

IMPROVISATION OF INSTRUCTIONAL MATERIALS FOR TEACHING SCIENCE IN BASIC SCHOOLS IN ILORIN SOUTH, KWARA STATE NIGERIA

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Abstract

Improvisation is the use of an alternative when the real material or object is not available. Improvised materials are produced from materials like paper, stick, cans, straws and others found within the learners' environment. This paper aimed at sensitizing Basic School Teachers to the production of improvised 2-dimensional visual of internal excretory mammalian organ. These materials were processed to produce the model of a kidney which cannot be seen unaided. Three research questions were raised and answered. Four Educational Technologists and Four Biology teachers were purposively selected and involved in the ratings of the model. It was rated as being cost effective compared to imported ones, the cost of production was ₦1,800.00. Simple percentage was used to analyze the responses from the evaluation form. Findings revealed that quality and suitability were rated 77% and 75% respectively by Educational Technologists, while Biology teachers rated the quality 80% and suitability 78%. It infers that the model is of good quality and suitable to teach Upper Basic students. It is therefore recommended among others, that teacher trainees should be encouraged in the production and use of improvised materials. Teachers should be sponsored to attend Workshops and Seminars on improvisation to enhance more enlightenment. Educational technologists should be employed in schools to teach and guide other teachers on how to convert waste materials to improvised teaching and learning resources. They should also be involved in objective rating of whatever material that is being improvised before utilization.

Keywords: improvisation, two or three dimensional, model, excretory organs.

INTRODUCTION

The environment where learning takes place is important because the resources available can be included in teaching and learning to accommodate learners of various needs. These are human and nonhuman resources that can enrich learning. Some of these materials which are discarded in the environment can be processed to become useful materials to stimulate teaching of integrated science at Basic school levels.

DK Illustrated Oxford Dictionary (2003) expressed science as a branch of knowledge involving the systematized observation of and experiment with phenomena. It is the study of the nature and behavior of living and nonliving things. Ogunleye (2000) also explained science as the dynamic human activity that is concerned with understanding the workings of the world. It means that the study of science helps man to be inquisitive to study mammals and plants. Science subjects include Physics, Chemistry, Biology, and Agricultural Science which are studied at senior secondary level. At Basic school level, Integrated Science is the combination of the science subjects which is taught as prerequisite to prepare students to study science at the tertiary level. It is introduced at the upper basic (Basic 7-9) level for students to be acquainted with science subjects so as to guide their choice of science subjects at the secondary school level.

FRN (2009) posited that special incentives should be made for the study of sciences at each level of national education systems. In order to further encourage learners, instructional materials are used to concretize learning and make abstract concepts clearer. Egwu (2009) expressed that to support the development of 9 years basic education curriculum, the NERDC produced a basic education teachers' handbook on selection and use of instructional materials and resources. Some of these materials are improvised as alternatives when the real objects are not easily obtainable. This empowers teachers to be aware of the materials to use to improve students' performance.

STATEMENT OF THE PROBLEM

Obioma (2009) expressed that instructional materials are scarce in Nigerian schools and teachers are not able to locate and use appropriate materials from local resources. Some of these instructional materials are not available because they could be costly, dangerous to human, too big to be brought to the classroom and not easily obtainable. Also The National Policy commented that sourcing for locally available materials to produce cheap but quality substitute materials are out of reach of the teachers.(FRN 2009) . It is on this premise that the researchers decided to produce mammalian kidney from waste materials found within the school environment.

PURPOSE OF THE STUDY

The main purpose of this study was to sensitize science teachers towards production of instructional materials from locally sourced materials for teaching basic science in Ilorin South Local Government Area, Kwara State Nigeria. Specifically, the study was carried out to:

1. find out the materials that can be used to produce improvised internal mammalian kidney
2. explain the stages of production of the mammalian kidney
3. Rate the improvised material by experts for quality and suitability.

RESEARCH QUESTIONS

The following research questions were answered in the study

1. What are the available materials needed to produce an improvised mammalian kidney.
2. What are the stages involved in the production of the improvised kidney
3. What are the experts rating of the improvised organ as regards quality and suitability

Scope of the study

The study was restricted to use of imitative method to produce a 2-dimensional excretory organ. Human and non-human resources like soft wood (board), straws, paper found within the schools environment were processed to produce the model. Addie model was adopted for the production of the two dimensional excretory organ.

