

ENHANCING ACHIEVEMENT IN SCIENCE THROUGH THE USE OF ICT INSTRUCTIONAL PACKAGE

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Abstract

The importance of science in the development of societies of the world cannot be disputed. The Information and Communications Technology (ICT) presently is known to be playing a major role in all spheres of human endeavour, the educational sector inclusive. This study examined how the use of ICT instructional package affects the achievement scores of children in science. It also sought to find out whether gender contributes to the effect that the ICT instructional package has on the achievement of the children in science. The study found that using the ICT instructional package to deliver primary science instructions enhanced the children's achievement scores in the subject and that gender did not contribute significantly to the enhanced achievement scores of the children. The study therefore recommended among other things that ICT instructional packages addressing topics in science and other school subjects should be developed and made available for use in facilitating teaching and learning in our schools.

Scientific literacy has remained important for developing nations like Nigeria considering the pivotal place of science and technology in the development of nations of the world. According to Alebiosu (2003), science has immense contribution towards the growth, development and the survival of mankind. Solarin (2005) cited in Olatoye and Agbatogun (2009) regretted that in spite of the importance of science to national development, performance of students in the area has remained worrisome.

Science is taught at all levels of the Nigerian education system. Children's literacy in science at the primary school level is particularly important considering that the primary school level is the foundation upon which other levels of education are built. Addressing the problems of science teaching and learning at this level will no doubt benefit the subsequent levels of the education system.

This study explores the potentials of the information and communications technology (ICT) in enhancing the achievement of learners in science. The information and communications technology is a concept 'typically used to refer to computer technologies but strictly speaking should also include technologies used for the collection, storage, manipulation and communication of information' (Newhouse, 2002 p.24). Consequently, information and communications technologies (ICTs) have been defined as a 'diverse set of technological tools and resources used to communicate and to create, disseminate, store and manage information' (Tinio, 2002 p.4).

The role of ICT worldwide in all aspects of human endeavour and in the educational sector in particular cannot be over-emphasized. Consequently, 'most of the developed countries have exploited the potentials of ICT to transform their educational landscape at the tertiary, secondary and even primary school levels particularly the instructional process' (Kasakowski, 1998 cited in Kalu and Ekwueme, 2003 p.14). Obviously, the western world has exploited the ICT for the

transformation of the classroom at all levels of education. This is not the case for most of the developing nations including Nigeria. Lamenting on the state of ICT and education in Nigeria, Kalu and Ekwueme (2003) and Ebenebe and Ezenwosu (2006) stated that, most Nigerian teachers are not even aware of the existence of ICT in some cases and in other cases, the use to which ICT can be put in order to transform the classroom and improve learning ultimately. This situation totally negates the mandate of the Federal Republic of Nigeria-FRN as contained in the national policy on education that, ICT should be integrated into the Nigerian educational system at all levels to aid instruction among other reasons (FRN, 2004).

Some studies have claimed that the use of the ICT for presentations of instructions has the potential of enhancing achievement of students (Dung, Nwansa and Dung, 2003; Ebenebe and Ezenwosu, 2006 and Ezugwu, 2007 among others). The whole idea of using ICT instructional package in this study was to make the presentations of instructions more colourful and attractive. Making the presentation colourful and attractive has implication for effective teaching and learning considering that the focus of the study is on children. Children are known to be easily distracted and so when presentation of instruction is made more colourful and attractive, there is the possibility that the children's interest will be sustained and their attention captured in the process. When the learners' attention is captured in this way, the expectation is that they will grasp the content of the instruction better and achievement will be enhanced.

Relating the use of ICT for purposes of instruction to achievement of learners, Bill (2003) indicated that ICT instruction has advantage over the conventional or traditional method of instruction. Bill further argued that ICT has features that appeal to learners and capture their attention.

