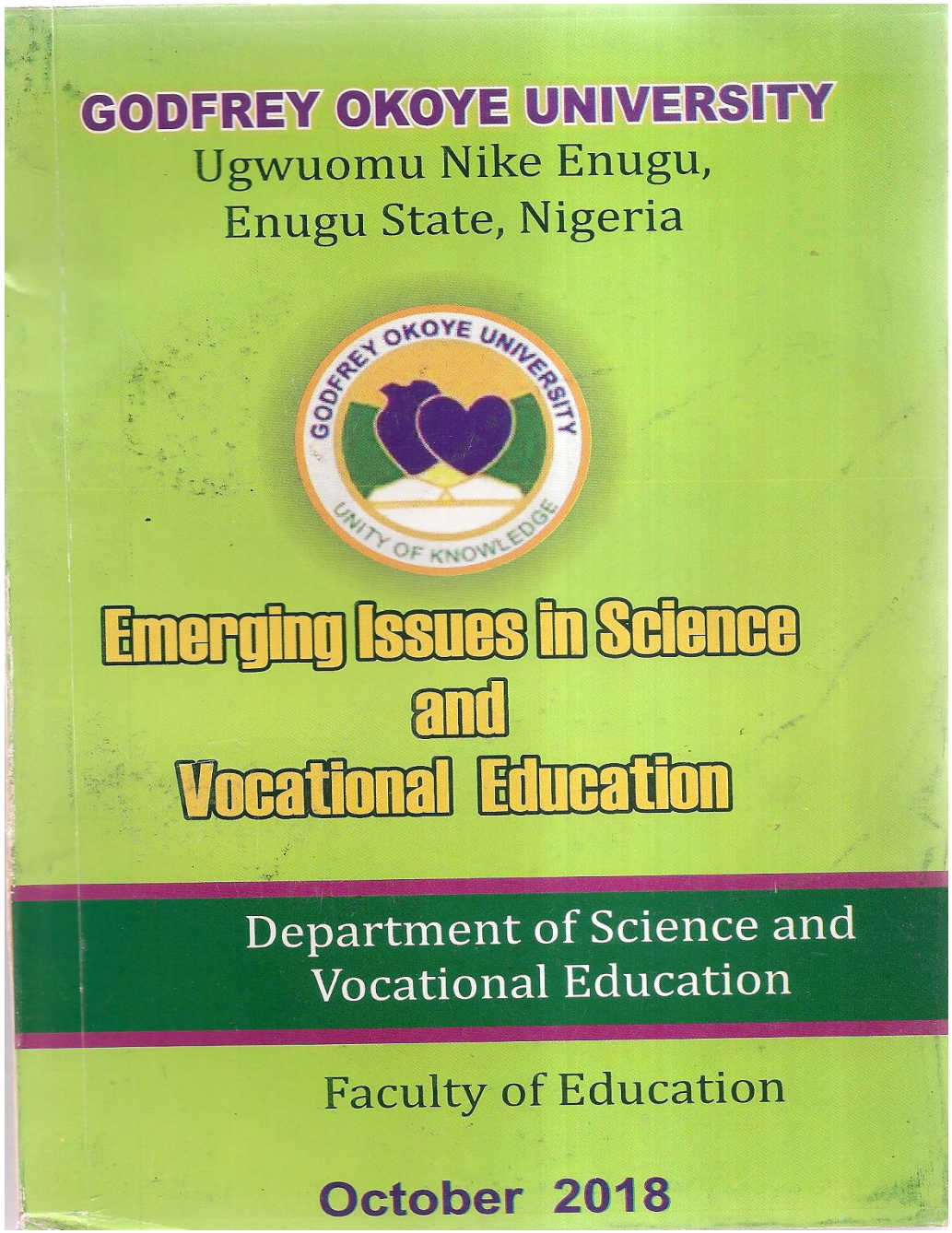

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CHAPTER 19

SOME ISSUES IN THE TEACHING AND LEARNING OF MATHEMATICS

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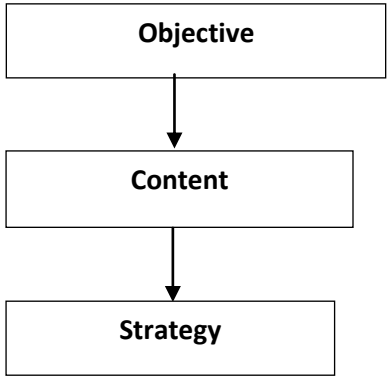
Introduction