REVIEW OF RELATED LITERATURE

Science and technology have been taken with all seriousness because it is the brain behind development of nature. The National Policy on Education stated that secondary science education should provide trained man power in applied science and technology. Science should be taught early to catch the learners' attention at a younger age to develop their interest (FRN 2009).

Science teaching calls for examining, analyzing and testing through experiments to be able to give a final judgment. FME (2009) supported that junior secondary school students shall be taught basic subjects which will enable the pupil to acquire further knowledge and skills. Farrant (1975) submitted that exploration through science helps man to solve his problems and enlarge his world. Abdulahi (2002) also remarked that science is the foundation upon which the

present day technology breakthrough is built. At the junior secondary level, basic science is taught to prepare junior secondary school students for learning science. In support of this, in 2010 university of Ilorin introduced the Greater Scientist Programme whereby junior secondary school students are sensitized on science education and the functionality of the science environment as part of community service. In this programme five junior secondary school students were purposively selected from the local government and are guided through the process of science practical at the university science laboratories. Part of goals of the University for this Initiative is to influence the interest and choice of science subject by senior secondary school students.

Part of the junior secondary school curriculum is the study of the internal excretory system which involves the removal of excretory waste that are poisonous to the body hence they must be removed. Ndu & Somoye (2013) posited that one of the organs of excretory system is the kidney. This internal organ cannot be seen unaided, thus it needs to be replicated with available waste materials. Also, The National Policy on education supported by specifying the goal of science as to:

- i. cultivate inquiring, knowing and rational mind for the conduct of a good life and democracy
- ii. produce scientists for national development
- iii. service-studies in technology and the cause of technological development; and providing knowledge and
- iv. Understanding of the complexity of the physical world, the forms and the conduct of life (FRN 2009).

Instructional materials are items or tools that are used to disseminate information, they are used to stimulate and enhance learning leading to improved performance. Soetan, Ogunlade, Fakomogbon and Bolaji (2014) expressed that children interact using all the five sense organs to touch and manipulate objects... which eventually lead to learning. Instructional materials are used to appeal to the learners senses and also to concretize learning. These could be audio, visual and combination of the audiovisual. All these materials can be purchased to ginger learners. Adeyemo (2008) opined that instructional media are made available at all levels to assist learners to improve the quality of learning, discernment and attention. Visual materials appeal to the sense of vision alone. Such include printed text, diagram, books and chart. These materials are purchased and used to teach for learning to be concretized. But there are times when such material might not be available hence the need for improvisation.

Improvisation is the use of the alternative when the real one cannot be gotten, too big to be brought to the class, too costly or cannot be seen unaided. Improvised materials should be portable, bold, clear, durable, simple and appealing to learners. Balogun (2000) described improvisation of science teaching equipment as a creation exercise of science teachers' imaginative, professional and technical ability. It is inferred that science teachers should be resourceful to improvise materials for use in the classroom because insufficiency of materials can lead to low productivity, lack of interest in choice of subjects or poor performance of students in science subjects. Part of contribution of educational technology to innovative learning is the use of everything that can be used to improve the learner's attention. Thus the need, ability, interest of the learners must be considered to assist the learners. educational technology considers human and non-human resources within the school environment as contributors to learning via production and use of improvised materials. To improvise instructional material, educational technology adopts creative, adaptive and imitative skills to produce such materials.

Onasanya, Adegbiya, Olumorin and Daramola (2008) commented that improvisation requires adventure, creativity, curiosity and perseverance on the part of the teacher and this can be realized through well planned training programme or improvisation. Ogungbade (2013) also

submitted that improvised materials assist students to be able to participate in sourcing for local materials of which the improvised materials are produced. This encourages interaction with the environment where learning takes place and improves creativity in the learners. If teachers can produce instructional materials by themselves, it will boost their morale and encourages them to do more in other topics.

RESEARCH METHODOLOGY

Research type

The research was production-oriented using Addie model by Dick & Carry 2005 as a guide. The model allowed evaluation at every stage to improve on the model. (Analysis, Design, Development, Implementation and Evaluation.)

Sample & sampling techniques

Four (4) educational technologists and four (4) Biology teachers purposively selected to assess the model using evaluation format.

