ISSN: 3448 - 2561
Volume 13, Number 1, 2023
International Journal of Research in Education

EFFECT OF IMPROVISED INSTRUCTIONAL MATERIALS ON BASIC SCIENCE AND TECHNOLOGY STUDENTS' PERFORMANCE IN JUNIOR SECONDARY TWO, BASSA, PLATEAU STATE, NIGERIA

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ABSTRACT

The study investigated effect of improvised instructional materials on Basic Science and Technology students' performance in junior secondary two in Bassa, Plateau State, Nigeria. A quasi-experimental pretest, posttest non-equivalent control group design was adopted for the study. Two research questions were raised and two hypotheses tested at 0.05 level of significance. The population of the study comprised 936 JS II students, made up of 503 males and 433 females from 18 public secondary schools in Bassa, Plateau State, Nigeria. The sample comprised 214 JS II students selected from two out of the 18 public secondary schools using intact classes. Simple random sampling was used to select the two public schools. Instrument used for data collection was "Basic Science and Technology Performance Test (BSTPT)" with a reliability coefficient of 0.834 obtained using Kuder-Richardson 21 (KR21). Data collected was analyzed using mean and standard deviation for the research questions while t-test and ANCOVA were used to test the hypotheses. Results revealed that students who were taught Basic Science and Technology with the use of improvised instructional materials had better performance than those taught without the use of improvised instructional materials. It was recommended among other things that in the absence of original instructional materials, Basic Science and Technology teachers should be creative to develop and use improvised instructional materials in teaching and learning as it enhances students' performance.

Keywords: Improvised Instructional Materials, Improvisation, Basic Science and Technology, Students' Performance.

INTRODUCTION

Education is the totality of life's experiences which enables people to be relevant, responsible, productive and useful to the society. A good educational system is a strong base for science and technological development which equips people with sound knowledge and skills for designing methods and processes that will enable them to make maximum use of their natural resources for the advancement of the society (Aremu, 2015, Awodun & Oyeniyi, 2018). The growth and development of a nation depends largely on the type and quality of science and technology education individuals acquire. Science and Technology therefore forms an integral part of the human society and its impact is expected to be felt in every sphere of life. Developed nations of the world, by applying science and technology education principles have been able to maintain sovereignty which has provided them with functional and meaningful roles in wealth creation, improvement of the quality of life, real economic growth and educational advancement. (Shodeinde, 2015). The National Policy on Education, Federal Republic of Nigeria (FRN, 2014) prescribed the following for science, technical and vocational education: provision of knowledge and skills necessary for economic development; providing people who can apply scientific knowledge to the improvement and solution of environmental problems for the use and convenience of man among others. One of the ways in which the above objectives can be fully achieved through Basic Science and Technology.

Basic Science and Technology (BST) is an integration of Basic Science, Basic Technology, Physical and Health Education and Information Technology. BST is a subject in the education curriculum which is instrumental in the acquisition of practical and applied skills. The above

statement is in consonant with the overall objectives of the BST curriculum content as outlined by NERDC in the JSS curriculum which are to enable the learners to: develop interest in science and technology; acquire basic skills in science and technology; apply scientific and technological knowledge and skills to meet societal needs; take advantage of the numerous career opportunities in the field of science and technology; avoid drug abuse and related vices; be safe and security conscious and finally, become prepared for further studies in science and technology (FRN, 2012). The Federal Government, through the National Policy of Education, (FRN, 2012) restructured the Nigeria system of education from 6-3-3-4 to 9-3-4 such that 9 years are devoted to primary and Junior Secondary education. This policy birthed Basic Science and Technology (BST) which is unified other affiliated subjects. With the foundation of BST, students can venture into subjects such as; Physics, Biology, Chemistry, Agricultural Science and Technical Drawing at the senior secondary school level of education and thereafter pursue science and technology related fields such as engineering, pharmacy, medicine, botany, zoology, surveying, architecture, geology, building, computer science, anatomy, physiology, among many others at the tertiary level of education. Going forward, BST deals with the fundamentals of science, engineering and technology which is to be taught as an integration of Physics, Biology, Chemistry, Agricultural Science, Technical Drawing, Building Construction, Woodwork, Metalwork, Electrical and Electronics, Automobile Mechanic, Food Technology, Health Science and Computer Education (Olarinde, Fakomogbon, Olabisi & Adetunde, 2017). Nigeria has laid a lot of emphasis on teaching and learning that will inculcate a culture of technology to learners especially at formative stages of development (Onanuga & Saka, 2017). The smooth transfer of knowledge to learners in the teaching and learning process therefore is required through effective use of instructional materials in the classroom by teachers.

