compare Integrated Science curriculum content organization in Nigeria and Ghana

At the end of this unit, you should be able to:

3.0 MAIN BODY

3.1 GENERAL AIMS OF INTEGRATED SCIENCE CURRICULUM FOR HIGH SCHOOL IN GHANA

Learners are expected to:

1. Solve basic problems within his/her immediate environment through analysis and experimentation.
2. Keep a proper balance of the diversity of the living and their non-living things on their interconnectedness and repeated patterns of change.
3. Adopt sustainable habits for managing the natural environment for human kind and society.
4. Use appliances and gadgets effectively with clear understanding of their basic principles and underlying operations.
5. Explore, conserve and optimize the use of energy as an important resource for the living world.
6. Adopt a scientific way of life based on pragmatic observation and investigation of phenomena.
7. Search for solutions to the problems of life recognizing the interaction of science, technology and other disciplines.

The content covers the basic sciences and includes topics in Health, Agriculture and Industry. Specific issues covered are the following:

1. Science for all students.
2. Science as an active inquiry process.
3. Science and the satisfaction of individual needs.
4. Science as a profession.
5. Science and culture.

The five themes chosen for this subject are:

- Diversity of matter
- Cycles
- Systems
- Energy

- Interactions

3.2 BRIEF HISTORY OF THE GHANAIAN EDUCATION SYSTEM

The history of education in Ghana dates back to 1592. After Ghana gained its independence in 1957, the education system then modeled on the British system, underwent a series of reform. Especially the reforms in the 1980's geared the education system away from purely academic to more in time with the nations manpower needs. The present structure of education, which starts at the age of 6years, consists of 6years of primary education, 3 years of Junior Secondary School, 3 years of Senior Secondary School and 4 Years University or Courses at other tertiary institutions. The first 9 years form the basic education and are free and compulsory.

Implementations of formal education in Ghana were linked to Christian missionaries who convinced the chiefs of Ghana in 1832 to send their children to the government school at Osu. Initial curriculum includes: reading, writing and arithmetic. Workshops were also organized for students to acquire practical skills; carpentry, blacksmithing, shoemaking and sewing for girls were taught, as well as practical agriculture and medical and health education.

3.3 EDUCATIONAL ADMINISTRATION IN GHANA

Education in Ghana is centrally administered under the purview of the Ministry of Education, which is responsible for the formulation of the national educational objectives. This ministry oversees the Ghana Education Service (GES), which is responsible for pre-tertiary levels of education, and the National Council for Tertiary Education (NCTE), which is obviously responsible for tertiary education.

The GES organizes its constituencies into a 6:3:3 format: Six years of primary education, three years of junior secondary school (JSS), and three years of senior secondary school (SSS). All children in Ghana are compulsorily expected to enroll in school at the age of six, for a free, nine-year basic education (primary and JSS). Those who enter the SSS generally pursue their education with their economic future in mind.

Exercise

Identify general aims of Integrated Science curriculum for high school in Ghana

Describe briefly history of the Ghanaian education system

Describe educational administration in Ghana

Compare Integrated Science curriculum content organization in Nigeria and Ghana

4.0 CONCLUSION

Education in general, and science education, for that matter, is serious issues for all Ghanaians.

5.0 SUMMARY

In this unit, you have learnt:

1 General Aims of Integrated Science Curriculum for High School in Ghana

2 Brief History of the Ghanaian Education System

3 Educational Administration in Ghana

6.0 TUTORED MARKED ASSIGNMENT

Briefly discuss the approach to content organization of Ghanaian Integrated Science curriculum

7.0 REFERENCES / FURTHER READINGS

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http://artofteachingscience.org/countries/ghana.html

MODULE 3: IMPLEMENTATION AND EVALUATION OF INTEGRATED SCIENCE CURRICULUM

Unit 1

INTEGRATED SCIENCE CURRICULUM EVALUATION

CONTENTS

1.0 INTRODUCTION

There are different types of evaluation methods which can be used. Depending on the purpose of evaluation, you the appropriate method of evaluation is needed to be determined. Some of the major types of evaluation include Process, Impact, Outcome, Summative, and Formative.

2.0 OBJECTIVES

At the end of this unit, you should be able to:
Define curriculum evaluation

State purposes of curriculum evaluation

List and discuss various types of evaluation methods

Discuss framework for examining curriculum evaluation.

3.0 MAIN BODY

3.1 EVALUATING INTEGRATED SCIENCE CURRICULUM

Curriculum evaluation is the process or processes used for discovering the extent to which the curriculum as designed, developed and implemented is producing or can produce the desired results, (behaviours, knowledge) in students. Thus, evaluation focuses on the strengths and weaknesses of the curriculum master plan before implementation as well as its effectiveness during and after active use.

