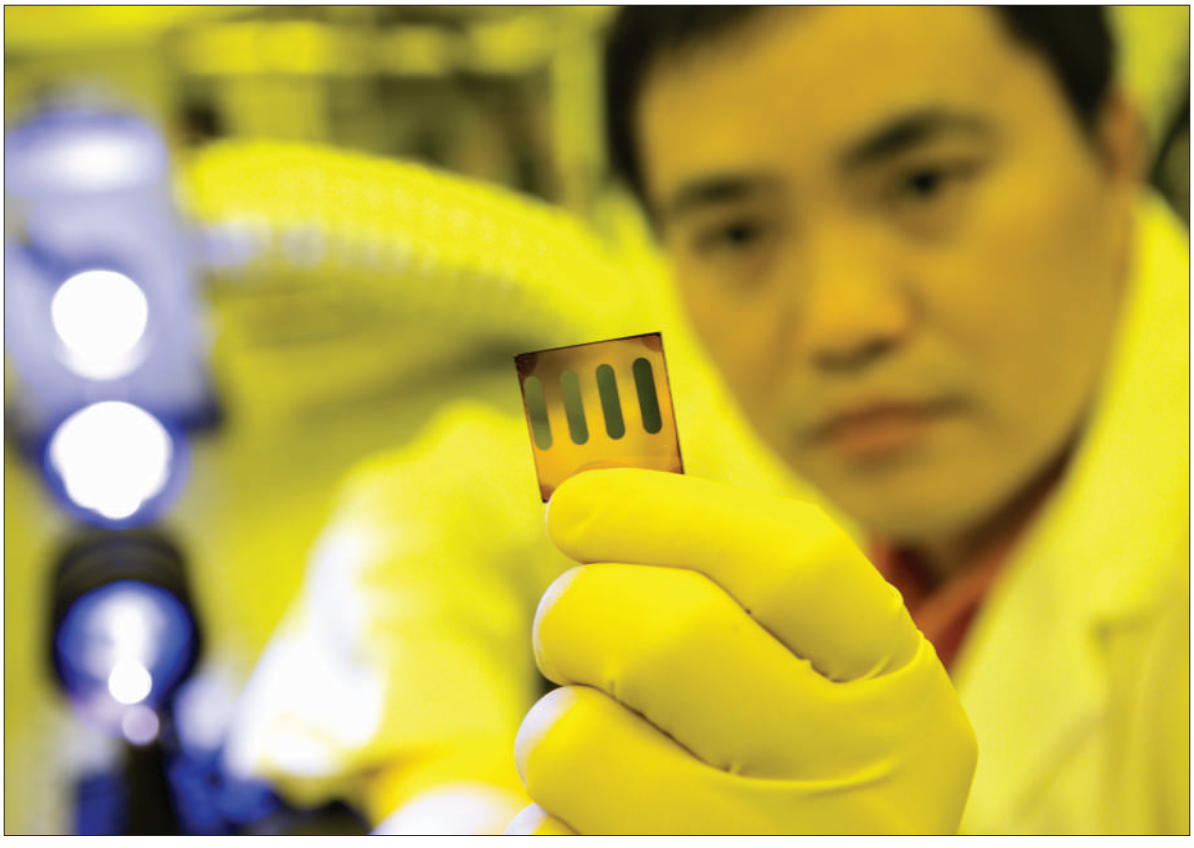

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Effect of Improvised and Standard Instructional Materials on Secondary School Students' Academic Performance in Physics in Ilorin, Nigeria

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ABSTRACT

The study examined the effect of using standard instructional materials and improvised instructional materials on Secondary School Students' Academic Performance in Physics in Ilorin, Nigeria. The sample consisted of selected Secondary Schools in Ilorin Metropolis of Kwara State. The research employed a quasi-experimental design of the pretest-post test non-randomized control group design. Two hypotheses were designed and tested at 0.05 level of significance. From the analysis, the following findings were made (1) there was significantly difference between the students taught with standard instructional materials and those thought with improvised instructional materials, i.e., mean scores on the posttest ($t = 4.09$, df 14, $p = 0.05$), (2) there was no significant difference between the post test scores of the experimental group and control group. This shows that the 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 ($t = 1.23$, df = 7, p = 0.05). The implications of improvised instructional materials were discussed. Recommendations for the improvement of standard instructional and improvised instructional Aids in teaching of physics and suggestions for further studies were made.

