

Trends in Production of Instructional Materials for Improving Mathematics Teaching In Lower Basic Education in Nigeria

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Abstract

Understanding of mathematics is both theoretical and practical that requires adequate instructional materials for effective teaching and learning process. Instructional materials helps pupils to interact with concrete objects or situations directly thereby enhance the pupils understanding of the concepts and the development of positive interest in the subject. Instructional materials are information carriers designed specifically to help fulfill objectives in teaching learning situation. Instructional materials are objects of study that act as stimuli for the learners. Significantly, there may be a link between the use of instructional materials and effective teaching and learning of mathematics in basic education. Against this backdrop, the paper examined the concepts of mathematics and instructional materials. It equally highlighted how children learn or fail mathematics. It further examined how teacher teach or destroy children interest and achievement in mathematics. Finally, it highlighted how to improve basic education mathematics teaching through the designing, production and use of teacher made instructional materials. The paper recommended that mathematics teachers should use real life object during mathematics instructions as well as games and audio visual materials and instructional materials in inculcating mathematics in pupils.

Keywords: *trends, production of instructional materials, mathematics, mathematics teaching, lower basics education, teaching materials*

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I. Introduction

The medium through which the individual acquire the needed skill for sustainable development is learning. Learning outcome, otherwise known as academic performance has become a parameter in measuring success in pupils. In spite of all guidance and counselling strategies embarked on in schools to improve pupils' academic performance in mathematics, poor performances are recorded yearly in lower basic education. This has been partly attributed to dearth of qualified teachers, poor quality of instructional techniques employed by teachers, poor conditions in schools across the country and overcrowded classroom. Several efforts have been made by psychologist, counsellors, parents, teachers and researchers to solve the problem of poor academic performance among pupils. Some of these efforts are in improvement of instructional techniques employed by teachers, method of presentation before the students, orientation programme and work-shops for teachers.

Admittedly, understanding of mathematics is both theoretical and practical that requires adequate instructional materials for effective teaching and learning process. Instructional materials helps pupils to interact with concrete objects or situations directly thereby enhance the pupils understanding of the concepts and the development of positive interest in the subject. Instructional materials are information carriers designed specifically to help fulfill objectives in teaching learning situation. Instructional materials are objects of study that act as stimuli for the learners. Significantly, there may be a link between the use of instructional materials and effective teaching and learning of mathematics in basic education. For instance, Ongamo, Ondigi and Omariba(2017) stated that adequacy of instructional materials is imperative to educational success because they are an inevitable component of the teaching-learning process and enable a qualified teacher to be motivated and to perform better. Achimugu (2017) gave credence to this, when they found out that in teaching and learning

situation in school subjects, instructional materials are helpful because they bring about meaningful experience, in helping student to investigate, motivating pupils to get fully involved in learning activity by arousing and sustaining the learners interest throughout the learning period and situation. Therefore, for pupils in lower basic education to have a firm grounding in mathematics there should be adequate design, production and use of instructional materials for teaching mathematics.

Concept of Mathematics

Mathematics, a subject offered at all levels of educational system, was originally being used by man outside the four walls of school system. Men had all the time been involved in the operations and processes of mathematics using intuition by direct interactions with the physical objects. The development of the subject cuts across many cultures and spans through the ages to the extent that the symbols and elements used in mathematics varied. The variations along side abstract tendencies associated with mathematics elements constituted the problems of conceptualizing its presentations as cultures began to interact. This is one of the reasons why mathematics was been defined differently by different people from different orientations. For instance, at the earliest stage of development, it was defined as science of numbers but recently, Aminu (2005) defined it as study of numbers, symbols, sizes, shapes, spaces, pattern, generalizations, measurements, models, quantities, relationships and functions. This definition is indicative that mathematicians have seen the subject as dealing with more than numbers, to include the uses of numbers (Ezenweani, 2006).

It is necessary to understand the meaning of mathematics from the points of view of many mathematics users. Nelist and Michel in Oginni (2017) defined mathematics as a set of precise and logical languages that lead to interesting activities applied to every day life. Ogunimoyela in Ladele (2017) defined it as the bedrock of all scientific and technological breakthrough and achievement. Furthermore, Obodoin Ojo(2018) saw mathematics as the language that uses carefully defined terms and concise symbolic representations which add precision to communication.

