

Effects of Compugraphics Instructional Package on Mathematics Achievement among Primary Pupils in Niger State, Nigeria

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Abstract

The study investigated the effect of computer graphics on the learning of Mathematics in some selected nursery and primary schools in Minna, Niger State, Nigeria. It further investigated the gender differences in the achievement of the subjects. Forty primary two pupils were randomly selected from four nursery and primary schools in Minna metropolis. Two schools each were randomly assigned to experimental and control groups respectively. Two hypotheses were formulated and tested. The researcher-developed compugraphics on Mathematics was used as treatment for the experimental group while the control group had the ordinary chalkboard drawing and sketches method. A 20-item Mathematics Achievement Test (MAT) was the instrument used to collect data for both the pretest and posttest. The data collected were analyzed at 0.05 significant level using statistical measures of means, standard deviation and t-test. From the analysis of data, the findings showed that students taught with compugraphics performed better than those taught without it. Also, there was no significant gender difference in the performance of pupils taught using compugraphics. It was discovered that the use of compugraphics in teaching enhances effective learning and higher performances. Also, the male and female pupils performed equally better which implies that compugraphics is gender friendly. The implications of the findings were discussed and recommendations were made for the improvement of primary education in Nigeria.

Introduction

Nursery and primary education have been the bedrock for all educational programmes of a nation and as such importance should be placed on it, as it must be provided with the desired ingredients to make it a worthwhile venture. However, public observations confirmed by research findings have shown that the teaching and learning in nursery and primary schools is beset with a number of problems that need to be overcome so that nursery and primary education can be meaningful and facilitative to the learners as well as result oriented to the nation as a whole (Nigeria Educational Research and Development Council, NERC, 2002).

Poor teaching and learning in primary schools according to Ajewole, et al,(2003) have been attributed to the following problems:

- (i) Lack of a progressive and articulate curriculum based on the knowledge of the national environment.

- (ii) Lack of adequate instructional materials e.g. equipment and materials
- (iii) Lack of qualified and experienced teachers in adequate numbers

In achieving the National Policy of Education (NPE) objectives in the nursery and primary schools, some methods have been recommended by the Federal Ministry of Education (FME) to implement the nursery and primary education curriculum. Among these are songs and rhymes, story telling, playing games, acting plays, discovery method, demonstration method, discussion method, project method, field trips and team teaching (Jegede and Brown, 1989) and of recent the use of computers.

Information technology can be defined as the technology of creation, processing, storage, retrieval and transmission of data and information (Rahman, 2002). According to Federal Ministry of Education (2004), with

particular reference to science and technology, Information communication Technology (ICT) is to be considered an important tool for the laying of a solid foundation of Science Technology and Mathematics Education (STME) at the primary school level as far as the popular slogan of "catch them young" is concerned.

The national computer education curriculum for primary schools was developed by the Nigerian Educational Research and Development Council (NERDC) in 2002. Information Technology (IT) is a subject to be taught and learnt in schools. IT equips the learner with the capabilities, understanding, skills and attitudes to maximally utilize ICT for the improvement of learning and life in the society (Technical Advisory Council (AC) 1988). The principles of ICT in education also promote the development of IT in the context of using ICT as a learning tool. In this information age, it seems therefore that educators and teachers are more interested in maximizing the benefits of ICT to enrich classroom instructional and learning rather than in the rhetoric of meanings and terminologies.

Compugraphics are drawings produced and generated by computers using input and output devices such as mouse, scanner, plotters, light pen and printers (Anyaogu, 1991). Brightman and Dunsdate (1986) have also observed Compugraphics as all techniques of using computers to prepare visual presentations. The result of these efforts may take the form of graphs and drawings printed on paper, displayed on Video Display Unit (VDU) or presented before an audience as slides and transparencies are now being used by architects, fashion designers, animations and fine artists. Computers are employed to design new type faces, prepare advertising artwork, create synthetic images, visualize garments, retouch photographs and even produce animation of objects that have no real existence (Vince, 1990).

Computers have been a positive and radical stimulus; they have provided a fantastic medium for the world of images.