3.2 PURPOSES OF CURRICULUM EVALUATION

Most curriculum specialists agree that curriculum evaluation can play either a formative purpose (helping to improve the curriculum) or a summative purpose (deciding whether a curriculum should be continued) Anderson and Ball (1978) in Ayodele (2002) further describe the capabilities of curriculum evaluation in terms of six major purposes (which are not necessarily mutually exclusive). They are:

(a) To contribute to decisions about curriculum installation.
(b) To contribute to decisions about curriculum continuation, expansion or "certification".
(c) To contribute to decisions about curriculum modifications.
(d) To obtain evidence to rally support for a curriculum.
(e) To obtain evidence to rally opposition to a curriculum.
(f) To contribute to the understanding of basic psychological, social and other processes.

3.3 TYPES OF EVALUATION METHOD

1 Process evaluation method

Process evaluation method is intended to examine the strategies and procedures involved in the implementation of the program. It is used for measuring the quality of the program and the related activities. With the help of process evaluation method, you can find out if your program is reaching the targeted audience.

This method is used to find whether the program operations are accurately depicted to all the participants and the outside parties. Process evaluation ensures feedback throughout the duration of the program by monitoring closely.

2 Impact evaluation method

Impact evaluation focuses on long term results of the program and changes or improvements in the activities of the program. It is used to measure how effectively the objectives of the program have been achieved.

As the name implies, Impact evaluation is used in measuring the impact of the program immediate to its completion. The results of the Impact evaluation method

may consist of changes in behavior of the participants such as self esteem, morbidity and confidence.

3 Outcome evaluation method

Outcome evaluation method is used to obtain the detailed data on the results of the activities such as changes in the attitude short-term effects, changes made in the policies, etc. It focuses both on long term effects as well as short-term effects of the program.

Outcome evaluation method is used to measure the effectiveness of the goal of the program. It can also be used to assess the program goal over a short-term period. This method helps to determine how the program affects the outcome of the participants.

4 Formative evaluation method

This method is used to evaluate a program during the time of its development, so that early improvements can be possible. It helps in refining and improving the program. Formative evaluation method is used to measure the strengths and weaknesses of the strategies involved, prior to its implementation.

This method helps in necessary revisions before it can be implemented fully. It's basically used to increase the chance for success of the program before starting the new activity. In other word, a formative type of evaluation assesses the curriculum as it is used. Instead of waiting until the end of the school year to look back on how well the curriculum worked, using a formative evaluation allows you to get feedback on a consistent basis. This type of assessment allows educators and administrators to make changes as the school year progresses and adapt the curriculum for different learning styles. Methods for formative evaluation may include collecting student reflection papers after lessons, midterm course evaluations or reviewing summaries that the students write on instructional units.

5 Summative evaluation method

Unlike formative evaluations that take place on a consistent basis, giving ongoing feedback, the summative type is done at the end of a course or school year or through standardized assessment testing. Summative evaluations measure curricular success by reviewing the outcomes against benchmark standards.

It is used to provide information on the effectiveness of the program. It is usually conducted after the program design is completed.

Summative evaluation method helps in deciding whether to continue with the program or to end it. It is used to determine whether a program is sustainable and whether it should be extended to other locations.

3.4 FRAMEWORK FOR EXAMINING CURRICULUM EVALUATION.

Four types of decision are involved in curriculum evaluation. These types include the decision about:

1 Planning intention, e.g., which objectives to select.

2 Planning procedures, e.g., which personnel, methods and material employ.

3 Implementing procedure, e.g., whether to continue, modify or abandon a procedural plan.

4 Outcomes, e.g., which intentions are realized, to extent and by whom.

3.5 INDICATORS OF A GOOD EVALUATION SYSTEM

a **Comprehensive**

A good evaluation system should have a wide scope. All content taught /tasks carried out are included in the evaluation tool.

b **Usability:** The system's instruments and materials should be easy to use. All stakeholders in the system should be in position to work well with the evaluation system tools.

c **Compatibility:** The match between content and objectives should be visible and realistic. The evaluation system should target to evaluate the pre set objectives.

Exercise

Define curriculum evaluation

State purposes of curriculum evaluation

List and discuss various types of evaluation methods

Discuss framework for examining curriculum evaluation.

4.0 CONCLUSION

Evaluation is about revealing how well a programme is working. So, without good evaluation, the effectiveness of a programme cannot be determined.

