

Improving Mathematics Achievement through the Use of Instructional Resources in Secondary Schools

Kyari Sunday Steven & Obed T. Akwana

Department Of Basic Sciences

College Of Agriculture, Lafia

Nasarawa State

danielnuhu92@gmail.com

Abstract

Instructional materials are resources or aids that teachers use to make learning more meaningful. This paper discusses the use of concrete objects to support the learning of mathematics as opined by some psychologist. The paper also discussed the task of selecting appropriate instructional material within given principles. Examples as it relates to some specific topics are also presented in the paper.

Introduction

The term instructional material refers to the items that are used to support teaching and learning. Instructional material, teaching aids instructional resources, teaching-learning materials, educational material are used interchangeably to refer to the same concept. Gaff (1975) defines instructional material as the systematic continuous application of learning principle and educational technology to develop the most effective and efficient learning experiences for student activities that are relevant, evaluating the results of these activities and taking remedial action if necessary.

Instructional materials are resources or material used by mathematics teacher in the classroom. These are resource which both teacher's and his student's use for the purpose of ensuring effective teaching and learning-process.

Potential of Instructional Materials in Mathematics Education

Many researchers have emphasised the importance of instructional materials in the teaching and learning concepts some teachers although have opposed to the use of concrete illustration to represent abstract ideals. Given the abstract nature of mathematics it is important to find something to support its reinforcement. The use of instructional material is not new. Odili (2006) points out that educator have been advised since 1885 to employ manipulating materials in teaching specific concepts in mathematics. He also emphasized laboratory approach to mathematics instruction at the turn of the 20th century. Some psychologists have also studied the effects of the manipulative materials on achievement, retention, attitude and transfer of mathematical concepts. Their results have led some authorities like Piaget, Bruner (1968) and many others to call for the use of the laboratory approach in the teaching and learning of mathematics.

Why do we need instructional materials?

There are many reasons' and opinion why we need instructional material in the teaching and learning of mathematics.

1. Instruction material helps to reduce the abstract nature of mathematics.
2. Using concrete material helps teachers to make learning of mathematics more meaningful.
3. They increase the learner's interest.

4. They increase the learner's intellectual potency.
5. They enhance the memory processing of learner's.
6. They increase the learner's motivation in the learning of the concept.
7. They stimulate student's imagination.
8. They save the teacher a lot of words and so conserve energy.
9. It provides a conducive atmosphere for learning.

Selection of Instructional Materials

The task of selecting the most appropriate instructional material, constitute the responsibility of the mathematics teacher. The mathematics teacher has the technical knowhow to decide what materials are needed, how to raise and spend money on these instructional materials. We know that money plays a vital role in the area of instructional materials for students' effective learning. When funds are available one will probably purchase instructional materials. When funds are short, one may make some of these materials using local available resources (Improvisation).

Improvisation means act of using local available resource to facilitate instruction Odili (2006).

Maduabum (1989) in Odili (2006) sees it, "as the act of using alternative materials or equipment's obtainable from the local environment or designed and or constructed by the teacher or with the help of local personnel to facilitate instruction.

The following considerations are given when selecting a good instructional material.

1. The material should be interesting to students.
2. The material should be economically durable.
3. The material should be easy to replicate by teachers.
4. The material size should be adequate (not too small or large).
5. The material should be simple to use and understandable.
6. The material writing should be clearly and boldly written.
7. The material should be adequate to the learner's age.
8. The material should be relevant to the topic taught

Basic Principles to Guide the Use of Instructional Material

The uses of instructional material in school are to achieve set objectives or goals of the teacher to the learner. Therefore the selection of appropriate instructional material must be very crucial. Below are some principles guiding the use of instructional material as outline by Odili (2006);

1. The behavioural objectives of a mathematics lesson should determine the instructional material to be used.
2. Instructional materials should be adapted to suit the needs of the learners and thus take care of individual differences in learning mathematics.
3. Different instructional materials should be used in a mathematics lesson when necessary.
4. Instructional materials should be used to supplement the efforts of the mathematics teacher. They should not replace the role of the teacher in the classroom.

