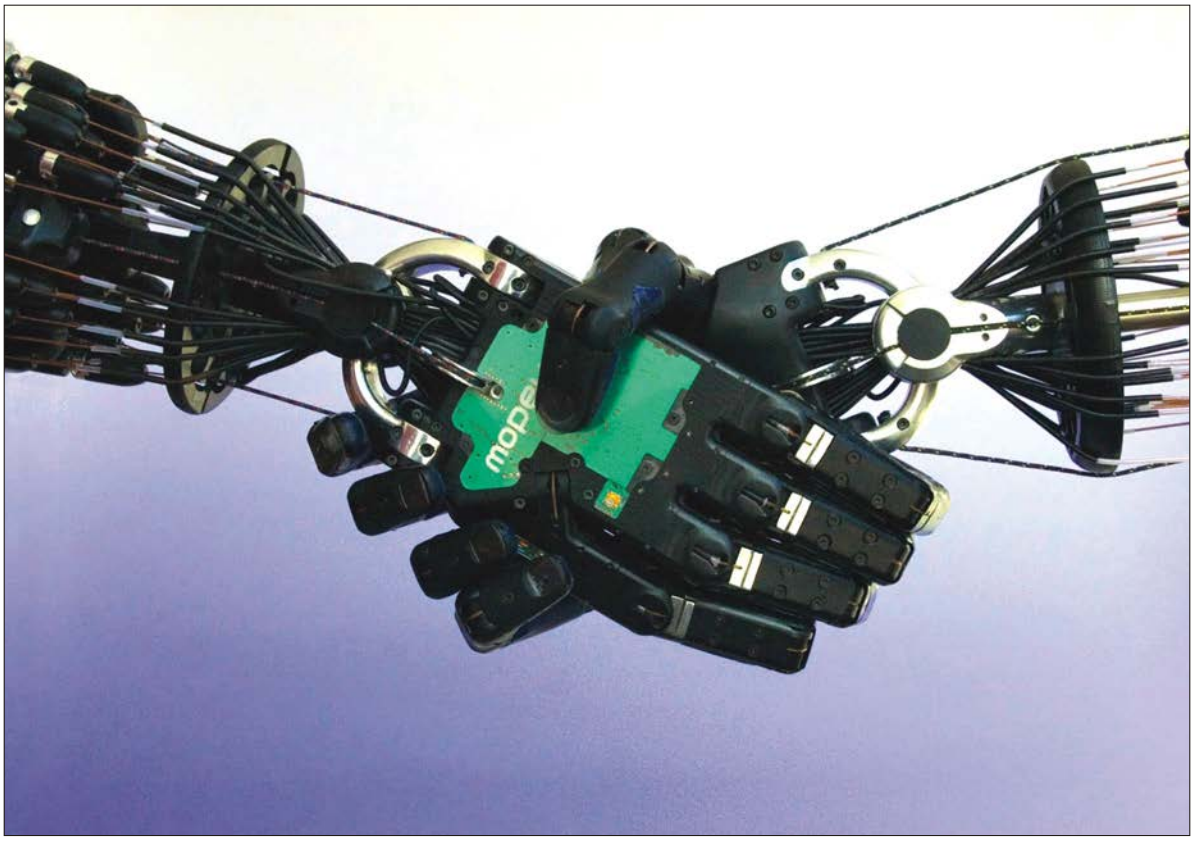

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Learning Information and Communications Technology Skills and the Subject Context of Introductory Technology Learning in Nigeria

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Abstract: In this study, the comparative effect of a researcher-designed ICT presentation on student's introductory technology in junior secondary school was investigated in Nigeria. Two hypothesis were postulated and tested at 0.05 significance level. Findings revealed that there was a significance difference between the achievement scores of introductory technology students taught with the ICT software and those taught with the conventional method on the posttest ($t = 15.54$, $df = 38$, $p \leq 0.05$). The implications of the findings for the use of ICT software were discussed. Recommendations for the improvement of introductory technology education in Nigeria and suggestions for further studies were also postulated.