5.0 SUMMARY

In this unit, you have learnt:

1 what curriculum evaluation is

2 Purposes of Curriculum Evaluation

3 Types of evaluation methods

4 Framework for Examining Curriculum Evaluation.

6.0 TUTOR MARKED ASSIGNMENT

Discuss the implications of evaluation to teachers

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UNIT 2

IMPLEMENTING INTEGRATED SCIENCE CURRICULUM

CONTENTS

1.0 INTRODUCTION

When implementing a new curriculum, there are a host of factors that must be considered; it is only by doing this that one can be certain the implementation is successful. Some of these factors and a host of others will be presented in this unit.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

Define Curriculum Implementation?

Discuss briefly stages involved in Integrated Science curriculum implementation

List and discuss Problems confronting the implementation of Integrated Science curriculum.

Outline factors affecting successful implementation of Integrated Science curriculum.

3.0 MAIN BODY

3.1 WHAT IS CURRICULUM IMPLEMENTATION?

Implementation is an interaction between those who have created the programme and those who are charged to deliver it. According to Ornstein and Hunkins (1998);

1 Implementation requires educators to *shift* from the current programme which they are familiar with to the new or modified programme.
2 Implementation involves *changes* in the knowledge, actions and attitudes of people
3 Implementation can be seen as a process of *professional development* and growth involving ongoing interactions, feedback and assistance.
4 Implementation is a process of *clarification* whereby individuals and groups come to understand and practice a change in attitudes and behaviours; often involving using new resources.
5 Implementation involves change which requires *effort* and will produce certain amount of *anxiety* and to minimize these, it is useful to organise implement-tation into manageable events and to set achievable goals.
6 Implementation requires a *supportive atmosphere* in which there is trust and open communication between administrators, teachers educators, and where risk-taking is encouraged.

3.2 STAGES INVOLVED IN INTEGRATED SCIENCE CURRICULUM IMPLEMENTATION

1 **Public Enlightenment:** During this stage, the community (National, State and Local levels-the learners, parents, guardians, teachers and government officials) is acquainted with the new programme.

2 **Dissemination:** The programme goes public and becomes popular among the target population.

3 **Monitoring:** This is done through various forms of evaluation procedures.

4 **Modification:** The feedback obtained from the monitoring procedure is used to modify aspects of the programme on continuous basis.

3.3 PROBLEMS CONFRONTING THE IMPLEMENTATION OF INTEGRATED SCIENCE CURRICULUM.

There are so many problems of science curriculum in our secondary education curriculum, they include;

1 Provision of instructional materials

2 Funding

3 Motivation of teachers

4 Inadequacy of qualified teachers

5 Teachers participation in decision- making and curriculum planning

PROVISION OF INSTRUCTIONAL MATERIALS

This is one of the problems facing the science curriculum implementation in our secondary education curriculum. Instruction materials which Dike (1987) described as alternative channels of communication which a teacher can use to compress information to make them more vivid to his learners needed for effective implementation of secondary education curriculum.

Babalola (2004) noted that as ingredient is to soup, so also is resource materials to curriculum implementation. These instructional materials are lacking in Nigerian secondary schools, as a consequence, teachers take to teacher chalk and talk and smell and hear in the process of teaching and learning

FUNDING

This is another problem that affect implementation of secondary education curriculum fund refers to money. Every project requires money for it effective implementation. Confirming this, onyeachu (2006) noted that, no organization function effectively without fund. Unfortunately, fund allotted for education is grossly inadequate. This affect implementation of a well designed curriculum situation where there is no money for payment of teachers salaries, purchase of equipment, books, furniture and other facilities , teachers cannot perform effectively. Commenting on the effect of inadequate funding of education in Nigeria. Nwachuku (2005) lamented that the present level of underfunding by the states, the public sector of education (secondary educational level) has wittiness stagnation and decay.

MOTIVATION OF TEACHERS.

Motivation can be described as anything that encourages an individual to perform his or her duty in an expected manner. Ofoegbu (2001).viewed motivation is any force that would reduce tension, stress, worries, frustrations, and problematic situations that are arising in a person’s life. Ofeogbu further argued that where there is where such incidence of tension, worries and such like occur, are all traceable to as work situation they are referred to as negative organization

motivation. Ugwu (2005) opinioned that when a person is gingered to do something , that person is motivated .he must in addition to getting his/her salaries and entitlements, be given other incentives and materials which will make his work easier and faster for him. In implementing secondary education curriculum, the teacher who is the key actor needs to be motivated.

