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Improvisation and Effective Utilization of Instructional Materials in Science Education by Student Teachers

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ABSTRACT

Effective learning hinges on concrete experience then proceeds towards theoretical experience. When lessons are presented with instructional materials, students are made to learn through associative mechanism using multisensory modalities. Hence, the need for improvisation and effective utilization of instructional materials by the student teachers to give students the bread of living experience rather than the stone of abstract theory. The effectiveness of instructional materials depends on the degree to which they meet the needs of the teacher and students. To attain effective, efficient and appealing application of improvised material, there is need for systematic planning of instructional development which embraces selection of suitable objective, content, learning experience, teaching strategy, materials and equipment, evaluate results and recommend improvements. The center of attention of this paper is the improvisation and utilization of instructional materials by the student teachers to enhance learning efficiency. The paper elucidates the concepts of improvisation and instructional materials; forms of improvisation, rationales, considerations and tools for improvisation; utilization, selection and types of instructional materials; and guidelines for preparation and presentation of lesson with instructional materials. It is recommended that student teachers should improvise relevant instructional materials locally, and efficiently utilize same to aid meaningful teaching and learning.

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INTRODUCTION

Instructional materials are sometimes lacking, not available or not suitable. This is because they are very expensive and some are sophisticated to come by in our local environment. However, the student teachers should endeavor to improvise most of the materials with available materials in and around the school and in the domestic environment. Improvisation of instructional materials and equipment becomes necessary when their originals are not readily available. For this reason, student teachers should make use of raw materials in the environment, waste and realizable material, and students' collection, and assistance from the local repairers like carpenter, painter, blacksmith, etc in facilitating improvisation of instructional materials to aid meaningful teaching and learning.

Learning is facilitated and consolidated effectively when instructional materials are selected, properly organized, relevant and adequately structured into the lesson activities. When students have access to instructional materials, learning retention has more permanent impression created in their minds than when verbal instructions are given out like the lecture methods often used by teachers in Nigerian institutions (Agogo, 1993). The task of the student teacher therefore is to realize that verbal language is no longer enough, he must master the use of concrete materials to present concepts, principles, laws and theories to the students.

Concepts of Improvisation and Instructional Materials

It is pertinent at the onset to provide working definitions of "improvisation" and "instructional materials". An improvised material is referred to as instructional material; as such, the two words are interwoven. Improvisation could be defined as the act of using alternative materials or resources to facilitate instruction whenever there is lack or shortage of some specific first hand material to enhance classroom instruction. Improvisation is not just mere substitution of the lacking instructional material with what is available but must serve the purpose of the original material. Balogun (2012) sees improvisation as the act of using alternative materials or equipment obtained from the local environment or designed by the teacher or with the help of local personnel to facilitate instruction. In practical terms, it means the provision of an "***alternative best***" which essentially must serve the purpose of the original instructional materials. Instructional materials are educational resources or materials used to improve students' knowledge, abilities, and skills to enhance their assimilation of the lesson,

and to contribute to their overall development and upbringing. The universal task of improvisation and instructional material is to make teaching and learning real and genuine to the students for increased performance and practical application of the lesson in and outside the classroom environment.

Forms of Improvisation

Fundamentally, there are two forms of improvisation as identified by Bomide (2005). The first is ***role substitution*** in which the original item generally requires little or no modification before it can be used to fulfill the teaching need of the class. Excellent examples are the use of kerosene stove as a burner, or a glass tumbler as a beaker. The second is **role stimulation**, which is the actual construction of a new improvised material as an emergency measure when the needed instructional material is either too expensive or not available. A high-quality example is the use of a local carpenter to construct test tube racks, tripod stands, balance and test tube holders.

Both the role substitution and role stimulation are equally important to the teaching need of the class and the student teacher. When the original material is lacking, the student teacher should immediately use his creative wisdom to construct new one using local resources to aid classroom instruction.

Rationales for Improvisation of Instructional Materials by the Student Teachers

The following are the underling-principles for carrying out improvisation by the student teachers:

1. It contributes to the achievement of the educational objectives by providing opportunity to develop necessary skills and attitudes needed to function effectively in the society as professional educationists, technologists or generalists.