Instructional Materials in Mathematics for Related Topics

Some instructional material which a mathematics teacher can provide easily with the topics to apply are stated below as contained in Odili (2006:22)

S/N	Materials	Mathematics related concept
i.	Bottle tops, sticks, beads, stones Melina seeds. etc	Counting, addition and subtraction
ii.	Abacus (using sticks, bicycle spokes beads or bottle tops)	Counting, addition, subtraction and place value
iii.	Cutting of geometric shapes, from plane sheets, wood, cardboard	Fractions, shapes and properties counting, addition and subtraction
iv.	Geo board or nail board and graph board.	Geometric shapes and their properties bar chart, histogram, pictogram, simple, quadratic or simultaneous equation graphs and other graphs.
v.	Tape, wooden metre rule	Length, height
vi.	Wooden scale or balance	Weight, simple equation
vii.	Beer bottle, tin empty packet tea/table spoon, tins of milk	Circumference and area of circular shapes. Volumes and capacity, surface area.
viii.	Coins, bank notes, various article, (e.g books, pens, pencil, metre rule) for sale	Shopping, addition and subtraction of money.

Some instructional resource materials used in teaching mathematics

a) Textbook

The textbook is an essential resource material in the teaching and learning process. The textbook is a very good instructional material when adequately used. Most often the teacher uses the textbook as a guide to the curriculum. Even some curricula are plane in respect of the textbook to use. The ideal situation is that the curriculum should select the textbook to use and not the reverse as the case may be. The textbook is a source of information to both the student and the teacher. Textbooks are reference material for the review of classroom work. A good textbook is a collection selected and guided work for learners. The detailed information that a learner did not grasp during the course of the teaching-learning process are contained in the textbook. The textbook allows for students who wants to read ahead of their teacher's to do so. All they need are available for them to read ahead. Students which for some reasons are absent from class will use textbooks to catch up with their fellow students who were in the class. In Nigeria especially the rural areas the textbook is the only source of information for both the teacher and the learner.

Guide to choose a good textbook.

1. Topics should be sequentially place leading learners from simple to complex and give insight to the next.
2. It should use simple language and clear statements.
3. The heading should be clearly written and arranged and attractive.
4. A book should provide sufficient material to motivate learners' to especially drawn from everyday experience.
5. The symbols use must be those that popular, new terms should be clearly defined.
6. Many example and exercises should be addressed including simple and difficult ones.

Selection of Textbook for Mathematics

The selection of mathematics textbook to be used in classroom is the responsibility of the

mathematics teacher. Although we said this is the teachers' responsibility the curriculum planners may however suggest additional books which they feel the topics so included are found in them. This is still subject to the teacher who will check out to see the method used by such authors for final implementation. The teacher should however check books for the following:

- Is the goal of the course captured in the textbook?
- lay out of sequence of textbook topics?
- Availability of the textbook in market.
- Effective methodology by author.

The teacher can in addition check guide for a good textbook to in rich his selection perfection.

b) Models

Models are other important resources use in the teaching and learning mathematics. They are non-projected three dimensional media. Models are concrete objects used to facilitate learning of abstract concept in mathematics. Models make the concept in mathematics meaningful to the learner.

Uses of Models

1. They concretise the ideas passed to students.
2. They are useful laboratory equipment.
3. It will expose students to self-discovery.
4. It can bring excitement to students therefore sustaining interest.

c) Abacus

An abacus is a counting device. This device is best use to teach students the place value when working in different bases. A wood can be used for the frame the bicycle spoke are used for the rods. Beads or cardboard disc are suitable for the counters. When colours are used on the beads or bottle cover as the case may be, the counting is made easier.

d) Scale Balance

The scale balance is a device used to treat topics like weight and simple equation.