Key words: Computer aided learning, introductory technology achievement test, ICT instructional software, junior secondary students, Kwara State

INTRODUCTION

Multimedia is a subset of the wider issue of the use of ICT (Information and Communication Technology) in schools. While there is widespread recognition that people need to learn how to use computers effectively in order to function in modern society, there is debate about the nature of that learning. Some see it as a simple but lengthy list of technical skills while others see it as including recognition of the power of ICT to bring about a major change in learning. Aviram and Talmi (2004) identified several groups active in ICT in education, including technocrats, that see the use of ICT as non-problematic and simply a matter of using the new tools and reformists, ICT is a major and possibly inexorable agent of change in education.

The reformist groups see the rapid growth in the use of ICT in schooling occurring in conjunction with the adoption of the constructivist learning theory (OECD, 2001). This theory supports active, hands-on learning. It is related to Cognitive Apprenticeship and the work of Jerome Bruner. Some educators see ICT as being a major driver of school reform. This reform is towards a more constructivist approach, using related terms such as: student-centred learning, problem-based learning and experimental education. Others point to the slow pace of such reform and suggest that ICT may support reform but it is by no means inevitable that it will do so (E-learning Europa, 2005).

The present study is based upon the background supported by previous researchers who see ICT as a powerful tool for constructivist learning point to its capacity to provide:

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- Active and highly motivating engagement with students
- Powerful tools to create text, art, music, sound, models, presentations, movies etc. that produce high quality products and remove much of the tedium normally associated with such creation
- An error-forgiving environment in which editing of a product fosters learning by trial and error
- Easy communication in text, voice, video
- Quick access to information and resources (Aviram and Talmi, 2004; Houghton, 2004; OECD, 2001; E-learning Europa, 2005)

Educators are finding out that while ICT can provide a technical environment for constructivist learning to occur, there is needs to develop quality teaching and to sustain environment that will challenge and inspire students to learn (Aviram and Talmi, 2004).

One of the problems of teaching and learning is the method of imparting knowledge to learners. The major difficulty in sciences is the method by which the subjects are customarily taught without regards to instructional materials. The pedagogical approach in imparting knowledge to learners has become inadequate to their needs. Bajah (1995) and Okeke (1986) found that science subjects has not been taught in Nigeria schools the way pupils can maximally benefits, as science instruments have mostly been teacher-centered. For the past two decades, science education has been facing a lot of difficulties which include poor performance of students in science subjects (Adeyegbe, 1992). Introductory technology, like other science subjects, recorded poor students' performance both in national and international examination (Akale, 1986). Many factors contributed to the poor performance of students in introductory technology examination (Akale, 1986; Okebukola and Jegede, 1997). These factors include:

- Inability of the teachers to put across the concepts to the students
- Lack of skills and competence required for teaching
- Shortage of qualified introductory technology teachers
- Lack of teaching materials and necessary equipment

Introductory technology as a subject is very important for the scientific and technological advancement of any nation. Though its usefulness cuts across all fields of human endeavor, the low enrolment of students in the subject at both secondary and post secondary levels has been a source of concern to various people especially introductory technology educators at various times (Omosewo, 1997; Balogun, 1985; Ogunneye, 1982; Orisaseyi, 1977; Ogunyemi and Eboda, 1974).

Lack of active participation of students is one of the factors responsible for students' poor performances in West African Examination Council (WAEC) results of secondary schools where students' performances are generally poor in introductory technology, physics, chemistry, biology and other sciences-related subjects (West African Examination Council, 2000). This pattern of poor performance in the sciences by students is also observed in tertiary institutions (Olarinoye, 1987). Omosewo (1997) asserted that teachers were using the lecture method of teaching the science subjects in the secondary schools. The direct impact of this method on learners is that it often leads to lack of understanding and this usually cause poor performance and low enrolment of students in the subject. The low enrolment in introductory technology is a cog in the wheel of the scientific and technological progress in Nigeria.

