EFFECTS OF SMART ELECTRONIC KIT INSTRUCTIONAL RESOURCES ON ACADEMIC ACHIEVEMENT AND INTEREST OF PRIMARY SCHOOL PUPILS IN BASIC SCIENCE AND TECHNOLOGY

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Abstract

This study was designed to determine the effect of smart electronic kit instructional resources on achievement and interest of pupils in primary school in Gwagwalada Area Council of Federal Capital Territory, Abuja. Two research questions and two null hypotheses, tested at 0 05 *level of significance, guided the study. The study adopted a pre-test, post-test, non-equivalent control group; quasi-experimental research design which involved groups of pupils in their intact class assigned to experimental and control group. The sample size for the study consisted of* 166 *participants. Random sampling technique was used to select the two schools that were assigned to experimental and control groups. The instruments used for data collection were Basic science and technology achievement test (BSTAT) and Basic science and technology interest inventory (BSTII). The reliability coefficient computed for BSTAT and BSTII were found to be 0.79 and 0.83 respectively. Mean was used to answer the research questions; while ANCOVA was employed to test the hypotheses. The study found out that the use of electronic kit in teaching is effective in improving pupils' achievement and interest in Basic science and technology. Consequently, it was recommended that government should provide the kit for the teachers and teachers should be encouraged to make use of the kit in leaching Basic science and technology in primary schools.*

Keywords: Smart Electronic Kit Instructional Resources, Academic Achievement, Interest and Basic Science and Technology

Introduction

Science and technology have contributed in no small measure to development and comfort of the modern world indeed, Science come to be recognized as the foundation upon which the bulk of the present day technology break through is Build. It is no longer in dispute that the prestige and political power of any nation relies largely on its level of science and technology as a requirement for the development of any country. The trend of development in the industrialized world show that science and technology were employed by many countries for rapid economic and technological transformation from agrarian to industrialized nation such as China, Russian and Asian. In Nigeria, these facts underscore the importance and priority accorded to science and technology and manifested in various policy statements and steps that encourage her citizens to pursue science and technology courses (Federal Republic of Nigeria (FRN), 2004). Such policies include the establishment of special science and technical schools, increasing the ratio of student enrollment in science and technology in tertiary institutions (60:40 science and technology to art) (FRN 2004). All these is done with the hope that a solid foundation in the science and technology would equip millions of Nigeria students for successful science and technology based careers, thereby contributing to the much needed scientific and technological advancement. It is this need to lay a solid foundation that led to introduction of Basic science and technology in Nigerian primary schools.

Basic science and technology as a subject in primary school came in to existence in the year 2005. The only subject related to it in primary school by then is science. The 9-year basic science and technology

curriculum is the product of a re-alignment and restructuring of the revised curricula for primary science and junior secondary school integrated science (Nigerian Educational Research and Development Council (NERDC), 2007).

Despite the role played by science and technology in nation development, the study of science and technology in Nigeria has been impeded by a lot of bottlenecks right from the primary school through secondary school to the tertiary level of education (Oranu, 2003). Oranu (2003) reported that the Nigeria science and technology education is seriously faced with a lot of problems. In the same view, Nworgu (1992) noticed that contrary to the spirit of science and technology, science and technology teachers still teach without the necessary activities needed for proper understanding of the concepts. He observed that unsatisfactory performance of students in science and technology and their inability to transfer what is learnt in the class to similar situation, outside the classroom reflect how they inadequately understands science and technology concepts. However, Harbor-Peters (2001) pointed out that students will be able to achieve better if there is effective usage of instructional resources and methodologies by the mathematics and technology teachers.