Concept of Instructional Materials

Instructional materials are print and non-print items that are rested to impact information to pupils in the educational process. Instructional materials include items such as: kits, textbooks, magazines, newspapers, pictures, recording videos etc. Instructional materials play a very important role in the teaching and learning process. It enhances the memory level of the students. At this time that education has spread wide and entirely, oral teaching cannot be the key to successful pedagogy; therefore the teacher has to use instructional materials to make teaching and learning process interesting (NIC hulls, 2013; Raw 2010) . According to Abdullahhi (2010), instructional materials are tools locally made or imported that help to facilitate the teaching/learning process. Obanga (2015) viewed them as material things which are used to compose poster that could make tremendous enhancement of intellectual use impact the instructional materials. Instructional materials are all those tangible objects used to facilitate teaching and learning. They are pre-selected objects brought into a teaching-learning situation to provide auditory, olfactory, tactile or visual stimuli/imagery relevant to and/or necessary for achieving the objectives of the teaching - learning situation. Instructional materials give to a lesson the breadth and depth that would be difficult to obtain in any other way. They link thought processes and reality they relate past experiences to a new situation. Hence, they help to make transitions from one idea to another. The creative teacher uses instructional materials to add meaning and interest to verbal instruction. However, in using instructional materials, the teacher must not fail to take pupils from the concrete representation to the concept behind it. The use of instructional materials can enhance learning achievement. Brown (2015) summarized the role of teaching aids as follows:

- It promotes meaningful communication and effective learning.
- They ensure better retention, thus making learning more permanent.
- They help to overcome the limited classroom by making the inaccessible accessible.
- They provide a common experience upon which late learning can be developed. They stimulate and motivate pupils to learn.
- They encourage participation especially if pupils are allowed to manipulate materials used.

How Do Children Learn or Fail Mathematics?

We now know that there are three levels at which mathematics (counting to calculus) can be learned. These are, firstly, through the use of concrete objects such as pebbles, sticks, bottle tops, oranges, etc; through semi-concrete objects as a child grows older such as diagrams, graphs, etc. (Unodiaku, 2002).

If the teaching of mathematics is enhanced, interesting, practical and useful and through abstract work as a child gets more mentally mature/older such as $\frac{7 \times 8}{11} = ?$. After age 7 to 10 or thereabout, there ought to be a shift in emphasis from the use of concrete objects to semi-concrete objects. Finally mathematics should be taught abstractedly.

There are many reasons why children fail mathematics. These reasons can be categorized into socio-psychological problems; environmental problems and curriculum-cum-evaluation problems. Socio-psychological problems concern those that have to do with the teacher and his pupils (their morale, motivation, and readiness to teach and learn). Environmental problems include those of depressing and limiting infrastructural facilities while curriculum-cum-evaluation problems relate to the efficacy, relevance and usefulness of the curriculum in mathematics with regard to the all of them manifest seriously in any child, teacher or school curriculum is meant for. Once any of these three problems or system achievements in mathematics becomes generally poor (Unodiaku, 2002).

Any attempt at enhancing learning or minimizing failures in mathematics at the basic education level must involve the use of play, games and real objects, as instructional materials. All of these must be based on relevant activities. Activities build upon the child's curiosity, creativity, interest and further inquisitiveness. Thus, the child learns mathematics by DOING not by rote which he forgets sooner than later. What we do, we tend to remember because more senses are involved when we do things - touching, smelling, hearing, tasting, manipulating, etc. (Unodiaku, 2002).

How Do Teachers Teach and Destroy Children's Interest and Achievement in Mathematics

They do this by:

- Rote teaching
- Pacing instruction faster than pupils can absorb
- Not being able to inspire pupils
- Not teaching pupils on how to reason or seek and find relationships, and
- Little or no emphasis on real life problems.

From the above reason, one can deduce that overcoming these problems clearly requires the use of a lot of games, play, puzzles and related activities. For instance, if children are engaged in a mathematical play, the question of rote learning, uninspiring teaching, over-paced teaching does not arise.

Therein lies the advocacy for the use of instructional materials/activities /play etc for teaching children mathematics. Nonetheless, the author is aware of the problems posed by large class size and pressure of time in the time table allotment to mathematics, and these make the use of instructional materials, games, puzzles, often cumbersome if not impossible (Unodiaku, 2002).

Improving Basic Education Mathematics Teaching Through the Designing, Production and Using of Teacher- made Instructional Materials

Some lower basic education teachers cannot design teacher made instructional materials for mathematics teaching. Some of such materials include geoboard, flannel board, abacus, flashcards, charts, pictograms, audio-visual tapes of games, quizzes, solids, paper cut-outs of various shapes, sizes and weights, etc. Designing instructional materials involves thinking through and deciding on the following:

- What instructional material do I want to design?
- What are the raw materials needed for producing it?
- What skills are needed for producing the instructional material?
- Do I have the skills needed for the production?
- What purpose would the use of the instructional material serve?
- What is the cost of production and is it worth the use?
- Who is the instructional material for and what special features would enhance its utility and benefit (colour appeal, sturdiness)?
- Can I draw or prepare a prototype of the instructional material I need?