As mathematics educators, our main job is primarily concerned with educating students. The process of education goes on all the time, at school, at home, even when relaxing. It is influenced by environment, people, physical and emotional problems and by a lot of other experiences which often seem hazardous and uncontrolled. Yet in the school, we try to maintain a process known as teaching process. In some curriculum, such as the J.S.S. Volume 1, 1985 Science Curriculum on Mathematics, the teaching process is summarized in a flow chart as illustrated below:



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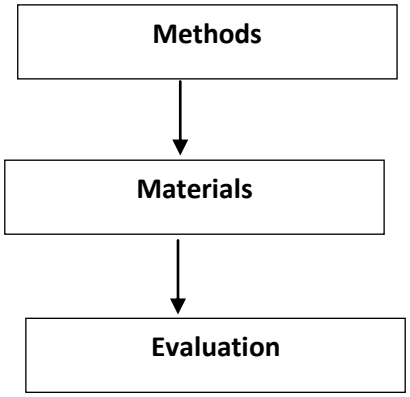

GOALS OFMATHEMATICS EDUCATION

Goals of mathematics education are the expectations to be achieved in the study of mathematics. Here, we are anxious about knowing our destination which is the objective and how to select appropriate materials, content or instructional materials that will help in attaining the objective (destination). Again, we can evaluate the effect of our instruction when we have seen the effort we have made in attaining these goals. Whatever should be the goals must definitely agree with the general goals of education. Scopes (1973) divides the goals of Mathematics education under a number of sub-headings;

1. **Utilitarian Goals:** Utilitarian goals are of two levels those of the state (country) and those of the individual. From the nation's point of view, education is a resource; it must therefore provide sufficient number of trained professionals to meet the requirement of the nation in its continuing existence and development.
   Clearly, the place of secondary education in this development is crucial Apart from the need for

people to do a number of specific jobs, there are certain practical or utilitarian skills that tan be expected of school children. Among these is the ability to read and write and to do a minimum amount of mathematics.

1. **Social Goals:** Beside the utilitarian goals, the society requires of the school leaver much more. The society expects that the student should see himself as the integral part of the community in which he lives. This includes his immediate family, school? Community, local community, various organizations. He should see himself as a citizen of the country with certain rights and responsibilities and having an attitude of understanding and concern for other people. The student should see each other as important; no one can claim to be more important than the other.

2. **Cultural Goals:** Every society has its own culture and part of the duty of education is to make young people aware of the virtues of the culture they inherited. Much of the culture of the country is written in its history and clearly some knowledge of the history of one's country is expected of any school leaver. The study of history will reveal the inner motivations of men through the centuries. It will touch on the values to be honoured and those to be deployed.

3. **Personal Goals:** This relates to the proper development of the ability of each individual for his own sake, to help him lead comfortable life with a measure of confidence, i.e. to find pleasure in a variety of activities. All these require the recognition of each person s n-• individual in his own rights distinct, separate and valuable for himself.

OBJECTIVES OF MATHEMATICS EDUCATION

In the previous section, we have seen briefly th goa1 of education under four headings: utilitarian, social, cultural and personal goals. We shall now try to discuss the objectives of mathematics education in each of the mentioned goals above.

The utilitarian goals are the most obvious and so they often assume too large a part of the overall objectives of mathematics education. Every person on leaving school should have clear ideas about number whether large or small. He should understand the way number is applied to measures of all varieties, particularly to those physical concepts he comes across most frequently, i.e. Length, volume, weight, area, density, temperature, speed, acceleration, pressure, etc. His knowledge of such measures should not be just academic but also practical so that the can estimate with reason the standard measure of the community; example, having an appreciation of the Size of standard metric measures. He should be able to use correctly, accurately and with understanding the four me fundamental operations of addition, subtraction, multiplication and division as applied to both numbers and measurements. He should be able to represent solid figures (3-dimensional shapes) on paper and understand the concept of ratio and scale drawing.