Key words: Improvisation, instructional materials, standard instructional materials, performance, academic ability

INTRODUCTION

Science is the foundation upon which the bulk of present day technological break through is built. Nowadays, nations all over the world including 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.

Owolabi (2004) defined science as an integral part of human society. Its impact is felt in every sphere of human life, so much that it is intricately linked with a nation's development. Science as a field of study has done a lot for mankind. For instance, life has been made a lot easier for man as a result of the advancements in science. Through science, man has been able to better understand his environment and this has enabled him to manipulate the conditions of his environment to suit his own benefit. Science has also made it possible for man to acquire his desired needs easily. It has reduced human needs to the barest minimum. Ogunleye (2000) observed that 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 applications of science, it would have been impossible for man to explore the other planets of the universe. Also, the awareness of the existence, of other planets would not have been realized without science.

Science comprises the basic disciplines such as Physics, Chemistry, Mathematics and Biology. Many investigations have shown that students in Secondary schools are not very much interested in science (Esiobu, 2005; Okonkwo, 2000). Besides, Physics as one of the science subjects has remained one of the most difficult subjects in the school curriculum NERDC (2005). A study by Owolabi (2004) revealed that the performance of Nigerian Students in ordinary level Physics was generally poor. This was attributed by the author to many factors of teaching strategy itself was considered as an important factor. Jegede *et al.* (1992) reported factors responsible for students general poor performance in science, technology and mathematics. These are poor laboratory facilities, inability of the Physics teachers to put across ideas clearly to the students and inadequate number of learning facilities in schools as against consistent increase in the number of students.

Physics as a science subject is activity oriented and the suggested method for teaching it which is guided discovery method is resource base (NTI, 2007). This suggests that the mastery of Physics concepts cannot be fully achieved without the use of instructional learning materials. The teaching of Physics without learning materials will certainly result to poor performance in the course. Franzer *et al.* (1992) stressed that; a professionally qualified science teacher no matter how well trained would be unable to put his ideas into practice if the school setting lacks the equipment and materials necessary for him or her to translate his competence into reality.

Bassey (2002) opined that science is resource intensive. Furthermore, in a period of economic recession, it will be very difficult to adequately find some of the electronic gadgets and equipment for Physics in Schools. A situation that is further compounded by the galloping inflation in the country and often unrelatedness of some of the imported sophisticated materials and equipment; hence the need to produce materials locally.

Researchers such as Ogunleye (2000), Okonkwo (2000), Mkpanang (2005) and Obioha (2006) reported that there were inadequate resources for the teaching of science subjects in secondary schools in Nigeria. They further stated that where there were little resources at all, they are not usually in good conditions, while the few that were in good conditions were not enough to go round those who needed them. Hence there is need for improvisation.

Omosewo (2008) and Akinsola (2000), considered the human factors as the teacher's professional commitment, creativity, mechanical skills, initiative and resourcefulness. They found that many of Nigerian science teachers were aware of possibility of improvisation but many exhibited poor attitudes towards improvisation. They also noted that very few teachers practice improvisation while majority depends on imported equipments and claim that improvisation is time-consuming and fund depleting. The authors also noted that students too, possessed little or no interest in improvisation.

Onasanya *et al.* (2008), Adebimpe (1997) and Aguisiobo (1998) noted that improvisation demands adventure, creativity, curiosity and perseverance on the part of the teacher. The author added that such skills are only realizable through well-planned training programme on improvisation. Akinyemi and Orukota (1995) noted that improvisation whether they cost less than standard manufactured ones or not they cost money. He added this money is usually not readily available for the teacher.

The objectives of any educational process determine the contents, methods and materials needed for achieving such objectives. The materials used for enhancing instructional effectiveness are aspects of media employed for achieving the instructional objectives. Bassey (2002) described instructional media as system components that may be used as parts of instructional processes which are used to disseminate information message and ideas or which make possible communicable in the teaching-learning process.