2. Improvisation promotes creativity and self-reliance among student teachers and students.

3. Improvisation undertaken by the student teacher enables him to rethink and research for cheaper process easier for the student.

4. It bridges the gap between practical and theoretical knowledge. Thus, it gives the students the ***bread of living experience*** rather than the ***stone of abstract theory*** (*Maduabum*, 1984).

5. Improvisation is particularly important when and where the equipment are available but not affordable, or where technical expertise for repairing equipment is lacking, or spare parts and replacement items are not readily available (Newby, Stepich, Lehman & Russet, 2007).

Basic Considerations in Improvisation of Instructional Materials by the Student Teachers

Certain basic considerations are necessary before embarking on any form of improvisation. Such considerations will enable the student teachers assess the relative worth of the improvised material. These include:

i. What to be taught (i.e. content of the lesson);

ii. The objectives of the lesson;

iii. The background knowledge (i.e. the entry behaviour) of the students/pupils;

iv. The durability of the improvised material; and

v. The cost advantage of the improvisation.

Tools for Improvisation of Instructional Materials by the Student Teachers

Improvisation calls for ingenuity, sound knowledge of the subject matter, professional commitment and imaginative ability on the part of the teacher. However, no matter the intelligence, motivation and ingenuity of the student teacher, he needs certain basic tools to help him make useful improvisation of instructional materials. Some of the basic tools for improvisation of instructional materials include large wood saw, tenon saw, hack saw, fretsaw, G cramps, screwdriver set, files, small vice, handrill and bits, square edge, wire strippers, glass cutter, pliers, spanner, steel rule among others.

Utilization of Instructional Materials by the Student Teachers

It is not enough simply to improvise instructional materials. Some efforts must be made to ensure that they are adequately used. In connection with this, it is imperative to consider appropriate steps in choosing and applying instructional materials to achieve the instructional objectives (Scanlan, 2010). The student teachers should consider the following steps in the utilization of instructional materials:

i. review instructional goals and objectives in line with the cognitive level of the students;

ii. choose instructional strategy;

iii. choose the best medium for the components of the lesson;

iv. find out and review existing instructional materials;

v. adapt existing instructional materials if applicable or decide if new materials needed to be developed;

vi. conduct formative evaluation;

vii. implement i.e. apply material to instruction; and

viii. Evaluate the contribution of the specified instruction.

Selection of Instructional Materials

Certain factors are to be considered by the student teachers in choosing instructional materials. These include appropriateness, relevance and availability of instructional materials. These could be monitored under the following features:

i. the communication channel of the instructional material;

ii. learning objectives;

iii. learners' attributes usually expressed in terms of age, number, interest, background of learners, previous knowledge and experience;

iv. educational theory;

v. the teaching and learning process (method employed, environment and structure of learning experiences); and

vi. time available.

Types of Instructional Materials for Teaching and Learning

Instructional materials can be broadly categorized here into four groups based on their compositions and forms. These are:

i. ***Real Materials***: Real materials include specimens, equipments and reagents, and objects. Specimens are living things such as plant, animal, bacteria, etc. Nonliving components of the environment such as water, air, soil, minerals, rocks, metals, etc are also examples of real materials. Equipments such as hardwares, glasswares, softwares, consumables, chemicals, etc are also in this category.

ii. ***Written and Printed Materials***: Such materials include scientific and scholarly references, methodological guides, teacher's sourcebooks, textbooks, journals, magazines, bulletins, laboratory manuals, encyclopedia, monographs, handouts, pupils' sourcebooks, workbooks, notebooks, etc.

iii. ***Designed and Technological Materials***: These are equipment for transmission and assimilation of information recorded on film or on phonographic recordings. Films, projectors, tape recorders, video, television sets, monitoring devices. Teaching machines like language laboratory, psychology clinic, Closed-Circuit Television Systems (CCTVS), computers and attached devices. These designed and technological materials are usually divided into three groups:

a. ***Audio***: Objects whose output appeal to the sense of sound (ear): e.g. sound box, radio, CD, Microphone, loudspeaker, etc.