INADEQUACY OF QUALIFIED TEACHERS

This is one of the critical problems in implementing secondary education curriculum. For any program to be successfully implemented the implementer must be adequate. It is heartbreaking to note that teacher are compelled to teacher subject that are no in their area of specialization. For instance a situation where a teacher who read English is allowed to teach physics, one wonders the type of knowledge he is going to impact to the learners. The question arises how we can get adequate number of qualified teachers to handle effectively all subjects meant for secondary education? Lassa (2007) therefore viewed teachers as the key to proper development of the child and consequently they are needed in greater number in all of the secondary schools.

TEACHER'S PARTICIPATION IN DECISION-MAKING AND CURRICULUM PLANNING.

For the set of aims of secondary education to be achieved, teacher must be involved in decision-making and planning of the curriculum. Obinna (2007: 8) observed that no government policy on education can be realized if it does not first perceive the problem opportunities before initializing decision – making process. The teacher in the best position and most qualified resource to be consulted. Mkpa (1987: 345) emphatically remarked as the most important person in the program in the curriculum implementation, the teacher must be involved in all stages of curriculum process.

3.4 FACTORS AFFECTING SUCCESSFUL IMPLEMENTATION OF INTEGRATED SCIENCE CURRICULUM.

Below are some of the factors that affect successful implementation of Integrated Science curriculum.

a) Recruitment of well qualified and competent teachers.

b) Full implementation of teachers salaries scale (TTC) both on federal and State levels

c) Provision of adequate instructional materials and facilities.

d) Provision of training and retraining of science teachers

e) Involvement of parent teacher association (P.T.A) and education trust fund (ETF) in provision of materials, facilities and fund.

Exercise

Define Curriculum Implementation?

Discuss briefly stages involved in Integrated Science curriculum implementation

List and discuss Problems confronting the implementation of Integrated Science curriculum.

Outline factors affecting successful implementation of Integrated Science curriculum.

4.0 CONCLUSION

Integrated Science curriculum implementation is critically important because it refers to the means of accomplishing desired educational objectives.

5.0 SUMMARY

In this unit, you have learnt:

1 What is Curriculum Implementation?

2 Stages involved in Integrated Science curriculum implementation

3 Problems confronting the implementation of Integrated Science curriculum.

4 Factors affecting successful implementation of Integrated Science curriculum.

6.0 TUTOR MARKED ASSIGNMENT

"Teachers' response to new innovations is usually low". Do you agree with this statement? If yes, give reasons for your answer and what could be the solution?

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Unit 3

IMPLEMENTING INTEGRATED SCIENCE CURRICULUM: THE NECESSITY OF TRAINING THE TEACHER AND MOTIVATING THE STUDENTS

CONTENTS

1.0 INTRODUCTION

Teachers are to look for new changes and consequently effect changes through the practice of curricular demands. However, the motivation of teachers to take part in new changes is sometimes very low (NTI, 2011). There are reasons for this teachers' behavior as presented in this unit. Also, Motivating students to learn science, especially, Integrated Science should be the concern of professional Integrated Science teachers. This unit will present ways that can help motivate even the most lethargic student. If students are not treated with respect and held to a high standard, lessons will have much less impact and might end up being an exercise in futility.

2.0 OBJECTIVES

At the end of this unit, you should be able to:
State reasons for low motivation of teachers to accept changes in Curriculum

Identify rationale for training teachers

List and discuss various ways of motivating students for successful curriculum implementation

3.0 MAIN BODY

3.1 WHY TEACHERS' MOTIVATION TO ACCEPT CHANGES IN CURRICULUM IS VERY LOW

The reasons might be:

1 Commitment (lack of commitment to attain higher proficiency)

2 Complaint (of time insufficiency, work-load, etc) and

3 Condition (if money or other benefits attached).

3.2 TRAINING INTEGRATED SCIENCE TEACHER FOR CURRICULUM IMPLEMENTATION

In the recent years, the ongoing project of training and retraining of teachers nationwide under Millennium Development Goals (NTI, 2008; NTI, 2009; NTI, 2010 and NTI, 2011) ensures that teachers are trained in order to meet up with the challenges of the new trends in science education and make necessary professional adjustments through the training.