Experience over the years has shown that teachers have been depending on excessive use of words to express, to convey ideas or facts in the teaching-learning process. This practice is termed the "chalk-talk" method. Today, advances in technology have made it possible to produce materials and devices that could be used to minimize the teachers talking and at the same time, make the message clearer, more interesting and easier for the learners to assimilate (Onasanya *et al.*, 2008). According to Soetan *et al.* (2010), graphics include charts, posters, sketches, cartoons, graphs and drawings. Graphics communicate facts and ideas clearly through combination of drawings, words and pictures. The use of graphics in teaching creates definitiveness to the materials being studied. They help to visualize the whole concepts learned and their relationships with one another.

The role of graphic materials in visual communication is both unique and significant. Historically, symbols, a basic part of graphics have made it possible, the whole range of written language used in the world today. The instructional value of graphical illustrations lies generally in their capacity to attract attention and convey certain types of information in condensed form (Onasanya and Adegbija, 2007). Okpala *et al.* (1998) started that graphical illustrations provide a common experience to a large group at the same time. Okpala *et al.* (1998) also summarized the values of graphic for instructional design as follows: They require no special machine for projection, the teacher is confident in manipulating the material, their improvisation encourages more creativity and diversification of teaching methods, they are very easy to preserve and they could produced within minimum cost and maximum efficiency.

Onasanya (2004) gave various kinds of models used in educational instructional namely: Mental models, theoretical models, mathematical models, diagrams, concrete models etc. These types of models are of special pedagogic significance in science and technology instruction due to the nature of knowledge and knowledge getting process in these disciplines. Concrete models are materials objects which are likenesses of natural or man-made structures or systems and which are intended to highlight and explain or describe structures, functional processes and relationships in the original. Concrete models are constructed in the effort to understand the behaviour of the physical world and the causes of such behaviour (Onasanya and Adegbija, 2007). He summarized the role of concrete models as follows: simplification of complex phenomena, concretization of complex phenomena, bridging of gaps in distance and time between phenomena and classroom events, enhancing of students ability to communicate in science.

MATERIALS AND METHODS

This study was carried out to determine the comparative effect of the uses of standard instructional materials and improvised instructional materials on the academic performance of secondary school students in Physics in Ilorin metropolis, Nigeria. The study was conducted during the second term of the 2007 and 2008 academic session in Ilorin, Nigeria. The primary purpose of this study was to undertake a comparative analysis of the effect of improvised and standard instructional materials. The following null hypotheses were formulated and tested at $p = 0.05$ so as to obtain answers to the research questions:

Research hypotheses

- There is no significant difference in the performance students taught with standard instructional materials
- There is no significant difference in the performance of the students taught with improvised instructional materials
- There is no significant difference in the post-test scores of the students in the experimental and control groups on standard materials
- There is no significant difference in the post-test of the male Students of experimental and control groups on Improvised Instructional Materials (IIM)
- There is no significant difference in the post-test scores of female Students of the experimental and control group on standard instructional materials

Research design: The research design was a quasi-experimental design, the pretest-post test non-randomized control group design, carried out in some secondary schools in Ilorin metropolis of Kwara State, Nigeria.

Sample and population: The population comprised of all the secondary schools in Ilorin, Kwara State, Nigeria. Three schools were randomly sampled from 237 secondary schools in Ilorin, Kwara State. Intact classes of Senior Secondary 1 (SS1) from the sampled schools were assigned to three groups (improvised, standard and control). The SS1 students in each sampled school were made to belong to one group to avoid inter group contaminations.

The independent variables in this study are the use of improvised and standard graphics and models and conventional method of teaching. The dependent variable is the students scores obtained from a researcher designed performance test. The assignment of samples into treatment groups are as shown in Table 1, format for research design.

Research instrument: The instruments used in this study were a researcher-designed Performance Test in Physics (PTP). The Performance Test in Physics (PTP) contain 50 items 4 option multiple choice objective test developed by the researcher on the units used in the study. The students were made to select the correct answer from four options. The performance test in Physics was used to measure the performance of students in both pre-test and post-test. Some intervening variables extraneous to the study such as teacher effect, group interaction effect were controlled by the presence of the researcher and the subject teacher in the schools.