In teaching mathematics, it is also an objective that school leavers should read, interpret graphs, diagrams and tables, especially those relating to statistical evidence. He should recognize that graphs are frequently convenient and Powerful ways of representing

relation, as such Play an Important role in the discovery of relations. Example,

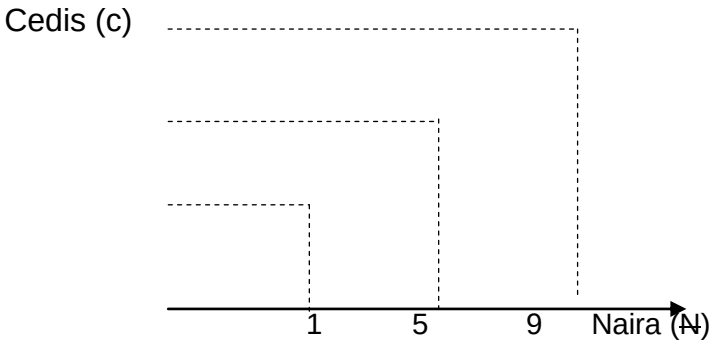

Fig. 1: Graph of relationship between Naira (N) and Cedis

Note: the graph is not drawn to scale.

The graph shows the relationship between Nigeria Naira (N) and Ghana Cedis (?). School leavers should be able to answer the following questions based on the graph above.

i. What is the equivalence of 10c in N?

ii, How many (?) will a Ghanaian change to buy an article costing #50 naira in Nigeria?

iii. What amount will a Nigerian change to buy an article costing 60c in Ghana?

The above mentioned objectives are very basic. We also teach mathematics as a tool for specialized occupation like science, engineering, economics and computing. In this connection, basic algebra, calculus, trigonometry, statistics etc. are considered as essential background.

There are also some objectives based on social goals on education.

Social objectives of teaching mathematics

Students need to understand how mathematics methods are used to investigate, interpret and make decisions human

affairs and how mathematics contributes to the understanding of natural phenomena. These methods may be summarized in four words:- scientific, Intuitive deductive and inventive (Ezike and Ohodo, 1991:4). In ideal situation each should be present in any overall programme of teaching mathematics.

Scientific Method:

Here, one seeks to discover order, pattern and relations. These patterns may relate simply to different, sets of numbers as in the study of series or they may relate to the set of quantities or measures e.g. increase in weight, length of pendulum etc. Certainly, the existence of pattern seem imply in relationship and making such relationships hold, is one of the fundamental objectives of mathematics. This is very evident in the study of graphs. Discovery of a relation is immensely satisfied and students should be allowed as far as possible to make such discoveries themselves. This helps to improve theft attitude toward mathematics.

Intuitive Method:

This is the intellectual technique of arriving at plausible but tentative formulations without going through the analytic steps by which such formulations would be found to be valid or invalid conclusions (Bruner, 1966). Bruner wanted learners to develop this type of thinking as much as possible and considered it a form of academic guessing that will generate more creativity. This is consistent with Polya's &s (1954), belief that let us learn proving, 'but also let us learn guessing. This method also involves a sudden discovery without a deliberate, conscious and well established procedure. Since this does not involve a

step-by-step and reversible process, care must

be taken as such discovery might be based on misconception

Examples 1. 2X2= 4 2) 2 +2 = 4

$\frac{3}{3} X \frac{3}{1} = 4\frac{1}{2}$ $\frac{3}{2} + 3 = 4\frac{1}{2}$

$\frac{4}{3} X \frac{4}{1} = 5\frac{1}{3}$ $\frac{4}{2} + 4 = 5\frac{1}{3}$

$\frac{5}{4} X \frac{5}{1} = 6\frac{1}{4}$ $\frac{5}{4} + 5 = 6\frac{1}{4}$

A possible intuitive discovery might be that multiplication and addition are interchangeable. Here is a counter example:

2X3=6

2+3=5

This Show that such a discovery' is invalid.