Most of the available studies, supporting that ICT has the potential of enhancing achievement in learning, focus mainly on secondary and tertiary education students. There is the dearth of such studies focusing on primary school children. There is therefore the need to explore, whether ICT equally enhances achievement of learners at the foundation (primary) level of our education system, so as to justify the provisions in the national policy on education that ICT should be integrated at all levels of the Nigerian education system to aid instruction (FRN,2004).

A number of researchers have reported poor success of learners in science (Adeniyi, 1995; Ajayi, 1998; Adeyegbe, 2000; Alabiosu, 2003; Olatoye and Agbatogun, 2009 among others). The poor state of primary science achievement has been blamed on poor instructional techniques among other factors (Ikoku, 1980; Nzewi, 1986; Obodo, 1993 and Egbegbedia, 1998). There is therefore the need to experiment on new approaches/techniques which have the potentials of improving achievement in science hence the adoption of the ICT instructional package in the delivery of science instructions in this study.

A study of this nature is considered imperative because apart from the expectation that such a study may hold the key to the improvement of science teaching and learning in Nigeria, it may also lend support and provide the justification for ICT advocacy in all human endeavours and in education in particular in Nigeria.

The purpose of this study was to investigate how the use of ICT instructional delivery package affects achievement in science and in doing so gender was also considered as a variable. In other words, the study also examined whether gender affected the achievement of the pupils exposed to the ICT instructional package.

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Two research questions guided the study.

1. How does the use of ICT instructional package affect achievement of pupils in science?
2. What is the interaction effect of ICT and gender on achievement of pupils in science?
Two hypotheses were formulated to guide the study.

H₀₁. The use of ICT instructional package will not significantly enhance achievement in science.

H₀₂. There is no significant interaction effect of ICT and gender on the achievement of pupils in science.

Method

The Quasi experimental research design was adopted in this study. The population of the study was made up of all the 2,554 primary five pupils in the 46 public primary schools in the Nsukka central education zone in Nsukka local government area of Enugu state for the 2008/2009 academic session (Local Government Education Authority, Nsukka).

A total of 177 primary five pupils drawn from two schools served as the sample for the study. Purposive sampling technique was used to select two schools that have ICT (computer) facility. The two schools involved in the study were randomly assigned into experimental (treatment) and control groups. The experimental group was exposed to the ICT instructional package while the control group was exposed to the conventional approach to instruction.

The ICT instructional package used in this study for presentations of instructions was designed by the researcher in consultation with some ICT programme experts. The package was designed by exploiting the potentials of the computer which is an ICT facility and involved the use of power points and some animation techniques. The power point took care of the wordings of the presentations while the animation technique added visual effects to the

presentations. The ICT instructional package was structured according to lesson plans prepared by the researcher and treating the topics; respiratory system and flowering plants which were contained in the primary five science module.

The instrument for data collection was the pupils' achievement test in primary science (PATIPS). The PATIPS was a 20-item multiple choice objective type achievement test, scored over 100 i.e. 5 marks for each item answered correctly. The lesson plans, the PATIPS and the corresponding marking guide were validated by experts in the content area (biology lecturers at the Federal College of Education, Eha-Amufu) as well as primary five teachers who were directly involved in the teaching and assessment of primary five pupils. The reliability of the instrument (PATIPS) was determined using the Kuder-Richardson's (K-R 20) formula and the reliability coefficient of 0.71 was obtained.

Before beginning the experiment proper (presentations of instructions), the PATIPS was administered to the pupils in order to generate their pretest achievement scores. Thereafter, the primary science instructions were presented using the ICT instructional package for the treatment group and the conventional mode of presentation for the control group. The difference between experimental and control groups however is that, the projector was used to project on a screen ICT packaged instructions with both static and motion diagrams to illustrate the points being made for the treatment group whereas chalk, chalk board and static diagrams were used as tools for presentation of instructions for the control group. The instructions lasted for four weeks after which the pupils were post tested with the PATIPS to ascertain the extent of achievement of the learners on the primary science content experienced. The researcher and research

assistants accomplished all of these. The data generated in the study were analyzed using means and analysis of covariance (ANCOVA).