Validation of research instrument: The instrument was subjected to face and content validation using test blue print and item analysis. The test items were carefully drawn to ensure

Table 1: Format for research design

Group	Pretest	Treatment	Post-test
Experimental Group$_1$ (R)	01	X_1	04
Control Group (R)	02		05
Experimental$_2$	03	X_2	06

01: Pretest scores of the experimental group (1), 02: Pretest scores of the experimental group (2), 03: Pretest scores of the control group, 04: Post test scores of the experimental group (1), 05: Post test scores of the experimental group (2), 06: Post test scores of the control group, X: Treatment

that the items fell within the scope of the SS1 syllabus and the specific area that have been selected for the purpose of the study. The test items were referred to the experts in science education for criticisms and their observations influenced some modifications on the instrument.

Method of data analysis: The mean, standard deviation and the t-test statistical analysis were used. Scores of the different groups were computed and used in testing the hypotheses. The level of the significance adopted for the analysis was p = 0.05. This level of significance formed the basis for or rejecting or not rejecting each of the hypotheses.

RESULTS

Two research questions were raised in this study and two null hypotheses were formulated and tested to provide answers to the research questions. Analysis of the pretest and posttest data collected by means of the students taught with Standard Instructional Materials (STM) and students taught with the use of improvised instructional materials were used to answer the research questions using the two null hypotheses as guide. Means, standard deviations and the t-test were employed in analyzing the pretest and posttest data.

The summary of the data analyses and results are presented below:

In testing the performance of Experimental and Control groups on the pretest, a pretest was administered to both the experimental and control groups. The test was the 50 items multiple-choice Physics Test (PTP). The subjects were allowed forty minutes to do the test. The test was given to determine the academic performance of the experimental and control groups.

The result in Table 2 indicates that there is significant difference at 0.05 level of significance between the pretest mean scores of the experimental and control group (t = 4.09, df = 14, p>0.05). This means that the pre-test mean score is significantly different from post-test mean score with respect to the use of standard Instructional materials. t-test was also used to compare the pre-test and the post-test performance of students taught with improvised instructional materials, the result as shown in Table 3 revealed that since (t-test value = 2.28, df = 14, p<0.05) is greater than the critical value, we reject hypothesis (Ho) and conclude that the pre-test mean score was significantly different from the post-test mean score with regards to Improvised Instructional Materials (IIM).

Table 4 showed the t-test comparison of the post-test scores of the students in the experimental and control groups on standard materials. The result of Table 4 (t = 5.03, df = 14, p 0.05 C = 2.15), implied that the null hypothesis be rejected. This concludes that the mean scores of the experimental group and control group are significantly different. This further show that the standard instructional materials used in the experimental group had positive effect on the students' performance.

Table 2: The t-test comparison of the pretest and post test mean scores of students taught with standard instructional materials

Variable	N	df	X	SD	t-value calculated	t-value critical	p-value	Remark
Pre-test	15	14	11.0	1.89	4.09	2.15	0.05	Significant
Post-test	15		30.1	4.55				

Significant at 0.05

Table 3: Performance of the students taught with improvised instructional materials, the t-test comparison of the pre-test and post-test scores

Variable	N	df	X	SD	t-value calculated	t-value critical	p-value	Remark
Pre-test	15	14	9.8	2.04	2.28	2.15	0.05	Significant
Post-test	15		26.1	5.87				

Significant at 0.05

Table 4: The t-test comparison of the post-test scores of the students in the experimental and control groups on standard materials

Variable	N	df	X	SD	t-value calculated	t-value critical	p-value	Remark
Pre-test	15	14	30.1	4.55	5.03	2.15	0.05	Significant
Post-test	15		26.1	5.87				

Significant at 0.05

Table 5: The t-test comparison of the post-test of the male Students of experimental and control groups on improvised instructional materials (IIM)

Variable	N	df	X	SD	t-value calculated	t-value critical	p-value	Remark
Experimental group	7	6	34	4.32	1.23	2.47	0.05	No significant difference
Control group	7		27	4.08				

Significant at 0.05

Table 6: The t-test comparison of the post-test of female Students of the experimental and control group on standard instructional materials

Variable	N	df	X	SD	t-value calculated	t-value critical	p-value	Remark
Experimental group	7	6	33	4.32	1.84	2.45	0.05	No significant difference
Control group	7		26	4.08				

Significant at 0.05

The result (of the t-test analysis) in Table 5 shows that there was significant difference. Since, (t = 1.23, df = 6, p. 0.05 C = 2.47). Therefore, the t-value is greater than the critical value, this implies that the hypothesis be rejected and to conclude that there is significant difference between the males in experimental group and control group. Therefore, deduction can be made that improvised materials are good for both experimental and control groups.