Instructional resources are materials used by teachers in the classroom (Obodo, 2004). They are materials or resources, which both the teachers and students use for the purpose of ensuring effective teaching and learning. The use of instructional resources is not new, as Grassman in Usman and Obidoa (2005) pointed out that education has been advised since 1885 to manipulative resources in teaching specific concept in mathematics. Furthermore, some researchers like Purdy and Luepruti (1982), have also studied the effects of instructional material on achievement, retention, attitude and transfer of mathematics concepts. Their result have led Abdullahi (1982) and Ehiaburine (2005) to call for the use of the laboratory approach where instructional resources are used as a means of stimulating and maintaining interest in teaching and learning. The use of instructional resources help to reduce the level of abstraction involved in teaching and learning concepts (Obodo, 2004). One of the greatest obstacles in arousing interest in basic science and technology for many pupils is its abstract nature. The teacher can minimize this with the effective use of instructional material when teaching. Instructional resources if properly used capture the learners' interest. They also keep the pupils busy and active, or provide for active participation in the pupils. Instructional resources also stimulate the imagination of the pupils and gives room for effective retention of basic science and technology concept. According to Ali (2005), improved instructional techniques like the use of smart electronic kits for teaching may de-emphasize role memorization and dogmatic application of rules and formula. Emphases need to be shifted to basic understanding of concepts and technique, while the textbook and chalkboard remain important teaching tools.

The need to stimulate pupils' interest and improve their academic performance in science and technology called for effective use of instructional resources for which smart electronic kit is one.Smart electronic kit is an electronic device that is specifically designed to eliminate the difficulties and frustrations associated with handling small and delicate electronic components in the basic science and technology laboratory. The kit is made up few electrical components and wires of different lengths and each component or wire with a particular symbol. Another advantage of the kit is that it improves pupils' academic achievement and arouses pupils' interest in studying science and technology (Crellin, 1999).

In 2011, The Federal Capital Territory (FCT) Agency for science and technology trained some of their Basic science and technology teachers on the use of smart electronic kit in teaching basic science and technology at primary school level in order to stimulate the pupils' interest and improve their academic performance. The study is therefore designed to determine the effect of Smart electronic kit on pupil's academic achievement and interest in basic science and technology in primary schools.

Statement of the Problem

In spite of the huge investment by the successive Nigeria governments on science and technology education which aimed at improving the performance of students in science and technology, the performance of the pupils in Basic Science and technology at primary school level has never been encouraging in Federal Capital Territory (FCT) specifically. The Federal Ministry of Education (FGN, 2000) has observed that some of the factors responsible for the high failure rate of primary school pupils in science include poor infrastructural facilities, poor quality of teaching staff and poor teaching in primary schools. Moreover, it has been discovered that the persistent poor academic achievement and low interest

of students in technology and other related subjects is as a result of lack of instructional resources and inappropriate teaching methods adopted by teachers (Aina, 2000). Therefore, can the use of smart electronic kit in teaching produce significant effect on the academic achievement and interest of Basic science and technology pupils in primary schools?

Research Questions

The study addressed the following research questions.

1. What is the effect of smart Electronic kit instructional Resources on pupil's academic achievement in primary six Basic science and technology?
2. What is the effect of smart electronic kit on pupils' interest in studying Basic Science and technology?

Hypotheses

The following null hypotheses were tested at .05 level of significance

HO_1: There is no significant difference in the mean achievement scores of pupils taught with smart electronic kits and those taught without the kits.

Ho_2: There is no significant difference in the mean interest scores of pupils taught basic science and technology with smart electronic kit and those taught without the kit.

Methodology

Random sampling technique was used in the selection of two public primary schools in Gwagwalada Area Council of FCT that their primary six pupils were used for the subject for the experiment and the schools assigned to experimental and control groups. In all 166 pupils participated in the study. Instruments used for the study were developed by the researchers. The instrument used are Basic science and technology Achievement test (BST AT) with a split-half reliability coefficient of 0.79 and basic science and technology interest inventory (BSTII) with Cronbach alpha reliability coefficient of 0.83. A lesson plan on the use of smart electronic kit was also developed by the researchers. The lesson plan was used for the experimental group. Meanwhile, another set of lesson plans was developed and used for the control groups.