Results

Research Question 1

How Does the Use of ICT Instructional Package Affect Achievement in Science?

Table 1: Pretest/Post Test Mean Achievement Scores of Pupils in Science

Experimental groups		Pretest	Posttest
Treatment-ICT package	Mean	29.19	61.28
	N	86	86
	Std. Deviation	11.16	15.98
Control-Conventional Approach	Mean	29.95	51.98
	N	91	91
	Std. Deviation	9.73	13.64

Table 1 shows the pretest/posttest mean and standard deviation scores of pupils in both treatment and control groups. From the Table, it can be seen that, the pupils who were instructed using the ICT instructional package (treatment group) had a superior posttest mean achievement score of 61.28 when compared with their counterparts who were instructed using the conventional instructional approach (control group) with a lower posttest mean score of 51.98. This suggests that the ICT instructional package enhanced the pupils achievement scores more than the conventional instructional approach.

Ho₁. The Use of ICT Instructional Package will not Significantly Enhance Achievement in Science.

Table 2: Summary of ANCOVA Statistics of Mean Achievement Scores of Pupils in Science.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	28044.033 ^b	16	1752.752	19.702	.000	.663
Intercept	12169.725	1	12169.725	139.794	.000	.461
Pretest	20414.081	1	20414.081	229.465	.000	.589
Experimental	1955.089	1	1955.089	21.976	.000**	.121

Experimental * Gender	28.572	1	28.572	.321	.572*	.002
Error	14234.215	160	88.964			
Total	607250.000	177				
Corrected Total	42278.249	176				

**Significant (S) at .05 levels

*Not Significant (NS) at .05 levels

Data presented in table 2 indicate that the use of ICT instructional package in the delivery of primary science instructions enhanced significantly, the achievement scores of pupils in primary science. This claim is supported by the calculated F-value of 21.98 in respect of the treatment as main effect, which is shown to be significant at .000 levels, and therefore significant at .05 level of probability. This means that the null hypothesis of no significant enhancement in the mean achievement scores of pupils taught science using the ICT instructional package is hereby rejected. So, the use of ICT instructional package enhanced the achievement of the pupils in science.

Research Question 2

What is the Interaction Effect of ICT and Gender on Achievement of Pupils in Science?

Table 3: Gender-Treatment Interaction Effect on Mean Achievement Scores of the Pupils in Science.

Experimental Groups	Gender of Respondents	Mean	Standard Deviation	N
Treatment- ICT package	Male	62.67	17.09	43
	Female	59.88	14.86	43
Control-Conventional Approach	Male	51.63	12.64	49
	Female	52.38	14.87	42
Total	Male	56.79	15.80	92
	Female	56.18	15.25	85

Data presented in Table 3 show the interaction effect of gender and treatment on

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mean achievement scores of the pupils in science. The mean achievement scores across the gender levels for the treatment and control groups differ. The difference for the males is 11.04. The males in the treatment group had a higher mean achievement score of 62.67 whereas their counterparts in the control group had a lower mean achievement score of 51.63. Again, the difference between the mean achievement scores for the treatment and control groups among the females is 7.50. The females in the treatment group had a higher mean achievement score of 59.88 as against a lower mean achievement score of 52.38 recorded for the control group. This could imply that the male and female pupils benefitted differently from the treatment package.

Ho₂: There is no significant interaction effect of ICT and gender on the mean achievement scores of the pupils in science.

From data on Table 2, it can be observed that the interaction effect of treatment and gender on the achievement scores of pupils in science is not significant. This is evidenced by the calculated F-value of .32 which is significant at .57 levels. Since this significant level (.57) is far much greater than .05 levels, the F-value obtained (.32) is therefore, not significant. Consequently, the null hypothesis of no significant interaction effect of gender and use of ICT on the achievement scores of the pupils in science is accepted as stated. This means that, the enhanced achievement scores recorded by the pupils in science was contributed more by the treatment than by gender.