Still on the need for teachers to embark upon professional development, National Science Teachers Association (NSTA, 2003)) advocates organized long-term research upon which to develop, assess, and maintain effective teacher preparation programs and collaboration among many institutions and individuals. Here, is the summary of the declarations:

- Develop robust, higher science knowledge and skills than the levels they are preparing to teach.
- Teach science effectively and appropriately.
- Construct science concepts with understanding and reflect on the history and nature of science.
- Consider the applications of science in society, the relationship of science to engineering, and the impact of cultural and personal values on science.
- Create a learning environment that encourages inquiry.
- Collaborate with a community of learners(expert science teachers, science teacher educators, etc)
- Engage in meaningful laboratory and simulation activities using contemporary technology tools.
- Understand science-specific pedagogical knowledge grounded in contemporary scholarship and school environments.
- Observe diverse learners' ideas of science and prepare teaching plans to help the students develop more meaningful understanding of science.

- Implement their teaching plans, assess and reflect on the learning outcomes, and adjust their teaching to enhance their students' understanding.
- Engage in data-based decision making regarding their teaching behaviors, strategies, and the selection of topics, activities, and materials.
- Understand how to find and use credible information on the school community, on the curriculum, and on safe and effective use of laboratory activities, independent science projects, science fairs, field trips, simulations, computer tools, and alternative curriculum resources.
- Develop dispositions for effective science teaching, including a sense of responsibility to students and the community and dedication to the need to grow continually, in part through active involvement in the larger science education community.

To promote the development of needed skills, knowledge, and attitudes, NSTA recommends that a research-based focus to develop professional knowledge and skills of teachers in science and science teaching is necessary (National Science Teachers Association 2003).There are new developments in the areas of teaching behaviours, strategies, curricula, and materials that manifest great potential in their ability to provide both the teachers and students with good education in science education. For this reason, National Science Teachers Association advocates organized, long-term research upon which to develop, assess, and maintain effective teachers (National Science Teachers Association 2003). Therefore, there should be training and re-training programmes directed at preparing teachers to meet many demands of varieties of new innovations in the curriculum (Sutman, 2000). From all indications, the country needs geniuses equipped with adequate knowledge and skills needed for national developments. Therefore, there is the need to put in place programme that would prepare teachers to meet this challenge and also for effective implementation of the curriculum.

3.3 RATIONALE FOR TRAINING TEACHERS

Teachers are needed to be trained for the following reasons:

1 There are curricular challenges teachers must be aware of

2 Teachers need to update their knowledge and skills.

3 It necessary to collaborate with experts in science education.

4 They need to get acquainted with contemporary technology tools.

5 They need to prepare lesson plans and adjust teaching to accommodate curricular changes.

6 They need to understand how to find and use credible information related to teachers' all-round performance regarding the implementation of the curriculum.

7 They need to develop dispositions for effective science teaching and dedication to grow continually.

3.4 IMPLEMENTING INTEGRATED SCIENCE CURRICULUM: THE NECESSITY OF MOTIVATING STUDENTS

1. *Emphasize the most critical concepts continuously*
Reiterate these concepts in lectures and assignments throughout the lesson. Include questions relating to these critical concepts on every exam, thus rewarding students for learning, retaining, and, hopefully, applying this knowledge in a variety of contexts.

2. *Provide students with a "visual aid" when possible to explain abstract concepts*
A significant proportion of today's students are visual learners. For these students, a simple diagram or flowchart truly can be more valuable than a thousand words in a text or a lecture.

3. *Rely on logic when applicable*
Point out to students which information is merely "fact" that must be memorized and which course material is based upon "logic." Show students how to employ logical thinking to learn and retain new information.

4. *Use in-class activities to reinforce newly presented material*
After a new concept or subject has been presented via text reading, lecture, or class discussion, allow the students to put the concept into action by completing an in-class assignment. These assignments can be short, but they must be developed to ensure that the students understand the critical concepts underlying the new material. Typically, the most learning takes place when the students are permitted to work in small groups, to refer to their text and notes, and to ask questions of the instructor while completing the assignment. If these in-class assignments are part of the lesson grading scheme, class attendance also improves.

5. *Help students create a "link" when teaching something new*

If the student can "link" the new material to something already learned, the odds of learning the new material are greatly increased. Examples of possible links include: prior material learned in this lesson, material learned in prerequisite lessons, and "real-life" experiences of the students outside the classroom.

6. *Recognize the importance of 'terms' in a lesson*

Students often struggle with new term in many lessons, especially introductory ones. To succeed in these lessons, students must become comfortable with the new terminology. As subjects are presented, new and/or confusing terms should be identified and introduced to the students. Present "real-world" definitions and alternative terminology, in addition to textbook definitions. One way to help students assimilate the course vocabulary is to create a "living" glossary on the instructor's content note where new terminology is added, explained, and illustrated throughout the lesson.

