

IMPROVISATION AND UTILIZATION OF RESOURCES IN THE TEACHING AND LEARNING OF SCIENCE AND MATHEMATICS IN SECONDARY SCHOOLS IN CROSS RIVER STATE

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ABSTRACT

This paper examined the importance of improvisation in the teaching and learning of science and mathematics in the senior secondary schools in Cross River State of N Nigeria. Human and material resources are inevitable in enhancing the teaching and learning of science and mathematics generally and practically at this level of Education. The instructional materials lend credence and reality to abstract concepts taught at this level. Such instructional materials include charts, computers, and television, audio and visual materials. When these materials are not available or inadequate, the teacher is expected to improvise. Adequate and relevant materials give room for effective and efficient teaching and learning of science and mathematics. It is the lack of such a situation that has resulted into poor performance and low achievement in science and mathematics. Therefore these papers recommend that the way forward in this issue is for all hand to be on deck. The teachers, government and all stakeholders in Education should provide and supply to all secondary schools in the state adequate and relevant resource materials for the teaching and learning of science and mathematics. Functional centers for the provision of locally made teaching aids and instructional materials. Teachers should be sponsored by the government to attend workshops and seminars, vocational course and conferences to be enlightened on the latest development in their subject areas.

INTRODUCTION

School environment has been described as an organization where resources are produced, improvised, managed and organized in such a way that enables the students to acquire desirable learning competencies.

Biology and mathematics are science subject which aim at equipping students with appropriate scientific attitude, competences and ability to apply scientific knowledge to every challenges of life. According to Umar (2011) Biology is a natural science that deals with living world: how the world is structured, how it

functions and what these functions are, how it develops, how living things came into existence, and how they react to one another and with their environment. Ahmed (2008) Reported that Biology is a perquisite subject for many field of learning that contributes immensely to the technological growth of the nation. This include medicine, pharmacy, nursing, agriculture, forestry, biotechnology and many others areas (Ahmed and Abimbolas, 2011). In spite of the importance and popularity of biology, Nigeria students' performance at senior secondary level has been poor over the years (Ahmed 2008). The implication of this failure is that Nigeria may have

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shortage in man power in science and technology in future.

It has been observed that science education is a veritable tool for scientific and technological advancement of any nation, this fact is enshrined in the national policy of education (FRN,2004) which state that science education should be among the subject taught to students to equip the students to live effectively in the modern age of science and technology .To achieve this, resources for the teaching and learning of science and technology(Biology inclusive) must be adequately produced and utilized judiciously in our secondary schools. It is on this basis that this paper tend to examine the utilization and production of resources under the following headings.

- Improvisation of biology resources in secondary schools.
- The need for improvisation of biology resources in secondary schools.
- Factors affecting improvisation of biology resources in secondary schools.
- Basic consideration in the improvisation of biology resources
- Influence of improvisation of resource material in the teaching and learning of biology
- Guide on Improvisation of biology Resources.
- Utilization of biology resources in secondary schools.
- Importance of effective utilization of biology resources

Improvisation of Science and Mathematics Resources in Secondary Schools

It has been observed in recent times that both the rural and urban secondary schools are increasing in population and the problem is that of acquiring adequate human and materials or facilities for effective teaching and learning of biology, which is the only science subject offered by both science and arts based students. For teaching and learning of sciences and mathematics to be effective it requires both human and material resources.

The human resources here include a qualified science and mathematics teacher, laboratory technologist, laboratory attendant and the students whom the content of science and mathematics will be delivered to. The science and mathematics teachers are the ones who will deliver the science and mathematics content to

the students while the laboratory technologist and the attendant are to assist him in making and preparing the laboratory and materials where the lesson is to take place. The effective utilization of human resources will help in the effective delivery of science and mathematics lessons.

The material resources in the teaching and learning of mathematics include all the materials that are needed for the effective teaching and learning of science and mathematics. These resources include the following microscope, meter rule, stop watch, mathset, handlens, preserved speciemen, Dissecting kids, petridise, gas cylinder, Aquarium, school building (Laboratory), test tube, mathematical charts, biological charts, beakers, school gardern, models, measuring cylinders, filter funnel, hygrometer, wind vane, wash bottle, quadrate, reagent, live speciemen, weigh balance, rain gauge, thermometer, computer, charts, photographs, anemometer, burnsen burner and barometer etc. The complete provision and utilization of these materials resources will help make the teaching and learning of Science and mathematics by the teachers and the students interesting and effective. One possible solution to this problem of inadequate material resources according to Eguabor (2006) and Akinrotorun (2001) as cited in Adejoh and Ityokyaa (2001) is improvisation.