Materials

1. A wooden arm 90cm x 5cm x 2cm (may be longer or shorter as desired).
2. A piece of wood (base) as desired to get a balanced.
3. A wooden stem (45cm x 5cm x 5cm, as desired).
4. String of length 120cm or as desired.
5. Two plastic plates
6. One bolt and nut
7. A semi-circular cardboard tagged with "right and wrong" zone marking.
8. A pointer to indicate balance.
9. Wooden blocks of various sizes mark; 1, 2, 3, 5, 6, 7, 8,

Construction. When the materials are assembled accordingly the device is therefore designed or improvised for use in teaching – learning process.

e) Games:

The use of games in mathematical experiences has not been fully utilized. Most teachers have

not been able to use this concept to stimulate mathematical thinking among students. Perhaps the programme of teaching education has not been able to incorporate this concept of games effectively in the curriculum. Therefore produce teaches with these kind of competence is still in doubt. The use of game inspire in students spirit of good competition and using winning or defeat as a yardstick to strive harder to maintain your winning or overcome your defeat in good faith. Instructional material should be made available for development and practice. According to Obioma (1983) in Odili (2006) asserts that games and mathematics learning are related, in the sense that each has rules, involving experience, drill and practical applications.

Uses of Mathematical Games in the Classroom

The word game can create excitement among students in the class. It can turn the classroom noisy and uncontrollable. In appropriate use of game method could make both teacher and learner's not to achieve anything.

The teacher may therefore use the following as a guide to achieve success in class using game method.

1. The teacher should select appropriate game that match the class needs, topic and the interest of the teacher himself for effective guidance.
2. The game should be used or introduced the game at an appropriate time during the lesson to be able achieve an objective or as introduction to bring in new topic as the case may be.
3. The teacher should arrange, and gain control of the class to all full participation of class members.
4. The teacher should carefully plan and organize the introduction of the game so that he can achieve the set objective.
5. The teacher should emphasized learning and evaluation at the end of the game process so that students can be more careful and attentive in carrying out the exercise.

The teacher should be able to explain clearly what the game stand to protract in the actual learning process.

f) Mathematics Laboratories

Mathematics laboratory just like any other laboratory in science is resource centre for learning of mathematics. The mathematics laboratories house equipment's that are liable to students' manipulation for clearer and better understanding of concept. Mathematics laboratory is a centre that is filled with all kinds of possible teaching aids, bought or improvised for effective teaching and learning of concepts. The setting of mathematics laboratory is expensive, but it is advisable that every school should have a mathematics laboratory at its grassroots so that the learning of mathematics can be exciting, interesting and meaningful for learners.

With mathematics laboratory in placed and equipped, students can be involved in discovery of mathematics relations and properties. Since students are allowed to do the thinking by themselves as they play with equipment in the laboratory. Students will have free hands to explore the variety of experiment and practice in the learning of mathematics and its related applications.

Materials in Mathematics Laboratory

The mathematics laboratories should contain all the items mentioned in list of improvise instructional materials and the following should also be included;

1. Cutters i.e. saws, blade, penknife and scissors.

2. Turners i.e. screw drivers, spanners etc.
3. Drill bits for making holes
4. Chissel, jackplane and smooth plane
5. Protractors, ruler, set squares
6. Paint brush
7. Vice mounted on table.

Conclusion

The discussion has highlighted some basic instructional resources that the teacher would apply to foster his teaching techniques. It is important for the teacher to identify in advance the resources needed for a particular lesson. He should also understand clearly the role of the teacher and student in the course of the lesson. Any instructional resources should be selected on the bases of its potential in the achievement of objective in the topic on ground. The resources should be able to assist to remove the abstractness of the mathematical concept. Activities should be reflected upon and be well planned to facilitate meaningful learning. Factors that guide for selection of teaching and learning resources have been discussed.

References

- Ezike, R. O. and Obodo, G. C. (1991): The Teaching of Mathematics in Schools and Colleges.
Eha-Amutu: Division of General Studies College of Education Ahu-Amutu, Enugu State.
- Obodo, G. C. (1991): Implementation of the JSS Mathematics Curriculum in Nigeria: Problems and Remediation. *Journal of Studies in Educaton* 11(1) January.
- Obodo G. C. (1997): Principles and Practice of Mathematics Education, Enugu.
- Odili G. O. (2006): Mathematics in Nigeria Secondary Schools. A Teaching Perspective. Anachuna Ltd Port Harcourt.
- Kulbir Singh S. (2006): The teaching of Mathematics New Delhi. Sterling Publisher Private\ Ltd.