Deductive Methods:

Deduction is another effective method in mathematics. It is clearly linked with intuitive method. Here, by working forward and backward, a whole chain of reasoning is established to link in a logically convincing way, the result of one's insight or intuition to a framework that is mathematically unacceptable. When writing books or precisely papers or projects iii mathematics, it is the trivial deductive process that is put in view. Although this they

seem to be duly long, the process is by far convincing. Deductive method is based on deduction. We proceed from general to particular and from abstract and concrete. In this type of method the educator tells the rule principle or law with the help of specific examples. According to Eya and Igbdkwe (1999), the rules are given and then students are asked to apply these rules to solve problems.

Inventive Method:

In the inventive method of teaching mathematics, what we do is to give a name to a concept which otherwise is not definite. In other words, we define an ideal element which has no physical reality but can be seen as a mathematical model or concept which represents the real world in all essential features. For instance, the concept of limit and infinity. The provision of adequate symbol for their representation is also a part of inventive method of mathematics.

Cultural objectives of teaching mathematics

In considering cultural objectives of teaching mathematics, we invariably want to consider the part mathematics has played in the culture by the world of the past and continue to play in the culture of the world today. Every student should know a bit of history of mathematics and how this has influenced the thought processes of successive generations. More especially, students should know three important aspects in the development of mathematically thought.

1. Complete or original thought processes which have changed completely the thinking of the world, these include: The Invention of a symbol for zero, Descartes' idea of representing a point in space by co-ordinates, the advent of calculus and in modern times the e1ectronc computer, etc. (Johnson & Rising 1972).

2. Development of techniques and a widening of the field of both pure and applied mathematics. This is the role played by the new generation.

3. The last aspect is rather an internal phase whereby the foundations of mathematics are-critically examined and the structure of mathematics thereby strengthened. This led to the development of new geometries including Euclidean and trans-formation geometry. Alongside the three aspects of development in mathematical thought is the development of

mathematics as a language Hence 257 can b d in mam 1 Languages and in all these languages the statement is acceptable mathematically so the language of mathematics is internationally accepted.

Content of Mathematics Education -

After defining the objective of mathematics education, the next step is the selection of the appropriate contents. The efforts made at this stage culminate in defining curriculum or outlining the course it is essential for every teacher to be able to say why any particular topic is included, for whom it is appropriate and in what way it can be best presented to learners.

For each content for a course, there is need to determine an appropriate strategy or approach for illustration or teaching. This will basically depend on the nature of topic itself; the class in question, and the overall objective which must constantly be kept in mind. Closely related to consideration of strategy are consideration of methods and materials.

Strategy-of teaching mathematics

The classroom is a dynamic environment, bringing together students from different backgrounds with various abilities and personalities (Eya &Igbokwe, 1999). Being an effective teacher therefore, requires the implementation of creative and innovative teaching strategies in order to meet students' individual needs.

A strategy is developed by straight forward, conventional lesson with the teacher talking with the class

and using the chalkboard. He could as well use other things, e.g. work cards or group discussion. The final step in teaching is to evaluate the work done by the teacher, the level of understanding and the attainment reached by the students. This can be done in a variety of ways, namely: tests, exercises, written work or project, discussion, etc. What the teacher finds out will affect the previous steps in the process

so that changes can he made when - the teacher revises or re-teaches. In this sense, the work of a teacher is never done; there must be constant evaluation, criticism and search for improvement.

Methods of teaching mathematics

Research findings have shown that there is no one best method of teaching, (Johnson and Rising 1971). Johnson and Rising were of the view that the method selected depends on the topic, the class, the objectives, and the procedures known to the teacher. Some guidelines however, may be considered by teachers in selecting the method to be used (Odili, 1986);

(i) The teacher must be familiar with the method

(ii) The teacher should believe in the importance and the efficacy of the method

(iii)The method must be easily understood by the students

(iv) The method must not leave students passive in the class etc.