Many students see science as too abstract to comprehend, thereby resorting to memorization or rote learning. Many students have also changed from science subjects to art and commercial subjects while some dropped out and some failed woefully at the final examination. Meanwhile, various attempts have been made by government, school proprietors and teachers to facilitate effective teaching and learning of these science courses, which are the rudiments of development of any nation. Textbooks have been constantly reviewed and rewritten in simpler forms and teaching aids of various types designed, yet the problems persist.

Ogunneye (1982) found out that in this era of technological advancement, technology is still having minimum impact on education. This is because 80% of teachers in Nigeria are mostly using the chalkboard and textbook method (traditional method) in teaching introductory technology. Actually, most schools do not have modern instructional equipment and media. The few schools that have are unable to use them effectively due to erratic electric power supply and at times the inability of some teachers to operate some of this instructional media equipment. However, constant use of the traditional method of teaching is a major factor contributing to poor academic achievement of introductory technology students.

One of the major problems faced by students is inability to remember what has been learnt. This problem is often caused by too much theoretical expression by the teachers while learners are passive listeners. Students memorize and regurgitate facts and concepts. These problems confronting the teaching and learning of introductory technology can be handled using slide presentations, video presentation process and other interactive ICT software facilities in which a student interacts with and is guided by visual equipment aimed at achieving certain instructional goals (Ezeliora, 1997; Onasanya, 2002).

Computer can be used to transform classroom instruction into a series of rich memorable experiences and thus, reduce boredom and forgetfulness in teaching subjects such as introductory technology. In the recent years, the development of microcomputer in the process of teaching and learning has become widespread in educational institutions (Ezeliora, 1997; Onasanya, 2002). Abimbade (1996) reported that the use of computer (1) increases the time of learners devote to learning , (2) enhance the speed of availability of data and information, (3) provide immediate feed-back, (4) assist less qualified teachers and (5) increase teachers efficiently and effectiveness.

Udousoro and Abimbade (1997) and Adeniyi (1997) pointed out that students taught mathematics and physics with visual aid achieved higher cognitively than those taught without computer. This study was carried out to determine the effect of ICT on introductory technology and its implication on student's performance. It was to address the problem of consistently poor performance of students in junior secondary schools and tertiary levels. The study also compared the effect of ICT presentation and the traditional method of teaching (chalk-and -talk method) in teaching and learning of introductory technology in secondary schools in Kwara State, Nigeria.

MATERIALS AND METHODS

The research design used for the study was a pretest-posttest experimental control group design carried out in some junior secondary schools in Kwara State, Nigeria between July 2007 and May 2008. The students were randomized into two groups. The researcher used an experimental research approach. Therefore, the pretest and posttest control group design was used for the study. Twenty students offering introductory technology were

randomly selected for the study from each of four secondary schools. In all, there were 40 males and 40 females. The students were taught the same concepts in introductory technology using the conventional method and the ICT learning software.

The sample subjects were drawn from two co-educational and two single gender schools in Ilorin East Local Government Areas of Kwara State. The subjects from the co-educational schools were selected by the use of stratified random sampling technique. This method was chosen so that the gender variable could be appropriately represented.

Research Hypothesis

The following null hypothesis were formulated and tested at $p \leq 0.05$ so as to obtain answers to the research questions:

- There is no significant difference between the mean achievement scores of students taught introductory technology with ICT presentation and those taught without the ICT (Verbal presentation)
- There is no significant difference between the mean achievement scores of male and female students taught introductory technology with the ICT presentations

Instrumentation

The test instrument was made up of 50 items of the Introductory Technology Achievement Test (ITAT) which was used as pretest and posttest to measure both the lower and higher cognitive skills of the students in introductory technology. The test items required multiple-choice objective questions with five options (A-E) as possible answers to the questions which the students answered before and after the experiment. The experimental group was exposed to introductory technology lesson using ICT method for period of 6 weeks while the control group was taught the same introductory technology using the conventional traditional method.