7. *Treat students with respect*

Patronizing behaviour may be expected in primary/secondary school teachers, and: drill sergeant" strategies may be effective in military book camps. However, most college student will not respond well to these techniques. Give students their dignity, and they will give you their best efforts.

8. *Hold students to a high standard*

If students are not required to maintain a specified level of learning and performance, only the most highly motivated students will devote the time and effort necessary to learn. In contrast, maintaining high standards not only will motivate student learning, it will also be the source of student feelings of accomplishment when those standards are met.

Exercise

State reasons for low motivation of teachers to accept changes in Curriculum

Identify rationale for training teachers

List and discuss various ways of motivating students for successful curriculum implementation

4.0 CONCLUSION

The interaction between teachers and learners and among learners and teachers go a long way in the implementation of the curriculum. So, training the teachers and motivating the students are germane to successful implementation of the curriculum.

5.0 SUMMARY

In this unit, you have learnt:

1 Implementing Integrated Science curriculum: The necessity of motivating the students.

2 Implementing Integrated Science curriculum: The necessity of training the teacher.

6.0 TUTOR MARKED ASSIGNMENT

Do you prefer a good curriculum in the hand of bad teacher? If no, how can you make a bad teacher good for successful implementation of the curriculum?

7.0 REFERENCES / FURTHER READINGS

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THE ART OF TEACHING INTEGRATED SCIENCE AND THE MAKING OF AN EFFECTIVE INTEGRATED SCIENCE TEACHER

CONTENTS

1.0 INTRODUCTION

On a global perspective, educational researchers continue to convey the need for reforms in education in an effort to promote a more critical professional literacy and upgrade teacher capabilities. Consequent on this, there is a question that should call for the attention of stakeholders in education. Here is the question: "Do we prefer good curriculum to be in the hand of a 'bad teacher' or 'bad curriculum' in the hand of a 'good teacher'?" Answer to this kind of question is simple. Good teacher is the answer. School systems that attempt to respond have an obligation to seek changes that make schools and teaching more effective. Any factor, including affective factors, proven to have an impact on the degree of teacher effectiveness and would be carefully considered in this unit. To start with, the two essential requirements for such a teacher are teachers':

1) Moral transformation and

2) Mental transformation.

2.0 OBJECTIVES

At the end of this unit, you should be able to answer the following questions:

What are the Goals of an Effective Integrated Science Teaching?

What are the Components of an Effective Integrated Science Teaching?

What Makes Integrated Science Teaching Really Effective?

3.0 MAIN BODY

3.1 WHAT ARE THE GOALS OF AN EFFECTIVE INTEGRATED SCIENCE TEACHING?

The goals can be organised into three main categories. Effective Integrated Science teaching must bring about:

1. Skills acquisition
2. Mental transformation of the learners and
3. Creativity

3.2 WHAT ARE THE COMPONENTS OF AN EFFECTIVE INTEGRATED SCIENCE TEACHING?

i. **Planning**

- The lesson: Schedule your time, make clear the objectives of the lesson, always consult relevant textbooks (conventional or e-books), use appropriate instructional materials, select strategy/strategies to use, meaningful activities, etc.

ii. **Presentation**

Attention must be on:

- Relevant and interesting *introduction*
- Minimum teachers' activities but *maximum students' activities*
- Maximum *students' academic freedom*
- Proper *class management*
- *Evaluation* (formative/summative)
- *Maximum reward* but minimum (very negligible) punishment
- *Effectiveness of the strategy* used
- *Feedback* from students
- Teachers' *self assessment/reflection*

iii. **Problem identification**

- How can you handle concept difficulty?
- Wrong/Right choice of instructional methodology
- How do you identify and treat maladjusted children?
- How can you manage large class size?
- Do you have sufficient educational resources? If no, how do you solve this problem?

- How can you manage the instructional time for students' success?

iv. **Pairing (Team teaching)**
No teacher can claim monotony of knowledge. Collaborate with other teachers in the same or relevant field. This will amount to effectiveness and success in the classroom.

v. **Parenting**
Teachers are parent. Teachers will continue to mismanage the learners if they are not conscious of their roles as parents and control their temperaments when students **'provoke'** them so to say. Are you to be provoked at all as an effective teacher? If you are easily provoked by any behaviour exhibited by your students, you are a **'professional dummy'**. It is stupid of a teacher to lose his temper. Control your temper; be friendly, approachable and caring.

vi. **Prospect**
Effective teaching guarantees learners' future in a systematic way.