Instructional materials are those resources used by teachers in teaching and learning processes (Ugoche & Usman, 2019). These materials include books, documents, archives, artefacts, sheets, flashcards, radio, computers, video, television, magazine among others. As a facilitator of knowledge and an encourager of learning, a teacher selects, develops and implements a variety of instructional materials and is required to continually look for interacting events that will challenge and enrich the daily learning experiences of learners. Effective teaching and learning can be attained through the application of resources that can aid the performance of Science and Technology education in schools. Recent reports show that BST students performed poorly in the State BECE in 2019, 2020 and 2021. Most failures recorded in BST students' performance have been attributed to inadequate exposure of students to instructional strategies by BST teachers (Adegbite, 2017). This is further affirmed by Daramola and Daniel (2015) who stated that there are many instances in schools where BST teachers stand on the chalk boards and deliver lessons through verbal instruction, while students serve as passive listeners and take note from the board. While funding has affected the purchase of instructional materials, teachers should be able to improvise to bridge this gap.

Improvisation is the use of local resources found in the immediate environment to build, construct, mould or make teaching and learning materials that can assist in the smooth dissemination and transfer of knowledge from teachers to students (Ajayi, 2018 & Owuamanam, 2017). Improvised science and technology education equipment have been found by educators and researchers on different continents to be useful in various areas of science education in secondary schools (Akuma & Callaghan, 2016). In a situation where instructional materials are not available, a serious minded and goal-oriented teacher cannot wait but adopt improvisation as a means to effectively teach skills and concepts in BST. Improvisation in BST therefore, entails creativity, innovation and resourcefulness on the part of the teacher (Oyetunde, 2018). To buttressed the above assertion, Udosen and Ekukinam (2019) emphasized that one of the instructional practices that has been of interest to some Nigerian educational technology teachers for a long time is the area of improvisation of instructional materials for effective classroom teaching and learning.

The process of teaching and learning requires a good deal of improvisation because it touches all students' learning domains; cognitive, affective and psychomotor. BST requires that teachers provide a learning environment that promotes effective knowledge, attitude and skills through functional learning aids. Despite the importance of improvised instructional materials however, many teachers do not use improvised instructional materials. Studies carried out by Akano (2018), Audu (2018) and Ofoegbu (2012) revealed that most teachers do not use improvised instructional materials for teaching and learning of BST. Improvised instructional materials are cheaper to produce because the raw materials are obtained within the local environment and can present objects in either two or three-dimensional views. The process of teaching and learning requires a good deal of improvisation because it touches all students' learning domains; cognitive, affective and psycho-motor. Salihu (2016) opined that the inability of teachers to improvise instructional materials not only affects performance of the learner but also produces poor quality students that cannot pursue further educational professions. Against this background, this study is designed to determine the effects of improvised instructional materials on the performance of Junior Secondary II students in Bassa, Plateau State, Nigeria.