The study employed pre-test, post-test control group non randomized quasi-experimental design in which the treatment was given. After the initial random selection of the classes to be used in each school, the classes were' randomly assigned to the treatment conditions. This was followed by the administration of the pre-test by the researcher.

(1) **Experimental Group:** For this group, smart electronic kit was employed in teaching the pupils.
(2) Control Group: For this group, the conventional lecture method was employed.
The treatment lasted four weeks of four periods of thirty five minutes per period per week. The researcher and two other assistants handled the treatments conditions in all the classes. At the end of the treatment, the Basic science and technology Achievement Test (BSTAT) and Basic science and technology interest inventory (BSTII) were administered on the pupils. The pre test-post-test performance scores were analysed using mean, standard deviation and analysis of covariance.

Results

Research Question One

Is there any significant effect of treatments (the use of smart electronic kit for teaching and conventional method) on pupils' academic achievement in Primary six Basic Science and technology?

Table 1: Mean Achievement Scores and Standard Deviation of Experimental and Control groups in Pretest and Posttest (BSTAT)

Group	Pretest	Posttest	Pretest- Posttest Gain
Experimental Mean	18.7805	55.4878	36.7073
Std. Deviation	10.81725	12.63470	
N	82	82	82
Control Mean	21.5714	40.1786	18.6072
Std. Deviation	8.59151	13.71936	
N	84	84	84

Table 1 show that the mean achievement score of PRE BSTAT for the experimental group was 18.7805 with a standard deviation of 10.81725, while that of control group was 21.5714 with standard deviation of 8.59151. This means that at the beginning of the study, the subject were almost at the same level in their knowledge of basic science and technology. The mean achievement score of POST BST AT for the experimental group in table 1 was 55.4878 with a standard deviation of 12.63470. While that of control group was 40.1786 with a standard deviation of 13.71936. The pre-test-posttest mean gain for the experimental group is 36.7073, while that of control group is 18.6072. This implies that the use of smart electronic kit in teaching basic science and technology seems to have affected pupils' achievement more positively in experimental group than their counterparts. The associated hypothesis HO_1)is further tested to ascertain whether the noted difference is statistically significant.

Research Question Two

Is there any significant effect of smart electronic kit for teaching on pupils' interest in studying Basic Science and technology?

Table 2: Mean Scores and Standard Deviation of Experimental and Control Group in pretest and Posttest (BSTII)

Group	Pre Interest	Post Interest	Pre-Post Interest mean Gain
Experimental Mean	20.4268	49.9146	29.4878
Std. Deviation	10.63889	14.42238	
N	82	82	82
Control Mean	24.4762	38.8690	14.3928
Std. Deviation	14.05795	13.49590	
N	84	84	84

From table 2, it was observed that mean pretest of the control group 24.4762 and that of the experimental group 20.4268; they are in equivalent entry knowledge at the commencement of treatment. This shows that before the commencement of this study, the pupils were almost at the same level of interest in basic science and technology. The experimental group students' posttest (POST BSTII) with a post mean gain of 29.4878 appeared to have a much higher interest score (49.9146) than their control group counterparts who scored 38.8690 in post interest inventory (POST BSTII) and with post mean gain of 14.3928. This suggest that the pupils taught with the smart electronic kit developed more interest in basic science and technology than the control group pupils. The second hypothesis ($H0_2$) is tested to determine the extent of this difference.

Null Hypothesis One

Table 3: Analysis of Covariance (ANCOVA) Result on Students' Post Achievement Scores (POST BSTAT)

source	Type III sum of square	Df	Mean square	F	Sig
Corrected Model	11635.633	2	5817.816	35.594	.000
Intercept	51771.971	1	51771.971	316.746	.000
Pre test	1910.580	1	10782.026	11.689	.001
Group	10782.026	1	1017.020	65.966	.000
Error	26642.229	163	163.449		
Total	416625.000	166			
Corrected Total	38277.861	165			

*. R squared= .304 (Adjusted R Squared = .295)

Table 3 revealed that the F-calculated for mean scores of experimental and control groups in the BSTAT. The F-calculated value for group is 65.966 with a significance of F at .000 less than .05. Hence, the null hypothesis is therefore rejected at .05 level of significance. This shows that there is a significant difference between the two groups in favour of those that were taught using smart electronic kit.