People are no longer obliged to use paper, canvas and others. The digital domain of compugraphics provides a unique method of storing monochrome drawings, full-colour images, and detailed annotated link drawings, most images were stored as marks on paper-using materials like pencils, crayons, paint or ink – or held photographically. With the use of image processing techniques – initially developed for enhancing satellite images – a coloured image can be scan into a computer and enhance its sharpness. Colour and contrast balance can be modified and individual pixels (picture elements) can be altered. Pieces of the image can even be removed and replaced by another image. In fact, there are very few tasks that cannot be undertaken by a computer (Vince, 1992).

It is understandable why compugraphics systems have found their way into television; the industry which employs the very latest in digital technology, would dearly miss its paints systems, digital video recorders, caption generators, and video effects machines. Television viewers would not be able to enjoy the high quality of design and creative flair that permeates modern television if the compugraphics was not part of the design process. The world of advertising would also suffer if graphics designers were completely constrained by the limitations of traditional methods and materials. The advertising and media industry employs some of the most sophisticated graphical applications of computers 3D animation. The compugraphics was not part of the design process. Onasanya, (2000) found that compugraphics is better than conventional graphics in each of the attributes of media design (balance, composition, effectiveness, timeliness and creativity).

There are many advantages in the virtual world offered by Compugraphics; part and ink need no time to dry; images can be cut and pasted with soft-edge scissors and without glue; colour balance can be corrected with infinite precision; photographs, painting, drawings and television pictures can be composited with

Compugraphics images; images can be stored on compact disks and sent anywhere in the world; and the highest quality artwork can be output onto any medium (Onasanya, 2000).

The computer is a good learning instrument and a companion for the learner while it serves as an able companion and helper for teachers. Using the computer-programmed instruction, the teacher can teach as many students as possible without overworking himself/herself. In this study, learning materials are programmed and stored in the system and released to the pupils through the computer. The system guides the pupils from one part of the frame to another in individualized manner of instruction. Actually, in learning with computer, the pupils do not need advance knowledge of the computer. It's the computer that directs them on what to do at every step.

Udousoro and Abimbade (1997) and Adeniyi (1997) pointed out that students taught Mathematics and Physics with computer achieved higher cognitively than those taught without computer. Gambari (2003) found out that students taught Physics with computer performed better than those taught with traditional chalk – and – talk method. Studies conducted by (Gambari and Mogbo, 2005 and Gbodi, 2006) concluded that gender had no effect on achievement of students using Computer-Aided Learning software and videotaped Instructional package respectively. However, this study is basically concerned with the use of computer graphics software for learning of basic mathematics concepts in primary schools in Niger State, Nigeria.

Statement of the Problem

The purpose of this research was to find out if compugraphics software could be used effectively used in teaching basic mathematics concept in nursery/primary schools to improve the standard of primary education in Nigeria.

Objectives of the Study

This study is carried out to determine the effectiveness of developed computer graphics in fostering learning and to assess its effect on gender disparity in academic performance. It was also design to reveal the degree of pupils achievement towards the use of computer for teaching and learning when compare to ordinary chalkboard drawings and sketches.

Significance of the Study

The ability of pupils to understand the scientific concepts at elementary level with the aid of computer in order to ensure that pupils motivate and assimilate easily what they are expected to learn is the main focused of this study. The findings from this study would hopefully improve the teaching and learning of basic scientific concepts through the use of computer graphic in nursery and primary schools and to create awareness of versatility of computer in teaching and learning.

Research Questions

- (i) Is there any difference in the performance of pupils taught with compugraphics and those taught without it?
- (ii) Is there any gender difference in the performance of pupils taught mathematics with compugraphics?

Research Hypotheses

In order to answer the above research questions, the following null hypotheses were formulated and tested at 0.05 level of significance:

- (i) There is no significant difference in the achievement of pupils taught mathematics with compugraphics and those taught without it.
- (ii) There is no significant gender difference in the achievement of pupils taught mathematics with compugraphics.

Research Design

The study employed a pretest posttest experimental control group design.

It investigated the effect of compugraphics instructional package on learning of basic mathematics concepts in selected primary schools in Minna. Four primary schools in Minna metropolis were randomly selected. Two schools each were randomly assigned to experimental and control groups. Ten (10) primary IV pupils (five boys and five girls) were randomly selected from each school and a total of 40 pupils took part in the study.