Improvisation is the act of construction of instructional materials from locally available materials that can adequately replace or function in place of the original material which otherwise may be very expensive or in short supply or unavailable (Eriba, 2011) .Improvisation therefore is not just an un pre-conceived on the spot activity, improvisation is a state of mind and it is a skill that lies at the heart of good science teaching. Eniayeju (1983) as cited in (Eriba, 2011) sees it as the art of using alternative materials and resource to facilitate instruction whenever there is a lack or shortage of some specific first hand teaching aids .Akinmoyewa (1992) as cited in (Eriba, 2011) says it is the art of designing a replica of something to make it function or play the role of real thing using available materials. (NTI, 1990) as cited in (Eriba, 2011) Sees it as the art of using alternative materials and resources due to lack or insufficiency of some specific firs hand teaching aids. Ada, (1985) as cited in (Eriba, 2011) sees it as provision of materials locally made by teachers, students or even an education agency as a substitute and supplement to standard

equipment. Gaberial (1951) as cited in (Eriba, 2011) sees it as the act of using materials and or equipment obtained from local personnel to enhance instruction. Bilikisu (1998) as cited in (Eriba 2011) Describe it as having composed and proving instructional tools or material at hand to meet a basic need. Eriba (2011) sampled option from biologist from different states.

Improvisation is an art of identifying, developing and using suitable materials in the absence of the real one for effective teaching and learning of process, morphology and anatomy of various organs (Biologist from Benue state). Improvisation could mean making of instructional material or teaching aid by science teachers where the original materials are not available or where there are available but not functional (Biologist from cross river state). Improvisation is the local provision of an object or material to meet a particular need (biologist from Kogi). Improvisation is an art of sourcing for and providing substitute materials for the original ones using what is locally available in the absence of standard materials usually aimed at meeting the specific instructional objectives (Biologist from Nassarawa State). However it has been observed that most science teachers are not creative enough to carry out the process of improvisation. Nwagbo (2008) Asserted that most science teachers (biology inclusive) cannot improvise biology equipment and materials because they lack creativity and resourcefulness. Given the indispensability of materials resources to students' acquisition of the much desired practical skills of self-reliance which Nigeria is in dire need of to alleviate unemployment and poverty level in the country .It becomes very important to look at the production and utilization of resources.

The decline in performance in STME may not be unconnected with the poor learning environment created by this state of infrastructural facilities (Fabayo, 1998 and Farombi, 1998). Mapaderum (2002) and Oni (1995) also emphasized that the availability of resources and adequacy of these facilities promote effective teaching and learning activities in schools while inadequacy affect the academic performance negatively. Several attempt has been extended by Science Teachers Association of Nigeria (STAN) to train secondary school teachers on improvisation techniques in various science subjects including Biology, hence there is need to evaluate how far that teachers have been able to improvise materials for effective teaching

and learning of biology. the use of fine granded stick as a meter rule, use of glass cup as a beaker, the moulding shapes using clay, drawing of plants and animals cells using cardboard papers, the use of watch in place of stop watch, the use of stove in place of bursen burner, the use of transparent glass container in place of aquarium.

Need For Improvisation of Science and Mathematics Resources

In an Ideal world, all science students would be taught in small classes held in well-equipped laboratories. In absence of those well-equipped laboratories, the place of practical activities cannot be over emphasized , yet those materials required for the teaching and learning of science are very much in short supply as Adebinspe (1997) lamented that these is a total or partial absent or inadequacy of the science teaching resources and gross inadequate finances most especially for the purchase of science equipment, galloping inflation using enrolment of students generally down ward trend in the nation's economy, poor maintenance culture and at times attitude of some school heads towards science and science equipment for effort at making science teaching and learning what it is supposed to be.

With all these heinous problems, it seem that the best option is the improvisation of science teaching materials in the classroom by teachers and even students, improvisation becomes imperative in a situation where there are scarce resources and facilities .The Nigerian school system today is experiencing a boost in population explosion, giving size to greater demand for classroom and laboratory facilities and equipment with limited government resources, the teacher ingenuity to improvise becomes tasking for learning to be more effective and productive.

Factors Affecting Improvisation of Science and mathematics Resource Materials in Secondary Schools

It has been noted that several factors affect the improvisation of learning resources. Balogun (2002) Identify two main constraints militating against the successful improvisation of science equipment which he mentioned as follows:

Technical Factor

This relate to the question of degree of accuracy and precision that is possible with improvised equipment.