Statement of the Problem

The lack of original instructional materials, teaching and learning of BST has negatively impacted the attainment of positive results in Nigerian schools. The above challenge which is often due to poor funding can be attributed to the current economic down turn in Nigeria (Onifade & Owoade, 2020). Going forward, the unavailable instructional materials led to the persistent poor performance of BST students in the Basic Education Certificate Examination (BECE) as revealed by the Plateau State Education Resource Centre. The situation above is a source of worry to stakeholders of education. Several researchers as revealed in literatures have achieved meaningful and interesting classroom experience when improvisation was employed as an option to the dearth of instructional materials in various secondary schools across the country. Bukoye (2019) affirmed that students learn little due to non-availability of instructional materials. A lesson taught without the use of instructional strategy results in a knowledge that is of memorization which stands the risk of being forgotten easily by learners and leads to poor performance (Suleiman & Audu, 2020). The teaching and learning of BST in Bassa, Plateau State has been devoid of the use of instructional materials, such that teachers' during classroom delivery employed traditional chalk boards, conventional and teacher-centred methods. If this situation of lack of instructional materials in teaching and learning of BST persists, it will to a large extent have a plummeting effect on students' performance in BST which in turn will affect the quality of science and technology education as well as hamper the growth and development of the nation. With the above in mind, the researcher deemed it necessary to carry out the present study.

Aim and Objectives

The aim of this study is to investigate the effects of improvised instructional materials on performance of Basic Science and Technology students in junior secondary schools two in Bassa Plateau State, Nigeria. The study has the following specific objectives;

1. Determine the pre-test performance mean scores of Junior Secondary II students in Basic Science and Technology students in Bassa, Plateau State, Nigeria.
2. Find out the post-test performance mean scores of Junior Secondary II students taught Basic Science and Technology with and without improvised instructional materials in Bassa, Plateau State, Nigeria.

Research Questions

The following research questions were formulated for the study:

1. What is the pre-test performance mean scores of Junior Secondary II Basic Science and Technology students in the experimental and control groups in Bassa, Plateau State, Nigeria?

2. What is the post-test mean performance scores of Basic Science and Technology students taught with and without improvised instructional materials in Junior Secondary II, Bassa, Plateau State, Nigeria?

Hypotheses

The following null hypotheses were stated and tested at 0.05 level of significance:

1: There is no significant difference in the pre-test mean performance of Junior Secondary II Basic Science and Technology students in the experimental and control groups in Bassa, Plateau State, Nigeria.

2: There is no significant difference in the mean performance of Junior Secondary II Basic Science and Technology students taught using improvised instructional materials in Bassa, Plateau State, Nigeria.

METHODOLOGY

This study adopted a quasi-experimental research design. Specifically, the study adopted the non-randomized, pretest, posttest control group design. The total population of students from the co- educational public secondary schools in Bassa Local Government Area is 936 made up of 503 males and 433 females. Out of the study population, a sample of 214 students from two co-educational Junior Secondary schools in Bassa, Plateau State was used for the study. Simple random sampling technique Sampling was used to assigned into experimental and control groups. The Basic Science and Technology Performance Test (BSTPT)" was used as instrument for data collection. The validity of BSTPT was determined using content validity established using three experts; one from Biology Education unit, the other Educational Technology unit and another from Test and Measurement unit of University of Jos. A pilot study was carried out to determine the reliability of BSTPT using Kuder-Richardson 21 (K-R21). The reliability coefficient of 0.834 was obtained from the response of the sampled students. The researcher obtained permission from the Area Inspectorate Unit in Bassa Local Government Area and the two principals of schools used for data collection in the two public schools selected for the study. Training of research assistants, administration of Pre-test, administration of treatment and administration of Posttest were carried out for data collection. Descriptive and inferential statistics was adopted to analyse data. Mean and Standard deviation were used to answer the research questions while t-test and Analysis of Covariance (ANCOVA) were used to test the hypotheses at 0.05 level of significance, using Statistical Package for Social Science (SPSS), version 26, 2019 and Excel 2016. Hypotheses one, three and four for the BSTPT was tested with t-test for independent samples while hypothesis two will be tested with ANCOVA at 0.05 level of significance. The decision rule for the research questions is as follows; if performance mean score is below 50 =Fail, if performance mean score is 50-59 =Pass, if performance mean score is 60 – 69 =Good, if performance mean score is 70% and above =Excellent. In the same vein, the decision rule for the hypotheses is as follows: If the p-value is less than 0.05; reject the null hypothesis but if the p-value is greater than 0.05; accept the null hypothesis.

