

EFFECT OF IMPROVISATION OF INSTRUCTIONAL MATERIALS ON LEARNING BIOLOGY CONCEPTS BY SECONDARY SCHOOL STUDENTS IN CHARANCHI LOCAL GOVERNMENT AREA OF KATSINA STATE

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Abstract

The study investigated the effect of improvisation of instructional materials on students' achievement in Biology. The study employed a quasi-experimental design, specifically the pretest-posttest nonequivalent group design. One hundred and forty (140) SS1 students from Charanchi Educational Zone of Katsina State formed sample of the study. Biology Achievement Test (BAT) instrument was used for data collection. Two research questions were answered and two hypotheses tested. The data were analyzed using mean, standard deviation and ANCOVA. The result revealed that students taught using improvised instructional materials performed better than students taught using conventional material, male students did not perform better than their female counterparts in Biology: The result did not suggest ordinal interaction effect between method of teaching and gender on students' achievements in Biology. There was no significant difference in the mean achievement scores of male and female students in Biology. The interaction effect of method of teaching and gender on students mean scores in Biology was not statistically significant. Based on the findings and implications, it was recommended that teaching of Biology in secondary schools should be conducted in a manner that students will be effectively taught with improvised instructional materials to enable them understand concepts in Biology.

Keywords: Improvisation, Biology, Teaching, Concepts.

Introduction

Science is the bedrock on which modern day technological breakthrough is hinged. Different authors according to their own understanding have defined Science. Igwe (2008) defined science as a systematic study of the nature of the behavior of the material and physical universe through observation, experimentation, measurement and recording. In addition, Esu (200) defined science as a systematic, precise, objective way to study the natural world. Science is often an exciting and satisfying enterprise that requires creativity, skill and insight based on this Fape (2009) defined science as rationally structured knowledge about nature, which embraces systematic methods of positive attitudes for its acquisition, teaching, learning and application.

The major goal of science education is to develop scientifically literate individuals that are concerned with high competence for rational thoughts and actions. The objectives of science education in this country according to Maduekwe (2006) include the need to prepare students to observe and explore the environment, explain simple natural phenomena, develop scientific attitudes including curiosity, critical reflection and objectivity, apply the skills and knowledge gained through science to solve everyday problems in the environment, develop self-confidence and self-reliance through problem solving activities in science.

In recent times, countries all over the world, especially the developing ones like Nigeria, are striving hard to develop technologically and scientifically, since the

world is turning Scientific and all proper functioning of lives depend greatly on Science. According to Ogunleye (2013) Science is a dynamic human activity concerned with understanding the workings of our world. This understanding helps man to know more about the universe. Without the application of science, it would have been difficult for man to explore the other planets of the universe. Science comprises the basic disciplines such as Physics, Chemistry, Mathematics and Biology.

Biology is one of the science subjects that senior secondary school students offer at the senior levels in the Nigerian secondary schools (FRN, 2007). Biology is a very important science subject and a requirement for further learning of a number of science-related professional courses like medicine, agriculture, pharmacy, etc. In contemporary Nigeria, greater emphasis is placed on science and technological development. As a result, students are being encouraged to take up science-related subjects. Today, Biology pervades literally every field of human endeavor, and plays a fundamental role in educational advancement. This is seen in all the technological advancement in the world today, which is because of scientific investigations. However, the issue remains that in most secondary schools in Nigeria, there is high rate of failure in the subject.

Studies have shown that secondary school students are exhibiting low interest in Biology (Esiobu, 2005). This low interest of students in Biology has been traced to poor achievement in examinations. In our march towards scientific and technological advancement, we need nothing short of good achievement in Biology at all levels of schooling. Unfortunately, achievement of students in Biology at the end of the secondary school has not improved in the last decade (Umoinyang, 2014). Folorunso (2011) has linked poor achievement trend in Biology particularly to the lack of instructional resources in schools due to poor funding of schools. The poor funding of schools has hindered the principals from providing the teachers with adequate instructional resources.

The National Policy on Education (FME, 2011) emphasizes the need for teaching and learning of science processes and principles. The policy recommends practical, exploratory and experimental methods of teaching. In this regard, Okebukola (2012) stated that the basic tools that science uses in the learning of science processes are the instructional materials.