After the duration of 6 weeks of treatment for the experimental group and the 6 weeks of lecture method for the control group, the posttest (ITAT) was administered to both groups at the same tradition in the usual per-pencil method. The treatment instrument which was interactive ICT learning software was developed by the researcher using the subject contents drawn from the secondary school syllabus. The program was written in Visual Basics, Fire Works, CorelDraw and Microsoft Word. The topics treated were selected based on junior secondary school the syllabus. The topic selected was from first term scheme of work and falls between the periods that research was carried out.

The development of courseware for this research material follows the systematic and recursive approach of instructional development model put forth by Mervill and Goodman (1997) and Philip (1987) however, five trails were made before the packages become successful. It was then tested with some few selected secondary schools in Ilorin, Kwara state. These schools used for testing the package falls between the population of the study but not part of the schools selected for research study. Some of the complaints from these selected students about the packages was later used for further modification and finally perfected the package.

Validity and Reliability of the Instruments

The ICT presentation (introductory technology package less) items were pilot tested and found to satisfy face, content and construct validity by three experts in educational technology, science education departments. Item analysis of the instrument was also carried out to determine the facility and discrimination indices after which the final items for the instrument were selected and the reliability coefficient computer using the split-half approach

and the Richard Kuderson formula 21 (KR-2). The value obtained for the reliability coefficient was 0.95 and this was considered to be adequate for this study.

Method of data Analysis

The mean, standard deviation and the t-test statistical analysis scores of the different groups were computed and used in testing the hypothesis. The level of the significance adopted for the analysis was $p \leq 0.05$. This level of significance formed the basis for rejecting or not rejecting each of the hypothesis.

RESULTS

Two research questions were raised in this study and two null hypothesis were formulated and tested to provide answers to the research questions. Analysis of the pretest and posttest data collected by means of the introductory technology were used to answer the research questions using the two null hypothesis as guide. Means, standard deviations and the t-test were employed in analysing the pretest and posttest data. The level of significance adopted for the analysis is 0.05. This level of significance formed the basis for rejecting or not rejecting a null hypothesis.

A pretest was administered to both the experimental and control groups. The test was the 50 item multiple-choice introductory technology. The subjects were allowed 40 min to do the test. The test was given to determine the academic equivalent of the experimental and control groups. The mean scores of students in the experimental and control groups on the pretest were calculated and the t-test computed for the two means. Table 1 shows the means, standard deviations and the result of the t-test analysis.

The result in Table 2 shows that there is no significant difference at 0.05 level of significance between the pretest mean scores of the experimental and control groups ($t = 0.22$, $df = 38$, $p>0.05$). This means that the subjects in the experimental and control groups were at the same entry level with regards to academic ability before the introductory technology topics were presented to them. Their mean scores were statistically the same.

Hypothesis 1

There is no significant difference between the mean scores of students taught introductory technology with ICT presentation and those taught using the conventional method of presentation.

To test this hypothesis, the posttest means scores of the experimental and control groups were presented and compared using the t-test statistics. The result is shown in Table 2.

Table 1: t-test comparison of the mean scores of experimental and control groups on the pretest

					t-value			
Variable	N	df	Mean	SD	Calculated	Critical	p-value	Remark
Experimental group	40	38	13.84	2.86	0.22*	2.08	0.83	Not significant
Control group	40		13.65	3.09				

*Not significant at 0.05

Table 2: t-test comparison of the posttest mean scores of the experimental and control groups

					t-value			
Variable	N	df	Mean	SD	Calculated	Critical	p-value	Remark
Experimental group	40	38	64.66	5.82	15.54*	4.75	0.001	Significant
Control group	40		49.63	4.79				

*Significant at $p \leq 0.05$

Table 3: t-test showing the posttest performance of male and female students in the experimental group

					t-value			
Variable	N	df	Mean	SD	Calculated	Critical	p-value	Remark
Males	20	19	62.26	6.23	0.29*	2.07	0.757	Not significant
Females	20		63.73	5.78				