When t-test was used to compared the post-test scores of female students of the experimental and control group on standard instructional materials, the critical value was lower than the calculated value (1.84, df = 6, C = 2.45), the result is as shown in Table 6. The difference between experimental group and control group was significant. Hence, we reject the null hypothesis. Standard materials had the same effect on the females of experimental and control groups.

DISCUSSION

It has therefore, been discovered that the use of standard instructional materials have the same importance in the teaching and learning of physics in Ilorin metropolis.

It is revealed from the results that there is no significant difference in the performance of students taught with standard instructional materials and those taught with improvised instructional materials. Using improvised instructional materials, assists the teacher economically and also allows students interaction. It makes students use their intellectual ability during learning and teaching processes. More so, there is equivalence in the correlation coefficient of experimental group to that of the control group. The result of finding shows that the correlated table value as out lined in the serial number two. This also shows that there is no significant impact on the performance test of the students taught with improvised instructional materials.

Aguisiobo (1998) expressed that learning is an activity that takes place in a contact and not in a vacuum. He reiterated that student with teaching aids do not have a bank mind but a consolidated and developed library of knowledge. Furthermore, the result of first research hypothesis revealed that those who were taught with standard instructional materials performed

equally better with those who were taught with improvised instructional materials. This could be due to the fact that the improvised materials are also of high quality and standard. It can be deduced now that no significant difference exist between student taught with standard instructional materials and those taught with improvised instructional materials during students exposure to the treatment conditions.

In other words students acquire more information through many instructional materials so as to bring deeper understanding of the topics under consideration. The analysis of scores between the post test of male students taught with standard instructional materials and male students taught with improvised instructional materials as outlined in the serial number four in the table revealed that the hypothesis was rejected because the calculated correlation coefficient is greater than that of the table value.

The third hypothesis expressed on the serial number five of the table shows that the correlated coefficient (ANOVA) of female student taught with standard instructional materials did not significantly higher than the critical table value. The statistical test indicated that the third hypothesis is accepted. This signified a non significant impact on the performance of female students taught with standard instructional materials and those taught with improvised instructional materials.

This result agreed with the view of Okpala *et al.* (1998) who stressed that science subject should be taught primarily as a practical subject. Earlier on, Omosewo (2008) ascertained that in a modern science curriculum programme, students need to be encouraged to learn not only through their eyes, or ears, but should be able to use their hands to manipulate apparatus.

Okoboh *et al.* (2001) study on sex difference in academic achievement of primary school pupils in English language and mathematics in relating to the results obtained above observed significant difference among female and male students in the two subjects and significant difference was in favour of using instructional materials.

Conclusively, in order not to be stagnant as life is dynamic. One could find out that improvised materials had almost the same effects as standard materials. Therefore, there should be cordial relationship between our policy makers and teachers and by way of provision of funds available for improvisation especially that funds may not be available for importing standard materials. It is important to note that students require information through many instructional materials so as to bring better understanding of what they are being taught.

As government does not provide standard instructional materials needed as a result, teachers can teach with improvised materials, if this is done, the deteriorating performance of students in physics could be reduced.

RECOMMENDATIONS

As a result of the fore going discussions and conclusion, the following suggestions and recommendations are made as regards how to improve the quality use of both standard and improvised instructional materials in secondary schools in teaching of physics.

- Since, it is not encouraged to denounce text-book and replace it with other instructional materials, recommended text books should be made available in the markets at an affordable prices so as to enable every student lay their hands on copies
- The teacher should make use of different instructional materials as long as they are relevant to their lesson content

- There is also the need for the teachers to be resourceful in materials selection and planning. This is to reduce the cost of production and maintenance of instructional materials (standard), Local production and improvisation have always been a positive step towards the realization of this suggestion
- The need to update teacher's knowledge on materials for teaching of physics and acquaint them with other new innovations is also to be enhanced. This could be made possible by frequently organizing seminars, workshops and in service training for physics teachers
- Policy makers in secondary schools should raise fund so as to procure materials necessary for improvisation of instructional materials in physics and text books that would facilitate the effective teaching of physics
- Furthermore, teachers of physics should be periodically supervised and assessed in relation to their students' performances in the subject

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