3.3 WHAT MAKES INTEGRATED SCIENCE TEACHING REALLY EFFECTIVE?

To answer this question, the following points must be properly considered:

1 Identify the most important concepts or skills to be learned.

2 Specify your learning goal (memorization, application, etc) and communicate it well to your students.

3 Carefully select your learning style.

4 Identify difficult works or concepts that require extra explanation.

5 Make efforts to help students make connections to previous learning.

6 Plan meaningful activities and procedures to create interest in the lesson.

7 Groups for group activities must be carefully formed for productive work.

8 Make available relevant materials that could facilitate the teaching-learning process.

9 Schedule your time for the lesson and for different parts of the lesson.

11 Carefully select your evaluation strategy.

13 Identify students with learning difficulty that need extra- or special-help.

14 Make effort to ensure that all students participate in the lesson.

15 Make effort in making sure that students use the concepts you presented in future. Etc.

Exercise

What are the goals of an effective Integrated Science teaching?

What are the components of an effective Integrated Science teaching?

What makes Integrated Science teaching really effective?

4.0 CONCLUSION

Effective teachers are unavoidably needed in our science classrooms today. They are the brains behind national development because they have been successful in developing the child, the right agent for national development.

5.0 SUMMARY

In this unit, you have learnt:

1 The Goals of an effective Integrated Science teaching

2 The components of an effective Integrated Science teaching

3 What makes Integrated Science teaching really effective?

6.0 TUTOR MARKED ASSIGNMENT

How can you as a teacher create the interest/enthusiasm to learn Integrated Science in your students?

7.0 REFERENCES / FURTHER READINGS

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Unit 4

DEFINITION, FUNCTIONS AND ATTRIBUTES OF AN EFFECTIVE INTEGRATED SCIENCE TEACHER

CONTENTS

1.0 INTRODUCTION

Teachers are required to fulfill many roles and perform many duties. At the core of the roles and duties is the real practice of teaching. The primary purpose of this teaching is to promote student learning. In this unit you will learn the attributes and functions of an effective Integrated Science teacher.

2.0 OBJECTIVES

At the end of this unit, you should be able to answer the following questions:

Who is an Effective Integrated Science Teacher?

What are the Attributes of an Effective Integrated Science Teacher?

What are the Functions of an Effective Integrated Science Teacher?

3.0 MAIN BODY

3.1 WHO IS AN EFFECTIVE INTEGRATED SCIENCE TEACHER?

The definitions of effective Integrated Science teachers consist of the following:

1. Effective Integrated Science teachers have high expectations for all students and help students learn.
2. Effective Integrated Science teachers contribute to positive academic and attitudinal outcomes.
3. Effective Integrated Science teachers use diverse resources to plan his learning.
4. Effective Integrated Science teachers organize and manage the classroom environment as an efficient learning environment.
5. Effective Integrated Science teachers collaborate with other teachers, administrators, parents, and education professionals to ensure student success both students with special needs and those at high risk for failure.
6. Effective Integrated Science teachers determine the difficulty of the lesson with the ability of the student.
7. Effective Integrated Science teachers give the opportunities to students to practice newly learned concepts.
8. Effective Integrated Science teachers maximize instructional time to control student learning.
9. Effective Integrated Science teachers use a variety of instructional, verbal methodology and visual aids during instructional process.
10. Effective Integrated Science teachers try to elicit responses from students each time a question is asked.
11. Effective Integrated Science teachers present material in small steps, encourage students to reason out, initiate classroom dialogues, encourage independent thinking, problem solving and decision making, and provide methods of learning with mental strategies for organizing and learning the content being taught.

3.2 WHAT ARE THE ATTRIBUTES OF AN EFFECTIVE INTEGRATED SCIENCE TEACHER?

Effective Integrated Science teachers have the following attributes:

i. Highly methodical;
ii. Certified in content and context of the subject;
iii. Skilful and knowledgeable;
iv. Enthusiastic during instructional delivery;
v. Tactical and logical;
vi Sound mind to read, learn, and deliver the right knowledge and skills;
vii. Not selfish in his instructional approach but has ability to create opportunity for students' active involvement;
viii. Ability to present difficult concepts to learners in a simplified form;
ix. Ability to communicate effectively;
x. Creativity and resourcefulness.
xi. optimistic about students' learning.

3.3 WHAT ARE THE FUNCTIONS OF AN EFFECTIVE INTEGRATED SCIENCE TEACHER?

The effective Integrated Science teacher performs many functions that can be organized into three major roles:

(1) Making wise choices about the most effective instructional strategies to employ.
(2) Designing classroom curriculum to facilitate student learning.
(3) Making effective use of classroom management techniques.

Exercise

Who is an Effective Integrated Science Teacher?

What are the Attributes of an Effective Integrated Science Teacher?