Research instruments

Evaluation format was designed to assess the model as regards quality and suitability. It contained 20 items. Section A had four items on the bio data of the respondent in terms of qualification, gender, area of specialization and year of experience. Section B was designed to gather information from the Biology teachers and Educational Technologists. This information was built around drawing, design, colour, portability, objective, content and sequence as well as relevance of the model to teaching and learning. Each concept is rated 5 points.

Procedure for data collection

In order to produce an instructional kidney, imitative approach is adopted. This involves use of real picture that is replicated with the use of sourced materials within the school environment. Addie model was adopted for the production of the organ which allows for evaluation at every stage of production.

Analysis – This involves analysis of the age, need, level, interest and ability of the learners to decide on the topic and relevant instructional material to be used to teach the students.

Design – This involves planning, taking into consideration the topic to teach and the improvised instructional material that would be needed.

Development – Materials available within the locality were picked around the school to produce the model. The excretory organ was drawn; paper was soaked, pounded and mixed it with cold water starch. It is molded and allowed to dry for 5 days in an airy space. It was painted and labeled according to the picture in the biology textbook.

Implementation – The model was trial tested on five students. They watched the way it was produced, materials were supplied and they produced the model. This was used to test its acceptability.

Evaluation – Five students from Junior Secondary School were taught with the model. Five other students were taught without the model. The two groups were tested, the group taught with the model performed better. This was to test for effectiveness.

Data analysis technique

The data was analyzed using frequency counts and percentages

Data Analysis and Results

The data collected were analyzed using percentages and frequency counts.

Research question 1

1. What are the available materials needed to produce improvised mammalian organ?

Materials for Making Mammalian Excretory Organ Model include:

i.	Used paper	-
ii.	2 white cardboard sheets	20.00
iii.	1 packet of poster colour	400.00
iv.	Brushes	100.00
v.	Water	20.00
vi.	3 medium size bowls	150.00
vii.	1 drawing board	500.00
viii.	1 ruler	20.00
ix.	1 small flat board	-
x.	Cold water starch	150.00
xi.	Mortar and pestle or stone and a flat surface	-
xii.	1 pencil	20.00
xiii.	1 plastic spoon	20.00
xiv.	Cost of labor for production of realia	<u>500.00</u>
		1,800.00

This implies that the improvised material is cost effective compared to the already made or imported one and considering the effectiveness on the students' performance.

Research Question 2

2. What are the stages involved in the production of the 2 dimensional mammalian organ

Procedure for making realia (mammalian kidney)

- i. Draw the diagram of the excretory organ on the white cardboard with pencil
- ii. Tear used paper into pieces and soak in cold water for a day or two
- iii. On the second day, collect the wet paper, squeeze it and put it in a mortar
- iv. Pound properly until it is soft
- v. Put the pounded paper inside a bowl
- vi. Pour cold water starch in another bowl, add water and mix properly until everything dissolves.
- vii. Add the starch to the pounded paper in a bowl and mix properly with hand.
- viii. Observe the drawing of the excretory organ and mold each part separately.
- ix. Arrange the molded paper on the flat board
- x. Put the board in an airy space for 3 or 4 days.
- xi. Mix colour with water and paint the objects accordingly.
- xii. Use cold water starch to join the molded objects together
- xiii. Use marker to label the parts.

The production of the model lasted for seven days and cost N1, 800.00 the cost implication is necessary to guide users and future researchers towards production of the kidney.

Research Question 3

3. What are the experts rating of the improvised materials as regards quality and suitability?

Table 1: Educational Technologists Ratings on Quality of the model of the mammalian organ.

Five points were allotted to each concept, and rated by four respondents as shown on the table.

SN	Selection Criteria	Rating Scale				Percentage
		Resp1	Resp2	Resp3	Resp4	
		5	5	5	5	
	Drawing					
1	Imitative	4	4	4	4	16 (80%)
	Design					
1	Proportional	4	4	3	4	15 (75%)
	Colour					
1	Attractiveness	4	4	4	4	16 (80%)
	Interpretation					
1	Portability	3	4	4	3	14 (70%)
	Originality					
1	Uniqueness	4	4	4	4	16 (80%)
	Total	19	20	19	19	77%

The table revealed the educational technologists ratings on quality of the model of the mammalian organ. The results indicated that 16 points (80%) was assigned to drawing by the four teachers, 15 points (75%) to design, 16 points (80%) to colour, 14 points (70%) to interpretation and 16 points (80%) to originality. The total score on quality was 77%. It infers that model of internal mammalian organ is of good quality.