Studies have shown that the use of instructional materials have improved achievement (George, 2013) and Nwagbo (2012). Instructional materials are wide varieties of equipment and materials use for teaching and learning by teachers to stimulate self-activity on the part of the students. The teaching of Biology without instructional materials may certainly result in poor academic achievement. Poor academic achievement in Biology could also be attributed to many factors such as, low interest of students in Biology, inadequate motivation from teacher, poor incentives to Biology teachers, lack of adequate supply of instructional material, lack of qualified teachers, and use of teacher centered instructional strategies, inadequate use of instructional materials and use of abstract standardized materials. Among these factors, teacher's use of abstract standardized instructional strategy is considered as an important factor in this study.

This implies that the mastery of Biology concepts might not be fully achieved without the use of instructional resources that the students are abreast with. The teaching of Biology without instructional materials may certainly result in poor academic achievement. Folorunso (2011) observed that there is lack of adequate and appropriate instructional resources for effective teaching of Biology in schools. For Ibitoye and Fape (2007) the poor achievement in Biology was traced to poor usage of instructional resources for Biology teaching and learning, poor state of infrastructure facilities, large class size, poor teaching, use of faulty assessment practice, and inadequacy of quality teachers. According to Okebukola (2009) the poor state of laboratory facilities and inadequate use of instructional materials has constituted a cog in

the wheel of students' achievement in Biology in the Senior School Examination. The verbal exposition does not promote skill acquisition, objectivity, and critical thinking abilities that will enable the child to function effectively in the society. This according to the researcher leads to poor achievement of students in the subject. The teaching of Biology cannot be done effectively without interaction between the teacher, students and the environmental resources. The Biology curriculum is planned to enable the teacher use activity oriented, child-centered approach (guided inquiry) to teach (Nzewi & Nwosu, 2010). However, evidence from research has shown that instructional materials, resources and equipment for science, especially Biology are either in short supply or are completely lacking in schools to the extent that most teachers end up with verbal exposition of scientific principles, facts and concepts. Studies have also revealed that the achievement of Nigerian students in Ordinary Level Biology was generally and consistently poor over the years (Nwagbo, 2010). This has been a major source of concern to the school administrators, parents and the government at large.

Bassey (2012) opined that Biology is resource intensive, and in an era of poor funding or scarcity of resources, it may be very difficult to find some of the original materials and equipment for the teaching of Biology in schools adequately. A situation that is further compounded by the galloping inflation in the country and many at times, some of the imported sophisticated materials and equipment are found to be expensive and irrelevant; hence the need to produce materials locally. Researchers such as Ogunleye (2002) and Obioha (2006) reported that there were inadequate resources for teaching Biology in secondary schools in Nigeria. The authors further stated that the available ones are not usually in good conditions in most cases. According to Abolade (2004) some of the factory produced/imported instructional materials have also been discovered to be based on foreign ideas and culture. It is against this background that the need to fashion out ways by which local resources can be used for

developing instructional materials becomes necessary. There is the need therefore, for improvisation.

National policy on Education (2008) further stated that the provision and use of available instructional materials for teaching will lay a sound bases for scientific and reflective thinking among students. The real materials that are the conventional instructional materials are imported or factory-made laboratory equipment for science teaching. Examples of conventional instructional materials are: microscope, herbarium, laboratory reagents, laboratory glassware, Bunsen burner, tripod stand.

However, if these conventional Instructional Materials are not available or inadequate, they can be locally made by using resources in the environment as alternative. These will include used electrical bulb for round bottom flask; beverage tins for convex and concave mirror; juices of unripe orange as acid, solution of ash from wood as base, candle or stove as burner, teaspoon for spatula (Okebukola, 2012). Improvised instructional materials may not be identical with the conventional one; therefore, teachers should be skilful in handling and using them (Igwe, 2008). Improvisation requires a considerable development through imaginative planning and good knowledge.

According to Ajayi (2009) improvisation is the provision of alternatives to real things. Improvisation is the making of substitutes when the real equipment or material is not adequate or available (Okebukola, 2012). It is the art of providing and using alternative materials or resources in the absence of the real or factory made one. Oyediran (2010) also defines improvisation as the art of using materials or equipment obtained from local environment or produced by the teacher, and with the assistance of the local personnel to enhance instruction. In other to teach by inquiry method or use activity-based instructions, improvisation is required since instructional materials seem not to be adequate (Okebukola, 2012). Bassey (2012) defined improvisation as the process of making equipment and materials by the

students or by engaging the services of others in the absence of real or manufactured ones.