What are the Functions of an Effective Integrated Science Teacher?

4.0 CONCLUSION

Effective teachers are hope for this generation. The crop of learners nowadays needs teaching scholars that will change their night to day and bring the whole world to them through their expertise.

5.0 SUMMARY

In this unit, you have learnt:

1 Who is an Effective Integrated Science Teacher?

2 The Attributes of an Effective Integrated Science Teacher.

3 The Functions of an Effective Integrated Science Teacher.

6.0 TUTOR MARKED ASSIGNMENT

An effective Integrated Science teacher is a model, maker and mentor. Discuss.

7.0 REFERENCES / FURTHER READINGS

Weimer, M. (2009). Effective Teaching Strategies: Six Keys to Classroom Excellence. http://www.facultyfocus.com/articles/effective-teaching-strategies/effective- teaching-strategies-six-keys-to-classroom-excellence/

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Unit 5

CRITARIA FOR MEASURING AN INEFFECTIVE INTEGRATED SCIENCE TEACHER AND THE MAKING OF AN EFFECTIVE INTEGRATED SCIENCE TEACHER

CONTENTS

1.0 INTRODUCTION

Teaching goes beyond being a profession but a calling, where one is given power to pass not only knowledge but skills, right attitudes plays fundamental roles culminating in to classroom success. This unit closely examines different roles of a teacher and also considers the criteria for measuring an ineffective Integrated Science teacher.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

List the criteria for measuring an ineffective Integrated Science teacher?

Identify what is expected to be the roles of an effective Integrated Science teacher.

3.0 MAIN BODY

3.1 WHAT ARE THE CRITARIA FOR MEASURING AN INEFFECTIVE INTEGRATED SCIENCE TEACHER?

An ineffective Integrated Science teacher is fond of:

a. Putting on cruel outlook.
b. Making himself a 'teaching soldier'.
c. Using punishment always as the only means of correcting students' wrong/bad behaviour (A specialist in the use of cane).
d. Not always excited and enthusiastic.
e. Fond of using mannerism.
f. Using slang language and derogatory words.
g. Always being pessimistic about learners' achievement.
h. Measuring academic victimization on students due to sexual (immoral) feelings and
i. Inability or reluctance to accept corrections from learners/colleagues.

3.2 THE MAKING OF AN EFFECTIVE INTEGRATED SCIENCE TEACHER

Anybody who is expected to be an effective Integrated Science teacher should be ready to be as:

1. *Cool headed individual***:** control your emotion not to hamper your student but to favour them.
2. *Parent***:** To love (not lust) and care
3. *Reader***:** To show yourself approved
4. *Researcher***:** To solve a defined problem
5. *Observer***:** Observe students' appearance, regularities, attention, interest, participation, etc.
6. *Psychologist***:** To study the behaviour (negative or positive) of the students with a view to helping them.
7. *Counsellor***:** To counsel them on career choice, emotional feelings etc.
8. *Sociologist***:** Always create time to give them moral talk.
9. *Instructor***:** Prepare and plan to give them what will meet their instructional needs during classroom interaction.
10. *Inspirer***:** Students develop an inner drive to forge ahead and relentlessly pursue their careers in life.
11. *Friend* to all students and their parents and finally,
12. *Hope* for students' future.

Exercise

List the criteria for measuring an ineffective Integrated Science teacher?

Highlight the roles of an effective Integrated Science teacher.

4.0 CONCLUSION

To define a teacher is easy but to describe in details what a teacher means could be demanding because a teacher is a complex person in one body with diverse roles that makes it more complicated. In other words, a teacher is a person of different responsibilities and jobs blended into one. A teacher needs to have all the positive traits available; patient, kind, loving, caring, honest, real, down to earth, friendly, calm, alert, smart, etc., because she/he has a lot of responsibilities to take care of and must be able to adapt to different personalities and situations around her/his.

5.0 SUMMARY

In this unit, you have learnt:

1 The criteria for measuring an ineffective Integrated Science teacher?

2 The Making of an Effective Integrated Science Teacher
(The roles of an effective Integrated Science teacher).

6.0 TUTOR MARKED ASSIGNMENT

Defining an Integrated Science teacher goes beyond imparting knowledge. Do you agree with this statement? Justify your answer.

7.0 REFERENCES / FURTHER READINGS

Doverspike, L. (ND). Seven Principles of Effective Teaching.
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Role of a Teacher as a Moral Educator.
http://www.ascd.org/publications/educational-leadership/mar03/vol60/num06/Moral-Teachers,-Moral-Students.aspx