Human Factor

This relate to the teachers skills in developing the resources while providing the appropriate learning experiences to the learners. Maduabum (2003) Report that lack of adequate professional training as a major problem militating against the effective use of local resources for science teaching. Oyediran (Isola 2010) he stressed the need for a definite well planned training programme of improvisation for teachers. He suggested regular meaningful workshop on improvisation techniques for science teachers to improve and update their competence.

Most at times teachers do not have access to the resources needed to conduct science experiments. Improvisation is the act of creating something or using something in the absence of the ideal tools, science teachers often try to teach students about scientific principles through the use of laboratory experiments, though they do not always have access to the resources needed to optimally perform experiments. Innovative teachers can use cheaper products to stimulate experiments; teachers can also help students to learn improvisation as an important life skill .If the technical and the human factors are taken into consideration the process of improvisation becomes very successful.

Basic Consideration in the Improvisation of Science and Mathematics Resource Materials

On embarking on any improvisation in the teaching and learning of biology certain pedagogical consideration is necessary. Some of this consideration according to Madubum (1996) includes:

1. What is to be taught?
2. Objectives of the lesson.
3. The background knowledge of the learner ‘
4. The durability of the improvised materials.
5. The cost advantage of improvisation materials.
6. Individual Difference
7. Learning Environment

The degree of sophistication of the improvised materials will be determined by what is to be taught and the objective of the lesson.

Knowledge of the learners student academic background would provide the teacher with insight to whether the improvised materials would be appropriate to learn the task at hand or not, It is also necessary to give consideration to the durability of the improvised materials. A durable material on a long term basis reduces cost as well as saves time and labour, In the cost advantage, it may be more beneficial to acquire an already existing cheaper factory made material than to spend time and labour to embark on the improvisation of such materials.

Influence of Improvisation of Resource Materials in the Teaching and Learning of Science and Mathematics

Improvisation becomes imperative in situation where there are scarce resources and facilities. According to STAN 40th anniversary conference proceedings (1997), some of influence that improvised materials would have on biology teaching and learning process are as follows:

- Improvised materials provide a cognitive bridge between abstraction and reality to students.
- Improvisation saves cost and in addition the teacher and the students makes positive effort towards effective instruction.
- Improvisation undertaken by teacher enable him to think and research for cheaper, better and faster methods of making the teaching and learning process easier for students

Guide on the Improvisation of Science and Mathematics Resource Materials

Having known what improvisation really is, it becomes necessary to have a guide for biology teachers embarking on the improvisation or production of biology resources .In other words, improvised materials should possess certain qualities and these are as follows:

- Appropriateness of teaching aids to the age of the learners.
- Its clarity in illustrations and simplification of concepts.
- Its adequacy in size.

- Its relevance to the lesson they are meant for.
- It should be interesting to the learners, durable and improvisable among others.

Boulind (1967) stated that when the desirable is not available then the available becomes the alternative if it can perform the same or similar functions as the desirable. It should be borne in mind that resource materials do not achieve any of the attributed values on their own. The usefulness depends on what the teacher makes out of them i.e. the influence made on the students by the teacher with the materials.

Utilization of Science and Mathematics Resources in Secondary Schools

The process of managing and organizing resources is called resource utilization. The utilization of resources in teaching brings about fruitful learning as such it stimulates students' senses as well as motivating them. Denyer (1998), in his study on science game in national curriculum in the united kingdom reported that game used as resource enable less able children to stay on task and remain motivated for a longer period.

There are varieties of resources, which the biology teacher can readily use to enrich learning. These resources are models, charts, preserved specimen of plants and animals, culturing equipment, herbarium and microscope Olagunju (2000) as cited in Okori (2005). The resources should be provided in quality and quantity in science, technology and mathematics (biology inclusive) classroom for effective teaching-learning process (Umeoduagu,2000). Nwoji (1999) in an empirical study revealed that essential facilities such as equipment like radio, Television, Computer, chemicals, specimen, videotapes, stove, burner, models and charts are not available in most schools. This inadequacy of teaching material resources, laboratory equipment / reagents / chemicals and laboratory space has been a great concern to science educators.

The implementation of biology program has been a matter of serious concern to biology educators. This interest stem from the fact that biology, which is the science of life, occupies a central position in the scientific and technological development of any nation (Maduabum, 1992). It is often referred to as the gateway to noble

professions such as Medicine, Nursing, Pharmacy, Dentistry, agriculture.

The teaching and learning of biology just like any other science subject demand active student's participation, involving the use of resources. Resources according to Ityokyaa (2010), refers to those facilities / equipment that can be used to ensure effective teaching and learning. These include laboratory equipment, reagents, visual and audio visual aids, models etc. Nwagbo (2008) poised that biology is activity based and students centered and as such, cannot be taught or learnt without resources. Similarly, Adeyemi (2008) found out that students' learn better through practical approach with the use of resources.