Generally, improvisation of instructional materials is an attempt to adapt and make use of local resources in the teaching/learning process when the ready-made materials are not available or are in shortfall or not within the reach of users. The teacher and the students could produce the improvised instructional materials. According to Okebukola (2012), improvisation in the context of Biology can be seen as the process of using alternative resources for enhancing Biology teaching in the absence of the real ones. The teacher initiates the production of the alternative resources, which is constructed by either the teacher or the local artisans e.g. carpenters, blacksmiths etc. The teacher may use the students for improvising some of the needed materials or equipment.

Improvisation is a technique of originating a very new tool, instrument, materials, device or modifying existing ones for serving a particular purpose. Improvisation of instructional materials in secondary schools for teaching/learning purposes cannot be overemphasized. To be able to promote quality instruction in our school system, there is the need to pay attention to improvisation of instructional materials in the teaching/learning process. Esu (2010) however noted that improvisation demands adventure, creativity, curiosity and perseverance on the part of the teacher, such skills are only realizable through well-planned training programme on improvisation. Fajola (2010) sees improvisation from the creativity involved. This creativity is substitution and construction. Substitution in improvisation simply implies the techniques whereby an already local material is used in place of a piece of equipment that is not available whereas construction involves making of a new instrument to serve in place of the unavailable original one, where substitution is not possible. Esu (2010), however asserted that improvisation provides connectivity between students abstract and real experience of teaching and learning. Improvisation is a teacher-oriented activity used to effectively

carry out the teaching/learning process successfully.

Statement of the Problem

Evidence from the studies reviewed shows that failure rate in Biology at senior certificate examinations is high. This could be attributed to a number of factors; one of such factors is lack or total absence of instructional materials. In teaching and learning, instructional materials play a key role towards concretizing learning. Instructional materials make learning meaningful and help to improve students' academic achievement. However, these advantages of instructional materials have not reflected in the education system because of the dearth of these instructional materials in our schools. Hence, the need for alternative instructional materials called improvisation.

Biology is resource intensive, and in an era of poor funding or scarcity of resources, it may be very difficult to find some of the original materials and equipment for the teaching of Biology in schools adequately, improvisation becomes the next option. Studies have shown the importance of improvisation in teaching of Biology. All these studies used conventional instructional materials, but there have not been studies specifically on the effect of improvised instructional materials on students' achievement in Biology. This study therefore, is geared towards finding out if the use of improvised instructional materials could bring a solution to the problem of poor achievement of students in Biology. Hence, the problem of this study is therefore posed as a question; what is the effect of students improvised instructional materials on students' achievement in Biology?

Objectives of the Study

The main purpose of this study is to investigate the effect of improvised instructional materials on students' achievement in Biology.

This study specifically will determine: Effect of students improvised instructional materials and conventional materials on

students' mean achievement scores in Biology.

Influence of gender on students' mean achievement scores in Biology when taught using students improvised instructional materials.

Research Questions

The following research questions will guide this study:

1. What is the mean achievement scores of students taught Biology using students improvised instructional materials and those taught using conventional instructional materials?
2. What is the influence of gender on students' mean achievement scores in Biology when taught using students improvised instructional materials?

Research Hypotheses

The following null hypotheses were formulated to guide this study and will be tested at 0.05 alpha level of significance.

H_{01} : There is no significant difference in the mean achievement scores of students taught Biology using students improvised instructional materials and those taught using conventional instructional materials.

H_{02} : There is no significant difference between the mean achievement scores of the female and male students taught Biology using students improvised instructional materials

Results and Discussions

Results were presented individually in tables for the five research questions and collectively in a table for the five hypotheses.

Research Question 1: what is the effect of improvised instructional on students' mean achievement scores in Biology?

Table 1: Mean (X) and Standard Deviation (SD) on effect of student's improvised instructional on students' mean achievement scores in Biology

Material	N	Pre – test		Post – test		Gain Score
		\bar{X}_1	SD ₁	\bar{X}_2	SD ₂	$-\bar{X}$
Improvised	67	10.57	4.4	24.76	21.76	11.19
Conventional	73			18.51	7.45	10.54

Source: Research Survey 2016

Table I showed that the mean scores for student taught Biology using improvised instructional materials was 21.76 while that of the students taught with the conventional material was 18.51. Meanwhile the gain score for students taught using improvised instructional material is 11.19 while that of students taught with conventional material is 10.54. Students taught using improvised

instructional materials therefore, performed better than students taught using conventional material in Biology.