Some of the methods to be considered are;

Discovery method

Guided discovery method is an aid to problem solving. Here the teacher explains exactly what the student must do, allows them a free hand to carry out the activities, but gives suitable guides to prevent students from derailing.

Group method

In most public schools, especially in the southern part of Nigeria, the number of students in each class exceeds 50. However, few a teacher to prepare teaching aids for such a. Number is tedious and so the grouping method is recommended. In this method, the class is arranged in groups and each group is given something specific to do. When there is limitation of materials and equipment to be used in class for demonstration, this method becomes very necessary. This method is advantageous to students in the sense that it makes for student- student interaction within the group each individual in the group helps to add to the general pool of thinking and so greater discovery is possible.

Some issues in The Teaching And Learning of Mathematics

Lecture / Expository method

This is the oldest method of teaching It requires the teacher to go into the classroom, tell the content development line by line, and allow the students to pay attention and to copy It does not require the opinion of the students. It may entertain few questions from students. The advantages inherent in this type of method include; being useful in large classes, saves time and necessary in the coverage of syllabus.

Demonstration method

In the demonstration method, a material or teaching aid is shown to the class, and a process is verified through this method by the teacher. A demonstration is an experiment if it involves a problem, the solution which is not immediately apparent to the class. A demonstration can also be given inductively by the teacher through asking several questions but seldom giving any answers. It has been shown (Sund & Trowbridge, 1973) that students particularly like experimental demonstrations because they usually have more action. The format for a demonstration lesson should include:

(i) Listing the concepts and principles to be learned:

(ii) devising activities to discover these,

(iii) Writing suggested questions to help students “discover”,

(Iv) Evaluating how well students achieved objectives of mathematics education.

Materials in mathematics education

Materials, otherwise known as learning aids, are the essential part of classroom teaching and learning process. There are different forms of materials that can aid or speed up the process of leaning with or without any assistance of a teacher. Various forms of learning materials in mathematics education

Are categorized below; - -

(i) Concrete objects

(ii) Books

(iii) Models
(iv) Calculator and computer -
(v)Mathematical laboratory
(vi)Audio visual aids

The above materials can be classified according to the categories they belong.

Concrete objects-: beads, counters- these are solid materials for counting leading to place value system. Counters can include stones, bottle tops, coins, sticks, pebbles etc. Books- textbooks encyclopedia Newspapers, work books, laboratory manual etc.

Models:- these are concrete devices utilized by teachers and Students to demonstrate mathematical concepts. They include opaque materials which refer to the concrete models for which the external part is to be considered and are made from opaque materials e.g., a cone, cylinder cube etc. Also, transparency which refers to the concrete models in which the internal structures are required and are constructed from transparent materials such as glass, cellophane, waterproofs e.g. Cuboid, sphere for longitude and latitude, triangular prism.

Calculator and computer: These are electric for computing. They are based on special programmes which yield results of various algorithms operations.

Mathematical games: These are games or puzzles in mathematics to stimulate student interest and encourage self-thinking and learning.

Mathematical laboratory: This is a special room or space reseed in a school for the purpose of conducting practical tasks in mathematics (Obodo, 1997). These tasks according to Obodo, may include building blocks, dismantling objects, laboratory models etc. A mathematics laborato0, will include such items as cardboards, wood blocks, nails etc.

Audio visual Aids: This is divided into print and non-print. - Print includes; books, charts, graph etc. while non-print include; radio, TV, tape recorders etc. Radio and tape recorder emphasize verbal statements (visual aids) while the rest combine verbal with pictorial activities (audio visual)..