Results

Table 1: Mean and Standard Deviation of Performance Scores of Basic Science and Technology Students in the Experimental and Control Groups before the Treatment

Group	**N**	$\overline{X}$	**SD**	$\overline{X}_{Diff}$
Experimental	105	44.78	12.811	
				5.29
Control	109	39.49	10.99	

reveals the mean and standard deviation results of pre-test performance mean scores of students

in Basic Science and Technology in the experimental and control groups. The result for experimental group yielded a mean score ($\bar{X}$= 44.78, SD = 12.81) and control group had a mean score of ($\bar{X}$= 39.49, SD = 10.99) before treatment. It means that both groups performed poorly in the pretest, although the experimental group was better with a mean difference of 5.29.

Table 2: Mean and Standard Deviation of Performance Scores of Basic Science and Technology Students in the Experimental and Control Groups after the Treatment

Group	**N**	$\bar{X}$	**SD**	$\bar{X}_{Diff}$
Experimental	105	62.74	10.78	18.64
Control	109	44.10	14.49	

Table 2 reveals the mean and standard deviation results of post-test performance mean scores of students Basic Science and Technology in the experimental and control groups. The result for experimental group yielded a mean score ($\bar{X}$= 62.74, SD = 10.78) and control group had a mean score of ($\bar{X}$= 44.10, SD = 14.49) after treatment with a mean difference of 18.64. This means that there was improvement after exposure to treatment. The result further shows that those taught Basic Science and Technology with improvised instructional materials performed better than those taught without.

Hypothesis One

Table 3: Result of t-test difference in Performance between Pretest Mean Scores of Experimental and Control Groups

Group	**N**	$\bar{X}$	**SD**	**DF**	**T**	**p-value**	**Decision**
Experimental	105	44.78	12.811	212	-3.24	.001	Significant
Control	109	39.49	10.99				

Table 3 reveals the result of t-test result of the pretest performance mean scores of students in map reading in the experimental and control groups. In the experimental group, the pretest mean score was ($\bar{X}$= 44.78; SD = 12.81) and the control group has a mean score of ($\bar{X}$= 39.49; SD = 10.99). The result also yielded t (212) = P < 0.05. Since the P-value of 0.001 is less than the 0.05 level of significance, the null hypothesis was rejected. It was concluded that there is a significant difference between pre-test mean scores of the experimental and control groups. It shows that the pretest performance of students' in the two groups was poor, although the experimental group performed better.

Hypothesis Two

Table 4: ANCOVA Result of Posttest Performance Mean Scores of Experimental and Control Groups

Source	**Type III Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**	Partial Eta Squared
Corrected Model	18587.116[a]	2	9293.558	56.442	.000	.349
Intercept	45324.337	1	45324.337	275.264	.000	.566
Pre-test	1.189	1	1.189	.007	.932	.000

Group	17768.177	1	17768.177	107.910	.000	.338
Error	34742.758	211	164.658			
Total	660087.000	214				
Corrected Total	53329.874	213				

a. R Squared = .349 (Adjusted R Squared = .342)
b. Computed using alpha = .05

The data were subjected to analysis of covariance (ANCOVA) having experimental and control to determine the difference between post-test Junior Secondary II Basic Science and Technology students exposed to improvised instructional materials and those who were not. The main effect of experimental group yielded (M = 67.74; SD = 10.78) and control group (M = 44.10; SD = 14.49); F (1, 211) = 107.91, P < 0.05. Since the p value of .000 is less than the 0.05 level of significance, the null hypothesis was rejected. This indicates that the mean score of students in the experimental group significantly differ from that of the control group in favour of the experimental group. The result reveals that the experimental group performed better than the control group. The result further reveals an adjusted R squared value of .342 which means that 34.2 percent of the variation in the dependent variable which is students' achievement in Basic Science and Technology is explained by variation in the treatment of improvised instructional materials, while the remaining is due to other factors not included in this study.