Research Question 2: what is the influence of gender on students' mean achievement scores in Biology when taught using student's improvised instructional material?

Table 2: Mean and Standard Deviation on the influence of gender on students' mean achievement scores in Biology when taught using student's improvised instructional material

Gender	N	Pre – test		Post – test		Gain Score
		\bar{X}_1	SD ₁	\bar{X}_2	SD ₂	\bar{X}
Male	81	9.96	4.35	20.11	5.87	11.19
Female	59	8.19	3.87	20.00	7.23	11.81

Source: Research Survey 2016

Table 2 revealed achievement mean score of 20.11 for male students, while female students had achievement mean scores of 20.00. Male students therefore, slightly performed better than their female counterparts in Biology.

Table 6: Analyses of Covariance of students' achievement scores by improvised and conventional instructional materials.

Sources of Variation	Sum of Square	DF	Mean Square	F	SIG
Covariance model	1550.852	8	193.856	5.987	.000
Intercept	4397.3	1	4397.342	135.81	.000
Pre – test	468.147	1	468.147	14.459	.000
Method	186.706	1	186.706	5.766	.018
Gender	69.301	1	69.301	2.140	.146
Location	213.85	1	213.851	6.605	.011
Method x Gender	6.494	1	6.494	.201	.655
Method x Location	59.124	1	59.124	1.826	.179
Gender x Location	17.938	1	17.938	.534	.438
Method x Gender x Location	121.523	1	121.523	3.753	.055
Error	4241.570	131	32.378	-	-
Total	62153.421	140	-	-	-
Corrected Total	5792.421	139	-	-	-

Source: Research Survey

Ho1: There is no significant difference in the mean achievement scores of students taught Biology using improvised instructional material and those taught using conventional materials.

Data in table 6 showed that there is a significant main effect for mode of instruction on students' achievement in Biology (1, 139) = 5.766, $p < .018$. The null hypothesis therefore, was rejected indicating that there is significant difference in the mean achievement score of students taught Biology using improvised instructional materials and those taught using conventional instructional materials. The mean achievement score for improvised instructional material was 24.76, while that for conventional material was 18.51. The difference was in favour of improvised instructional materials. The student's instructional materials therefore, were superior to conventional material in Biology instruction.

Ho2: there is no significant difference in the mean achievement scores of female and male students taught Biology using student's improvised instructional materials and those

taught using conventional instructional material.

Table 6 revealed non-significant main effect of gender on students' achievement in Biology $f(1, 139) = 2.140$, $p > .146$. The null hypothesis was therefore, not rejected indicating that there is no significant difference in the mean achievement scores of male and female students in Biology.

Table 6 revealed significant main effect of location on students' achievement in Biology $f(1, 139) = 6.605$, $p > .011$. The null hypothesis was therefore, rejected indicating that there is significant difference in the mean achievement scores of urban and rural students in Biology.

Summary of Findings

Students taught using improvised instructional materials performed better than students taught using conventional material. Male students did not perform better than their female counterparts in Biology when taught using student's improvised instructional material.

The results do not suggest ordinal interaction effect between mode of method and gender on students' achievement in

Biology when taught using student's improvised instructional material. This was because at all the levels of gender, the mean scores were higher for student's improvised instructional material.

The result suggests ordinal interaction effects between modes of method and location on students' achievement in Biology when taught using student's improvised instructional material. This was because at all the levels of location, the mean scores were higher for student's improvised instructional material compared to conventional materials with lower mean scores.

There was significance difference in the mean score of students taught using students improvised instructional material and those taught using conventional instructional materials.

The interaction effect of method and gender on students mean achievement scores in Biology was not statistically significant. The interaction effect of method and location on students mean achievement scores in Biology was not statistically significant.

Discussion of Results

Discussion of the findings is presented under the following subheadings: effect of improvised instructional materials and conventional materials on students' mean achievement scores in Biology influence of gender on students' mean achievement scores in Biology when taught using student's improvised instructional material interaction effect of methods and genders on students' mean achievement scores in Biology when taught using improvised instructional material interaction effect of methods and locations on students' mean achievement scores in Biology when taught using student's improvised instructional material.