Evaluation in mathematics education

Evaluation in mathematics education means the general design or approach to mathematics evaluation. There had not been any clearly defined mode of evaluation generally in Nigeria until 1977 when Nigerian Government first conducted continuous assessment as contained in the National policy on education (Federal Republic of Nigeria, FF14, 1997). Before this, evaluation in mathematics was haphazard and lacked design. Evaluation in primary and secondary mathematics was done by teachers with teacher made tests which include class assignment, take home questions, weekly tests, termly examinations and end-of-year promotion examination (Obodo, 1997): The results o this evaluation are not taken into consideration in the final certification of a candidate. There was one- shot summative evaluation administered to students at the end of school year for promotion purposes.

Conclusion

Some issues in mathematics education have been discussed in this chapter. The processes involved in the teaching and learning of mathematics were also put into perspectives, which include; goals, objectives, contents, strategy, method, Materials and evaluation in mathematics.

Goals mathematics education were discussed looking at the utilitarian, social, cultural and personal aspects of the goals of mathematics education. It is hopeful that every person on leaving school should have clear ideas about number, whether large or small. The person should understand the way number is applied to measures of all varieties of physical concepts like length, volume, weight etc. Besides. Utilitarian goal, the society expects that the students should see himself as the integral part of the community in which he lives. Also it makes young people aware of the virtues of the culture they inherited.

The objectives of mathematics education make students understand how mathematics methods are used to investigate, Interpret and make decisions in human affairs,

and - how mathematics contributes to the understanding of natural phenomena. It is thither summarized in four words-: scientific, intuitive, deductive and inventive. Finally, it is expected that any child exposed to mathematics education should be employable, good citizen, develop interest, aware of Cultural values and have confidence in his abilities.

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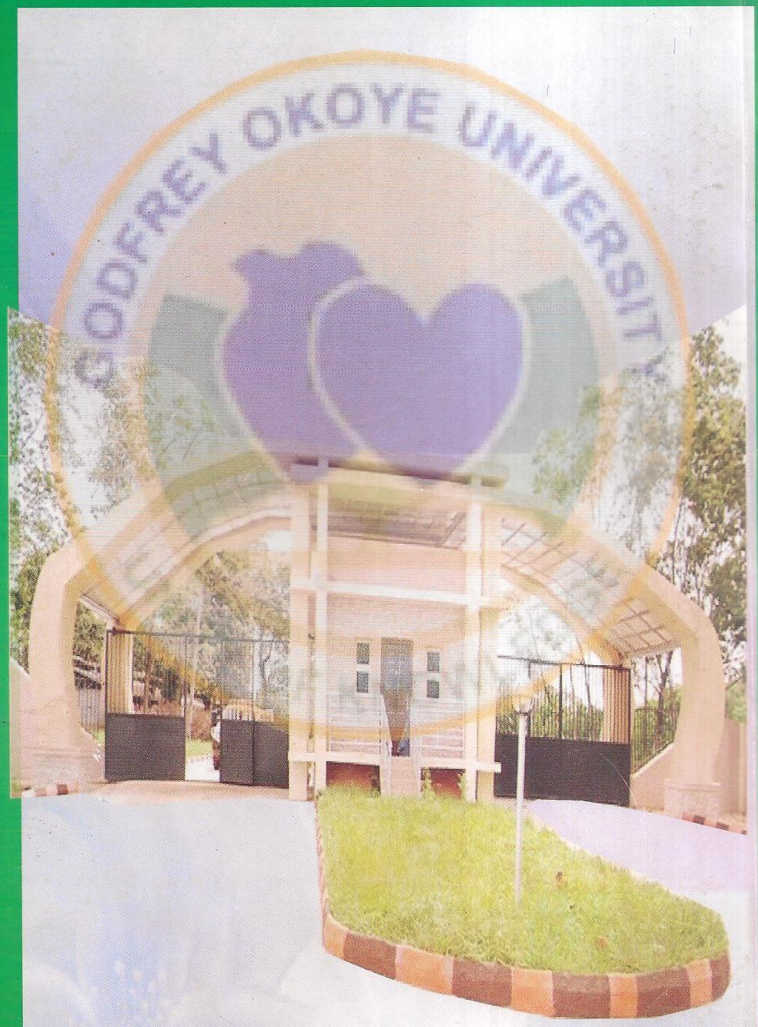

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