b. ***Visual***: Objects whose output appeal to the sense of sight (eye): overhead projector, slide projection, opaque projection, whiteboard marker, LCD, etc.

c. ***Audio-Visual***: Objects whose output appeal to both senses (sense of sight and sound) e,g. Television, Blackberry, laptop, handset, VCD, DVD, IWB, etc.

iv**.** ***Computer Facilities***: Computer today can be used to plan, produce, implement and evaluate classroom instruction. The use of computer and ICT facilitates pleasant excitement to students, brings about great ease and efficiency in learning. It is the new technologies for teaching (Oshodi & Aremu, 2003). The computer can function as an information delivery system. Thus, a programmed software to solve calculation problem and as a tool for

drawing; makes tables, charts and graphs. It can be used for storing and recording information, administering and scoring multiple test items. It is used for monitoring some events on the internet, etc. These benefits make the computer a versatile machine. Teachers and student teachers in particular are enjoined to understand the potential of the computer, capitalize on it and adapt it for teaching and learning.

Guidelines for Preparation of Lesson with Instructional Materials

For effective utilization of improvised instructional materials for classroom instruction that warrant meaningful teaching and learning, the student teacher should meet the following preparatory specifications:

- Preparing the venue and the instructional materials for instruction;
- Check the venue to ascertain that it will be suitable for the number of students, support facilities and appropriate sitting arrangement;
- Ensure that every student will be able to see the instructional material to be used. Make a student eye view of the material from various location of the classroom;
- Make satisfactory arrangement of the lighting and blackout facilities;
- Provide adequate ventilation;
- Make arrangement for control of noise, let the room be as quiet as possible;
- Prepare for good note taking and moderate illustration on whiteboard, chalkboard flipchart, etc;
- Familiarize yourself with the equipment that you intend to use and make rehearsal, trial operations, and control;
- Take precautions; ensure that the layout of equipment will not cause any commotion, guard against accident, leakages on cables, gas and other connections;
- When using projectors, avoid halo effect and keystone effect. These effects are:

i. **Halo effect**: This is a circle of colours at the edge of the image. This can be solved by adjusting the wheel at the side of the projector box.

ii. **Keystone effect**: This is the situation where the image at the top of the screen is wider than at the bottom. This can be solved by slanting the screen away from the wall at its top and ensuring that light beam projected is at right angles to the screen.

- If you are using the internet, ascertain that the web pipes you wish to use display properly;

- In a large classroom, confirm that microphones are working properly. Fine-tune the projection of your voice through initial testing; and

- Confirm the suitability of network access (if required) in case of phones; satellite, internet, etc.

Guidelines for Presentation of Lesson with Instructional Materials

The student teacher should ensure that:

- students can see/hear the instructional material;

- he does not obstruct the view of any student. He should stand to one side of the board or screen or projector;

- students are allowed to read the image on the screen before talking about it;

- when information is displayed on the screen or board, he should talk to the students not the screen;

- he always faces the students while talking; and

- he allows individual student to contribute at a time except for chorus responses.

RECOMMENDATIONS

It is recommended that:

1. Student teachers should improvise relevant instructional materials locally, and efficiently utilize same to aid meaningful teaching and learning.

2. Student teachers should improvise instructional that would meet the objective of the lesson to widen the knowledge horizon of the students through multisensory perceptions.

3. Student teachers should ensure that every student in the class have opportunity to see clearly the instructional material used for the lesson from their seats and allow them to manipulate it for proper assimilation of the learning experience.

CONCLUSION

Improvised materials or instructional materials, if well selected, utilized and appropriately integrated into teaching and learning, will equip students with significant learning performance, thereby increasing learning achievement and retention tremendously through physical skills (use of tools), social skills (interaction with others), concept development (themes, basic features, comparison), process skills (practical activities) and attitude development (interest, persistence to solve problem, perseverance). It is therefore, concluded that student teachers should improvise instructional materials that would meet the objectives of the lesson to widen the knowledge horizon of the students through multisensory, associative and compensatory perceptions. This will have an important effect on classroom teaching for lifelong learning.

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