Effect of improvised instructional materials on students' mean achievement scores in Biology

Students taught using improvised instructional materials performed better than students taught using conventional material did. When the students generated instructional materials, they seemed to understand their

own materials better than the ones produced for them (conventional). Consequently, those exposed to improvised instructional materials performed better in Biology than those that were taught with conventional instructional material. The improvised instructional materials were more effective because the students produced these materials and during the production process, their interests were captured which lead to maximizing comprehension of the subject matter. Even though improvised instructional materials may not be aesthetically pleasing to the eyes than the conventional, they were very effective in stimulating students' knowledge comprehension. This finding is in line with the observations of Ehikioya (2013), Olagunjo (2011), Abolade (2004), Olagungu (2014), Mbajiorgu (2003), Onasanya and Omosewo (2010), Adeyemi and Olaleye (2010) who found out that improvised instructional material affects students' achievement than conventional materials.

Influences of gender on students' mean achievement scores in Biology when taught using students improvised instructional material

Results showed that male students did not perform better than their female counterparts in Biology did. The different socialization processes of male and female persons in which the male persons are expected to explore their environment while the female ones are to conform or maintain their existing environment notwithstanding; female students significantly perform better than male students. The finding did not support Onasanya and Omosewo (2010) who found out that improvised instructional materials in the comparison of the male mean scores of experimental and control groups were the same entry level with regard to academic ability. In addition to this, the studies by Ogunleye (2002) show that science achievement depends on gender. Nevertheless, Nwosu (2001) found that students' acquisition of science process skills are not gender specific. Also, the studies by Ogunleye and Babajide (2011); Agommuoh and Nzewi, (2003) lend credence to non-

significant gender effect in science achievement. In addition, influence of gender on students' conceptual change has been equally investigated. However, Madu (2004), and Agomuoh (2010) found that gender influences students' conceptual shift in favour of the male.

Interaction effects of methods and genders on students' mean achievement scores in Biology when taught using student's improvised instructional material

The results do not suggest ordinal interaction effect between mode of method and gender on students' achievement in Biology. This was because at all the levels of gender, the mean scores were higher for student's improvised instructional material. This finding is in line with the findings of Miriogu (2012), Madu (2004), and Agomuoh (2010) who found no interaction effect of gender and instructional treatment. Nevertheless, the result of the study contradicts with the finding of Baser (2006) who found out that gender significantly interacts with the instructional treatment.

Conclusion

From the results obtained in the study on the effects of students' improvised instructional materials on students' achievement in Biology, it was found that students taught Biology using improvised instructional materials performed better than students taught using conventional material; male students did not perform better than their female counterparts in Biology; rural students performed better than urban students in Biology; The results do not suggest ordinal interaction effect between mode of method and gender on students' achievement in Biology. This was because at all the levels of gender, the mean scores were higher for student's improvised instructional material; the result suggests ordinal interaction effects between modes of method and location on students' achievement in Biology; this was because at all the levels of location, the mean scores were higher for student's improvised instructional material compared to conventional materials with lower mean

scores; there was significant difference in the mean score of students taught using students' improvised instructional material and those taught using conventional instructional materials; there was no significant difference in the mean achievement scores of male and female students in Biology; there was significant difference in the mean achievement scores of urban and rural students in Biology; The interaction effect of method and gender on students' mean achievement scores in Biology was, therefore, not statistically significant. The interaction effect of method and location on students' mean achievement scores in Biology was, therefore, not statistically significant.

Recommendations

Based on the findings of this study, and their implications, the following recommendations are made:

1. The teaching of Biology in secondary school should be conducted in a manner that students will effectively understand and learn the concept taught. It should be practical as the use of improvised instructional materials has played greater role in students' achievement.
2. Teacher should try to improvise instructional materials and encourage students to do the same. This will give students enough understanding of Biology concepts as the child's local environment will be used as a source for the materials.
3. There should be cordial relationship between policy makers and schools for the provision of essential resource materials, like laboratory, glass wares, reagents, microscope, burner, etc.
4. It is suggested that regular meaningful workshop on improvisation technique for Science teachers should be conducted to improve and update their competence in teaching.
5. At the local education authority level, effort should be made from time to time to organize workshops for Biology teachers on improvisation and needs for the use of instructional materials. This is to compliment the efforts of the Millennium

Development Goals (MDGs) for re-training of Science teachers.

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