Null Hypothesis Two

$H0_2$: There is no significant difference in the mean interest scores of pupils taught basic science and technology with smart electronic kit and those taught without the kit.

Table: Analysis of the covariance (ANCOVA) of pupils' Interest (By using kit in Teaching)

source	Type III sum of square	Df	Mean square	F	Sig
Corrected Model	1226.903*	2	6130.952	40.351	.000
Intercept	40985.892	1	40985.892	269.747	.000
Pre test	7199.431	1	7199.431	47.383	.000
Group	7036.354	1	7036.354	46.310	.000
Error	24766.354	163	151.942		
Total	363174.000	166			
Corrected Total	37028.434	165			

*.R square = 331 (Adjusted R Square = .323).

Table 4 shows F-calculated for mean scores of experimental and control groups in the interest inventory. The F-calculated fo group is 46.310 with a significance of F at 0.000 which is less than .05. Hence the null hypothesis is rejected. Therefore, there is significant difference on the interest of pupils in basic and technology at P <.05 level of significance. This implies that pupils that were taught with smart electronic kit developed more interest in basic and technology than those taught without the kit.

Discussion of the Findings

The finding of this study revealed that the use of smart electronic kit for teaching basic science and technology had significant effect on pupils' achievement and intrestin basic science and technology. The experimental group had higher achievement and mean gain scores of (55.4878; 36.7073) than their control group (40.1786;18.6072). This showed that experimental approach affected pupils' achievement positively than the conventional method.

In comparing the achievement of the subject in basic science and technology, the mean score of the experimental groups were higher than those in the control group. The difference in achievement was statistically significant too. This, positive and higher achievement may have been as a result of the used of kit which involved the use of real object for teaching, which confirmed the view of Obodo (1991, 1998 and 2002) and WAEC (1998), which reported that teaching method should be practically applicable and project oriented.

This high achievement is not surprising since the pupils had contact with the kit and demonstrated with the kit. This was also in line with the findings of Usman and Obidoa (2005). This type of exposure to practical and applicability of basic science and technology in concrete situation make the pupils to easily understand the subject and thereby resulting in higher achievement.

It was also revealed in table 2 that the experimental group have higher interest and mean gain scores of (49.9146;29.4878) than the control group (38.8690;14.3928). This showed that the pupils taught basic science and technology with smart electronic kit developed more interest than their control counterparts. This different in mean interest scores of this group was also statistically significant. It can be inferred that the used of smart electronic kit in teaching has stimulated pupils' interest in basic science and technology and thereby, enhanced their performance. This in line with Crellin (1999) that one of the advantages of instructional kit is that it improves pupils' academic achievement and arouses pupils' interest in studying science and technology

Abdullahi (1982) and Ehiaburine (2005) also asserted that instructional resources are used as a means of stimulating and maintaining interest in teaching and learning. Pupils' interest in basic science and technology was rekindled for better achievement. Unnecessary fear in basic science and technology was driven away and basic science and technology become meaningful and relevant to the learner.

Conclusion

Use of smart Electronic Kit is at the pilot phase in Gwagwalada and other Area Councils of FCT. This makes the results of this study reliable. The results of this study give insights on effects of such usages on pupils' achievement and interest.

Recommendations

1. Having found out that the kit is effective for improving pupils' achievement and interest in basic science and technology, there is need for all science and technology teachers at primary school level to adopt the use of smart electronic kit in teaching basic science and technology.
2. A model of teacher training on the use of smart electronic kit need to be developed for effective instruction in basic science and technology and other related subjects in primary and secondary secondary.
3. The below average pupils in basic science and technology need to be given supplementary coaching through the use of smart electronic kit for the purpose of reinforcement.

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