Table 2: Educational technologists Ratings on suitability of the model of the mammalian organ

Five points were allotted to each concept, and rated by four respondents as shown on the table.

SN	Selection Criteria	Rating Scale				Percentage
		Resp1	Resp2	Resp3	Resp4	
		5	5	5	5	
	Objectives					
1	Clear & specific	3	4	4	3	14 (70%)
2	Model contains detailed information	4	4	4	3	15 (75%)
	Content and sequence					
1	Simple and free from bias	4	3	4	4	15 (75%)
2	Reinforced learning	4	4	3	4	15 (75%)
	Relevance					
1	It is relevant to teach JSS 3	4	4	4	4	16 (80%)
	Total	19	19	19	22	75%

The results indicated 14 points (70%) and 15 points (75%) were assigned to objectives by the four teachers, 15 points (75%) to content and sequence and 16 points (80%) to relevance. The total score on suitability was 75%. It implies that Educational Technologists rated the model suitable to teach internal mammalian organ in basic schools.

Table 3: Biology teachers' ratings on quality of the model of the mammalian organ

Five points were allotted to each concept, and rated by four respondents as shown on the table.

SN	Selection Criteria	Rating Scale				Percentage
		Resp1	Resp2	Resp3	Resp4	
		5	5	5	5	
	Drawing					
1	Imitative	4	3	4	4	15 (75%)
	Design					
1	Proportional	4	4	4	4	16 (80%)
	Colour					
1	Attractiveness	4	4	3	4	15 (75%)
	Interpretation					
1	Portability	5	4	4	4	17 (85%)
	Originality					
1	Uniqueness	4	5	4	4	17 (85%)
	Total	21	20	19	20	80%

The results indicated that 15 points (75%) was assigned to drawing by the four Biology teachers, 16 points (80%) to design, 15 points (75%) to colour, 17 points (85%) to portability and 17 points (85%) to Uniqueness. The total score on quality was 80%. It implies that the Biology teachers' rated the model of good quality to teach internal mammalian organ in basic schools.

Table 4: Biology teachers' ratings on suitability of the model of the mammalian organ

Five points were allotted to each concept, and rated by four respondents as shown on the table.

SN	Selection Criteria	Rating Scale				Percentage
		Resp1	Resp2	Resp3	Resp4	
		5	5	5	5	
	Objectives					
1	Clear & specific	4	4	4	4	16 (80%)
2	Model contains detailed information	4	4	4	5	17 (85%)
	Content and sequence					
1	Simple and free from bias	5	4	3	4	16 (80%)
2	Reinforced learning	5	4	3	3	15 (75%)
	Relevance					
1	It is relevant to teach JSS 3	5	4	4	4	17 (85%)
	Total	23	20	18	20	81%

The results indicated 16 (80%) and 17 points (85%) assigned to objectives by Biology teachers, 16 (80%) and 15 (75%) to content and sequence, 17 (85%) to relevance. The total score on quality was 81%. It implies that Biology teachers' rated the model suitable to teach internal mammalian organ in basic schools.

Summary of major findings

Based on the responses received from educational technologists and biology teachers on production of mammalian kidney, the result of research questions 1,2,3 are thus addressed as follows;

1. Improvisation encouraged interaction of teachers and learners with the environment where learning took place.
2. Production of improvised materials encourage active involvement and participation of teachers and students to be creative and self-reliant
3. Awareness is created that waste products can be recycled to produce useful improvised materials to teach in the classroom.
4. Improvisation of kidney is cost effective and relatively cheap as local materials used.
5. Educational technologists rated the quality and suitability of improvised materials high.
6. Biology teachers rated the material high which implied that it can be effectively used to teach.

RECOMMENDATIONS

1. Curriculum planners should always organize pre-service and in-service trainings, workshops and seminars on improvisation of science materials
2. Educational technologists should be employed in schools to guide teachers towards improvisation of materials for teaching in schools.
3. Improvised instructional materials should be produced and distributed to schools by
4. Educational Resource Centers
5. Funds should be made available by school proprietors to encourage teachers to produce improvised materials.
6. Teachers should develop positive attitudes towards improvisation where the standard ones are not available.
7. Subject teachers should be involved in the rating before being used.

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