Production of Teaching Materials

This is the stage of putting raw materials together in order to produce the instructional material needed. If one does not have the needed skills, one can arrange for an appropriate skilled workman to construct a needed instructional material under the supervision of the teacher. In all cases there is need to exercise care and prudence in handling tools and materials so as to avoid injury, damage to tools or materials or their wastage (Unodiaku, 2002). The following issues usually guide the nature and scope of production of instructional materials, among others:

- The item to be produced and how many of it needs to be produced
- What the total cost of production will be, based on the quantity, quality and variety of things needed.
- How long it would take to produce it.
- Solutions to the problems of needed skills, tools, raw materials.
- Storage facilities available, for proper and secure storage of materials

- Durability in-put into the instructional material.

Preparation of Models of Plane Shapes

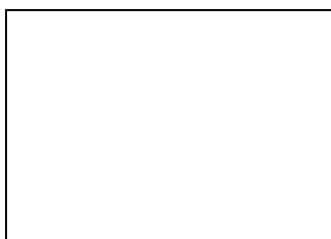
Materials-Needed: Plywood, hardboard or cardboard, razor, scissors, hand saw.

Construction Guide: Models of plane shapes are easy to construct. Plywood hardboard or cardboard can be used; for instance although plywood is the most durable to use, it is also the most difficult to handle for construction purposes. First carefully draw out the shapes (to be constructed) on a plywood, hardboard or cardboard. Make sure that each shape is accurately identified by name or its associated characteristics.

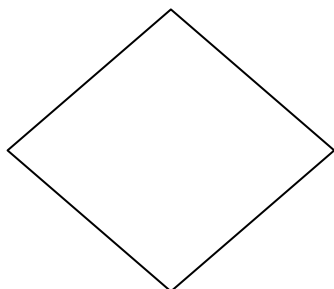
After the shapes have been represented on the plywood, cut them out carefully. You may clear the shapes or add useful information on them, as may be necessary. Prepare the cut-outs as shown in the figure below:

Models of Plane Shapes

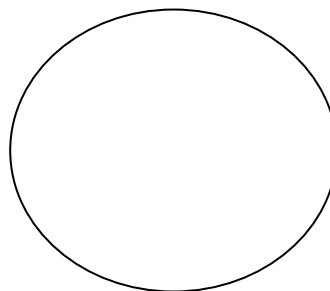
Square



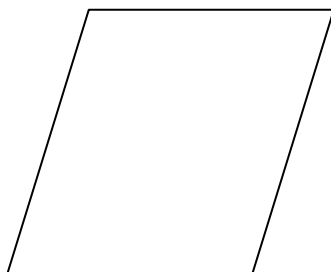
Rectangle



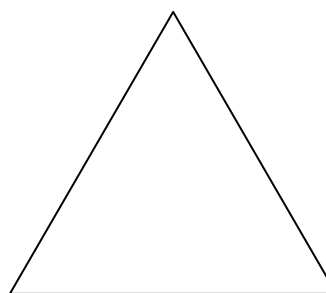
Kite



Circle



Trapezium



Equilateral Triangle

Some of these teaching materials can be borrowed from Resource Centres, State Secretariat of Mathematical Associations, and so on.

Use of Instructional Materials

Teachers should use materials for relevant and useful purposes especially as they concern the concepts being taught. Activities involving the use of instructional materials should not be misused, underused or abused. Children should be allowed full participation in such activities with the teacher acting as a guide or umpire. The use of instructional materials is often guided by the following considerations:

- Storage and retrieval of the material
- Skill needed in using the material
- The educational benefits of using the materials
- Handling problems
- Pupils acceptability of the material
- Maintenance/upgrading problems from repeated use

II. Conclusions and Recommendations

Mathematics, a subject offered at all levels of educational system, was originally being used by man outside the four walls of school system. Men had all the time been involved in the operations and processes of mathematics using intuition by direct interactions with the physical objects. This indicates that mathematics is an important subject because it is applicable to all facet of life. The lower basic education is the entry point in inculcating mathematics in pupils. The inculcation of mathematics at this level may be made better if real life object, games and instructional materials are used during instruction. As such, it may be necessary that the mathematics teacher should be able to plan and produce models and instructional materials to enhance effective teaching and learning of mathematics in the lower basic education in Nigeria. In this regard, the following recommendations are made:

1. Mathematics teachers should use real life object during mathematics instructions.
2. Games and audio visual materials and instructional materials should be used in inculcating mathematics in pupils.
3. There should be training and workshop for lower basic mathematics teachers on designing production and news of teacher made instructional materials
4. There should be regular mandatory training for lower basic mathematics teachers on the preparation of models of plane shapes that can enhance children interest and achievement in mathematics

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