Findings

The findings of this study included:

1. Pupils exposed to the ICT instructional package had enhanced mean achievement score when compared with their counterparts in the conventional group.

2. The enhanced mean achievement score recorded by the treatment group is also statistically significant.
3. The interaction effect of gender and treatment on the mean achievement scores of the pupils in science is not statistically significant.

Discussions

The result of the study revealed that the use of ICT instructional package in the delivery of primary science instructions significantly enhanced the achievement of the pupils in primary science. Data of the study showed that the experimental group who were taught science using ICT instructional package recorded higher post test mean achievement score when compared with their counterparts who were taught using the conventional instructional approach and recorded lower post test mean achievement score. Hence data of the study indicated that there is a significant difference in the collective mean achievement scores of the pupils in both treatment and control groups.

The finding of the study agrees with a number of studies (Lawal, Ahmadu and Dogara, 2003; Dung, Nwanse and Dung, 2003; Ebenebe and Ezenwosu, 2006; Ezugwu, 2007 among others) which suggested that the instructional use of the ICT has the potential for the enhancement of achievement in learning. Literature evidence also supports that ICT instruction has advantage over the conventional or traditional approach to instruction thus; Bill (2003) argued that ICT has features that appeal to learners and capture their attention. The possible explanation to the superior achievement score recorded by the pupils in the treatment group may be that the treatment appealed to the learners and they were also less distracted because the treatment captured their attention during the learning process unlike their counterparts who were saddled with the

method in regular use. In addition to this, the differential achievement scores recorded by the pupils in the treatment and control groups may be explained in line with the present age. We are living in a technology driven age and from our experiences, today's children are overwhelmingly interested in technology. They like to play video games, watch cartoons and other programmes of interest. They like to manipulate computers, handsets and other components of technology around them. These attitudes displayed by children towards technology may have been translated into the classroom when the ICT instructional package was utilized for instructional presentation. The children's attention was therefore captured in the process and resulted in the enhanced achievement in favour of the pupils in the treatment group.

The data of the study indicated that the interaction effect of gender and treatment on the achievement scores of pupils in science was not significant. In other words, the effect of the use of the ICT instructional package for the delivery of primary science instructions to both male and female pupils did not affect their achievement scores differently. That means that the treatment effect was consistent across the gender levels. Data obtained from the study also showed that the male and female pupils responded to the treatment in about the same way as indicated by the total mean achievement scores recorded by the male and female pupils. Consequently, gender is not a significant factor to be considered in the packaging and delivery of primary science instructions.

Conclusions

Based on the findings and discussions that followed, the study concluded that:

1. Use of ICT instructional package significantly enhanced the achievement of the pupils in primary science. The pupils exposed to the ICT instructional package showed superior mean achievement score when

compared with their counterparts who were exposed to the conventional instructional approach.

2. Gender-treatment interaction did not significantly affect the achievement of the pupils. Both male and female pupils appear to have reacted to the ICT instructional presentations in about the same way.

Recommendations

Based on the findings and conclusions of the study, the recommendations included:

1. Government should quicken the pace of implementing its intention to embark on computerization of schools (at all levels of our education system) to afford both teachers and learners the opportunity to function effectively in the present age. Government should create forum for training in ICT and provide the necessary training facilities for teachers and learners to enable them fit into the global trend of incorporating ICT in education.
2. ICT instructional packages treating topic areas in science and other subjects should be developed and made available for use to facilitate teaching and learning in our schools. In fact, the instructional process should be revolutionalized in tune with the present age. The use of chalk and chalk board should be reappraised especially considering that use of ICT instructional package makes instructional presentation easier for the teachers and also makes learning more exciting for the learners, capturing their attention in the process as observed in the present study.
3. Both male and female learners should be given equal encouragement to learn science at all levels of education since gender has not proved to be a barrier to success in science in the present study.

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