DISCUSSION

Table 1 shows that the BSTPT pretest mean scores of the experimental and control groups were 44.78 and 39.49 respectively with a mean difference of 5.29. This result reveals that when the performance students in Basic Science and Technology was poor before treatment. This finding is in agreement with the finding of Aina (2013) which showed that poor performance is as a result of teachers' inability to provide learners with variety of instructional materials in teaching and learning of basic science and technology subjects.

Table 2 reveals that BSTPT posttest mean scores of the experimental and control groups were 62.74 and 44.10 respectively with a mean difference of 18.64. This result shows that there was improvement in students' performance in Basic Science and Technology after exposure to treatment. This finding is in agreement with the findings of Olu-Ajayi (2017), Ikwuka and Chukwuemeka (2016) which showed that improvised instructional materials has significant impact on teaching and learning of basic science and technology as well as improved students' performance.

Table 3 shows that the P-value (0.001) is less than the 0.05 level of significance with t (212) = (P< 0.05). Hence, the null hypothesis is hereby rejected. This implies that there is significant difference between pretest mean scores of the experimental and control groups as both groups performed poorly. This further means that the lack of instructional strategy such as improvised instructional materials negatively affects students' performance in Basic Science and Technology.

Table 4 reveals that the P-value (0.000) is less than the 0.05 level of significance with t (212) = (P< 0.05). Hence, the null hypothesis is hereby rejected. This indicates that the experimental group's mean scores significantly differ from that of the control group. This means that the use of instructional strategy such as improvised instructional materials enhance students' performance in Basic Science and Technology.

FINDINGS

i. Students of Basic Science and Technology without treatment performed poorly both in the experimental group and control group.

ii. Students taught Basic Science and Technology with improvised instructional materials in the experimental group performed better than students taught without improvised instructional materials in the control group.
iii. The mean scores of students in Basic Science and Technology without treatment was not statistically significant.
iv. The mean score of students taught using improvised instructional materials in the experimental group in Basic Science and Technology was statistically significant.

CONCLUSION

Based on the findings of this study, the researcher concludes that students who were taught Basic Science and Technology with the aid of improvised instructional materials performed better than those taught through conventional method. Thus, the place of improvised instructional materials as an instructional strategy in the effective implementation of Basic Science and Technology education curriculum is established by the use of locally available materials from resources within the immediate environment which bridged the gap of lack of original instructional materials and students' performance.

RECOMMENDATIONS

Based on the above findings, the following recommendations were made:

1. Teachers should be creative to improvise instructional materials using resource around the immediate school environment in teaching and learning of BST to make up for shortfall in supply of the original ones.
2. In- service training through seminars, conferences, symposiums and workshops should be organized regularly for teachers by the State Ministry of Education and School administrators to update their knowledge and improve their skills and creative knowledge on identification, production and improvisation with the use of locally sourced material within the immediate school environment.

REFERENCES

Adegbite, A. F. (2017). Improvisation of drawing instruments for basic technology in junior secondary school, Oyo state. *Journal of Multidisciplinary Research and Development*, *3*(3), 71 – 77.

Aina, K. J. (2013). Instructional materials and improvisation in physics class: implications for teaching and learning. *IOSR Journal of Research and Method in Education, 2*(5), 38-42.

Ajayi, D. T. W. (2018). *Educational technology; teaching, learning and communication.* Abuja: Ya-Byangs Publishers.

Akano, B. U. (2018). Effects of teachers' use of improvised instructional materials on students' academic performance in physics. *International Journal of Social Science Management Research, 4*(7), 77-83.

Akuma, F. V., & Callaghan, R. (2016). Framework for reducing teachers' challenges relating to improvisation of science education equipment and materials in schools. *Eurasia Journal of Mathematics, Science and Technology Education, 12*(10), 2697-2717.

Aremu, S. J. (2015). *Competency improvement needs of technology teachers in the implementation of basic technology in Kogi State*. Unpublished M.Ed Thesis, University of Nigeria, Nsukka.