*Not Significant at $p \leq 0.05$

The result (of the t-test analyses) in Table 2 shows that there was significant difference between the posttest mean scores of the experimental and control groups at 0.05 level of significant ($t = 15.54$, $df = 38$, $p<0.05$). Hypothesis I was therefore not accepted. This means that there was a significant difference at 0.05 level of significance between the performances of students taught introductory technology with the ICT presentation and those taught conventionally. Students taught with the computer package performed better than those who were taught without computer; hence, the ICT software enhanced the learning of introductory technology.

Hypothesis 2

There is no significance difference between the mean achievement scores of male and female students taught introductory technology with the computer-aided learning software.

To test this hypothesis, the posttest mean scores of male and female students in the experimental group were computed. The analysis was carried out using the t-test statistics and the result shown in Table 3.

From the result, in Table 3, it can be seen that there was no significant difference between the posttest mean scores of male and female physics students in the experimental group at 0.05 level of significance ($t = 0.29$, $df = 19$, $p>0.05$). Null hypothesis 2 was therefore not rejected. The performances of the male and female students in the experimental group were equally enhanced by the use of the ICT software; hence, the computer software on introductory technology was gender friendly.

DISCUSSION

The result seem to support earlier studies which concluded that students taught Mathematics and Physics with computer achieved higher cognitively than those taught without computer (Udousoro and Abimbade, 1997; Adeniyi, 1997; Hassan, 1997; Jonah, 1991). Finding on Table 2 shows that there was a significant difference in the introductory technology achievement of students taught with the computer-aided learning software. Those students taught with the computer software performed better in the introductory technology achievement test compared with those who were taught using the conventional method. Computer aided learning promotes intrinsic motivation for graduate students to learn better, therefore, be seen as a tool for effective teaching and learning of introductory technology subjects. The ICT is an effective tool that can efficiently and effectively develop individual's cognitive structure, psychomotor and affective abilities.

Findings on Table 3 indicated that there was no significant difference between the performances of male and female students who were taught introductory technology software. The male and female students performed equally well. The result agrees with the findings of Abdullahi (1982), who found that gender did not influence students' performance in science generally.

CONCLUSION AND RECOMMENDATIONS

From the findings of this research work, the following conclusions were drawn:
(1) Instructional strategies that teachers employ in teaching science subjects at secondary school level have significant effects on students' achievement. The findings of the present study showed that better performance in introductory technology can be achieved through the use of ICT software package and (2) male and female students were affected positively and equally by the use of ICT software package in teaching introductory technology. This showed that the ICT is not gender dependent.

From the findings of the present study, the following recommendations are made:

- The use of ICT and CAI for teaching and learning in our schools should be encourages. Therefore, computer instructions should be made compulsory for teachers and students in all levels of our educational systems
- Curriculum planners should enforce/inoculate the use of ICT and computer education/training into school curricula
- Educators should continue to lay more emphasis and implement the concepts of educational technology as a means of enhancing the quality of education
- Federal government should fully implement ICT literacy at all levels of education in Nigeria
- In-service training should be given to teachers on educational technology particular on the production and use of computerized instructional materials
- There is need for government and non-governmental organizations to organize seminars, workshops, conferences as well as in-service training for teachers on methodology of teaching so as to be able to compare and contrast effects of different methods of teaching on students' achievement
- Schools should be equipped with computer and Internet facilities and other necessary instructional packages like slide and video presentations
- Science teachers should learn how to prepare lesson notes and instructional packages using the ICT method of presentations
- Emphasis should be placed on making learning to be a learner-centered affairs as well as teaching for meaningful learning
- The role differentiation amongst boys and girls should be avoided when teaching science and technology. Each gender deserves equity in exposure to educational experience
- Academic cooperation, though not to the point of replication or subjugation should be worked out by departments of introductory technology/computer science and educational technology to develop adequate software for effective learning

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