Importance of Effective Utilization of Science and Mathematics Resources

The importance of resources to effective teaching and learning of biology cannot be over emphasized. Resources when appropriately utilized in teaching and learning of biology makes learning more concrete, real, immediate and permanent Shamija (2005). The teaching and learning of biology involving students' interaction with resources will no doubt enhance student acquisition of much desired process skills of self-reliance which most nations of the world including Nigeria are yearning for. One of the general objectives of secondary education according to federal republic of Nigeria (2004) is the preparation of students for useful living. The attainment of these objectives requires adequate production and utilization of requisite laboratory facilities; that will help the students' acquire the much desired practical skills.

In spite of the immense importance of biology resources to effective teaching and learning of the subject, many researchers Nwoji cited in Olagunju and Abiona (2008), Taiwo (2008) and Adejoh and Ityokyaa (2009), found out that essential resources for teaching and learning of science (biology inclusive) are inadequately provided in schools, It is a noted facts that biology teachers do not put the available resources in their school into use. Nwosu (1993) and Aguisobo (1994) found that biology teachers do not utilize the resources available in their schools.

Resources are indispensable in the teaching and learning of science, technology and mathematics education (Biology inclusive) process. The STME teacher is the central figure

in the use of resources for curriculum implementation. This being the case, STME teachers are expected to have a wide knowledge of the usage of resources available for teaching and learning of science (Biology). The STEM (Biology) teachers need to cultivate the culture of utilizing available resources to enhance effective teaching of STEM (Biology). Adegun (1997) stressed that effective teaching and learning to a large extent is dependent on a combination of factors which include personality of teachers, learners characteristics, instructional support, availability and utilization of instructional resources.

Instructional resources is a subset of educational technology. Ughamadu (1992) described instructional resources as different kind of materials of media that teachers and the entire class use in the teaching and learning process so as to make it more effective and productive. Adegun (1997) viewed it as things which are to help teachers to teach more effectively and enable the students to learn more readily. In this context resources were conceptualized as devices used to provide the richest possible learning environment which help the teachers and students to achieve specific objective in the shortest possible time.

Instructional resources when appropriately utilized bring about more effectiveness in teaching and learning process but this depend on the teacher's ability to use them efficiently (Ughamadu, 1992). Creative use of resources in teaching STEM (Biology in particular) increases the probability that STEM (Biology) students will learn and improve the performance skills that are to develop. No wonder Abomibade (1999), attested that instructional resources when appropriately used enhance learning, improve the competency of the teachers and make learning more meaningful to learners. On the other hand, when instructional resources are misused sequel to lack of knowledge on how to use them, STEM teaching and learning process may be adversely affected.

Instructional resources are misused when they are not effectively put into use to achieve predetermined objectives. Misused instructional resources as observed by Abimade (1999) could lead to misconception of ideas, cause confusion and make a learner hate the subject not gain back the motivation that arouse his interest on the topic. Misused instructional resources emanating from lack of knowledge

could result failure of STEM learners and teachers.

RECOMMENDATIONS

- Workshop and seminars should be organized for serving Science and Mathematics teachers on improvisation and utilization of essential material resources in the teaching and learning of Science and Mathematics.
- Non-governmental organization should take it as a responsibility in funding the local production of material resources used in the teaching and learning of Science and mathematics.
- Science and Mathematics teachers should select the cheapest available equipment for demonstration or illustration of principles and science concepts
- Teachers who carries out improvisation should be rewarded and motivated adequately.
- Governments should take sole responsibility of supplying and procurement of necessary instructional materials and facilities, they should equally ensure high maintenance culture by the administrators.
- Employment of science and mathematics teachers should not be based on paper qualification but also acquired knowledge and the level of practical skills should be tested
- Both the Federal and State ministries of Education should ensured that there is the availability of both human and material resources before the take off of any school or giving approval for the take off of schools.

EDUCATIONAL IMPLICATIONS

1. Better understanding of concepts taught by the teacher since the students are able to see what the teacher is talking about.
2. It will enable the teacher have mastery of the subject or concept he or she wants to teach.
3. It enable the Government, both the Federal and State ministries of Education and other Education stakeholders to access the level of teachers performance

and his or her knowledge on improvisation and utilization of resources in the teaching and learning of Science and Mathematics

CONCLUSION

The utilization and production of biology material resources would help to enhance the teaching and learning of Science and Mathematics, if teachers who are the implementers of the curriculum engage themselves in proper utilization and improvisation material resources used in the teaching and learning of Science and Mathematics.

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