Audu, T. O. (2018). The poverty of lecture as an instructional strategy in the teaching of science at the secondary school level. *Humanities and social science letters, 6*(4), 130- 136.

Awodun, A. O., & Oyeniyi, J. D. (2018). Influence of school location on students' academic performance in basic science in junior secondary school in Ekiti State, Nigeria. *International Journal of Research and Analytical Reviews, 5*(6), 125-129.

Bukoye, R. O. (2019). *Utilization of instruction materials as stools for effective academic performance of students*: Implications for counselling. Paper presented at the 2nd innovative and creative education and teaching international conference at Badajoz, Spain on 20th – 21st, June.

Daramola, I. S., & Daniel O. (2015). The influence of teaching among technical teachers towards acquisition of technical skills in Taraba state. *International Journal of Research in Science, Technology and Mathematics Education, 2*(2), 217-225.

Federal Republic of Nigeria (2012). 9-Years Basic Education curriculum reform. *basic science and technology for junior secondary 1-3.* Lagos: Nigerian Educational Research Development Council (NERDC) press.

Ikwuka, O. I., & Chukwuemeka U. A. (2016). Effect of improvised instructional materials on senior secondary students' academic achievement in mathematics in Oshimili South Local Government Area of delta State. *Journal of Science Education and Technology, 4*(8), 1-56.

Federal Republic of Nigeria (2014). *National policy on education*. (4th Edition) Lagos: Nigerian Educational Research Development Council (NERDC) press.

Ofoegbu, T. O. (2012). Resources for teaching Basic Science and Technology in Nigerian primary schools. *Proceedings by STAN.*198-202.

Olarinde, L. A., Fakomogbon, M. A., Olabisi, A., & Adetunde, I. (2017), Assessment of instructional resources for teaching basic technology in Junior Secondary schools in Ogbomoso, Nigeria. *IJRDO-Journal of Educational Research, 2*(7), 113-158.

Olu-Ajayi, F. E. (2017). Effects of mentoring in the utilization and improvisation of biology learning resources on the performance of senior secondary school students in South West Nigeria. *European Scientific Journal, 13*(4), 270-277.

Onanuga, P. A., & Saka, A. O. (2017). Trend analysis of students' academic performance in selected science, technology, engineering and mathematics subjects in Ogun State Basic Education Certificate Examination (BECE) Nigeria from 2011 to 2015: A projection for five Years. *International council of Association for Science Education, 29*(2), 110-116.

Onifade, A. O., & Owoade, O. A. (2020). Utilization of improvised resources for effective teaching and learning of agricultural science in senior secondary in Nigeria. *Capital Journal of educational studies, 6*(2) 15 – 24.

Owuamanam, C. N. (2017). Creativity in the improvisation and utilization of instructional materials for the Nigerian school system. *International Journal of Public Policy and Administrative Studies, 11*(3), 48-59.

Oyetunde, T. T. (2018). *Issues in postgraduate studies: Promoting high quality higher education*. Jos: LECAPS Publishers.

Salihu, Y. (2016). Perceived usefulness of improvised instructional materials for teaching motor vehicle mechanics trade in technical colleges in Gombe State. *ATBU, Journal of Science, Technology & Education. 4*(2), 54-61.

Shodeinde, B. I. (2015). *Effects of improvised instructional materials on the academic performance of Junior Secondary school students in social studies in Kaduna State, Nigeria*. Unpublished M. Ed Dissertation, Ahmadu Bello University, Zaria.

Suleiman, F. H., & Audu, L. (2020). Effects of instructional materials on students' academic performance in technical education. *Direct Research journal of Social Sciences and Educational Studies, 7*(2), 25 – 30.

Udosen, N. I., & Ekukinam, T. U. (2019). Improvisation of teacher-made instructional media and students' performance in primary science in Nigeria schools. *Research Journal of Education, 5*(5), 63-68.

Uguche, B. A., & Usman, K. O. (2019). Effect of improvised instructional materials on students' achievement and interest in longitude and latitude. *International Journal of Research and Innovation in Social Science, 3*(4), 313-320.