The Instrument

The research instrument used in collecting data was Mathematics Achievement Test (MAT). The instrument developed by the researcher was made up of 20 items prepared based on the primary IV pupils curriculum in mathematics. The twenty items were multiple-choice questions based on Blooms' taxonomy of educational objectives. The instrument was scored over 100 (5×20 times). The instrument was subjected both the face and content validation by experts. This was further subjected to field testing. The test-retest method was used for the reliability of the instrument. The reliability coefficient of 0.88 derived from Kuder- Richardson 21 (KR 21) was recorded, showing that the instrument is reliable for the study.

The Treatment

The treatment given comprised of compugraphics instructional package on Basic mathematical concepts on "basic shapes (triangle, rectangle, square, circle, etc)". compugraphics software package is a systematic instructional design package that could be used for group or individualized study. It could also be used for instruction and remediation purposes. It is researcher developed and duly validated for content by experts in curriculum and educational technology as well as computer experts for its technicalities. Interesting and motivated science activities (such as animations, colors, effects, sounds, etc) were incorporated into each lesson of the package. This was also field tested and necessary adjustments were made.

Method of Data Collection and Analysis

Before the commencement of the treatment, the MAT was administered to sampled pupils as pretest. The control group was taught using the ordinary chalkboard drawing and sketches method while the experimental group had compugraphics instructional package on the topic treated. The test was 20 item multiple choice objectives type administered, marked and scored (5×20 times=100). The score formed the basic data for testing the hypothesis. The study lasted for two weeks of three periods per week. Descriptive and t-test inferential statistics were used to analyze data.

Research Methodology

The pretest-posttest experimental control group design was adopted for this research. Pretest and posttest were given to the students before and after the lessons. The experimental group was taught using computer graphics instructional package while the control group was taught using ordinary chalkboard drawings and sketches. The instruments use for data collection were researcher's developed pretest and posttest multiple – choice objective type questions called Mathematics Achievement Test (PSAT). The pretest was given to both groups before their respective lesson treatments, while the posttest was given after the lessons.

This study was conducted with Primary I pupils from four selected Nursery and Primary schools in Minna Metropolis. In each of the schools, forty (40) pupils comprising twenty males and females were randomly selected for the study are representative of the school body in Niger State. The four Nursery/Primary schools used for the study were selected because they were owned by privately individuals and well equipped with teaching facilities and manpower, while those schools used for treatment have computer facilities and taught it as a course in their curriculum. Mypa Nursery and Primary School, Minna and Hill-Top Model Schools, Minna were used as the experimental group taught with

the use of compgraphics software. While El-Betel Nursery and Primary School, Minna and Bosso Nursery and Primary School, Minna were used as control group, the pupils were taught using ordinary chalkboard drawing and sketches.

Both the pretest and posttest were scored over one hundred percent. The data were collected and the hypotheses tested using t-test.

Results and Findings

A summary of the data analysis and results are presented below in Table 1 and 2 respectively.

Table1: Mean, standard deviation and t-test result of experimental and control groups in pretest and posttest

Test	Group	N	df	Mean (X)	SD	t-value calculated	t-value critical	Significant Level
Pretest	E.G.	20		20.15	1.69			
			38			0.74 ^{ns}	2.58 ^{ns}	0.05
	C.G.	20		20.49	1.23			
Posttest	E.G.	20		84.7	7.64			
			38			10.60 ^x	2.58 ^s	0.05
	C.G.	20		63.4	4.73			

ns – not significant at 0.05 level

C.G.- Control group

s – significant at 0.05 level

E.G.- Experimental group

Table I shows that the pupils in the C.G. and E.G. in the pretest were at the same cognitive level with mean of 20.15 and standard deviation of 1.69 for E.G as against a mean of 20.49 and standard deviation of 1.23 for C.G. This gives t-value calculated as 0.74 and t-critical as 2.58 at 0.05 level. This proved that there was no significant difference in the performance of students in the two groups during the pretest. The two groups were found to be academically equivalent before the treatment commenced.

However, in the posttest analysis the calculated t-value (10.60) is greater than the t-value critical (2.58). This indicates that there is significant difference between mean scores of the experimental group (84.7) and control group (63.4) at 0.05 significant level.

H_0 : There is no significant difference in the performance of pupils taught with compugraphics and those taught without it. To test this hypothesis, the mean scores of the experimental group and control group in the pretest and posttest were computed.

The results show that there is a significant difference in the performance of pupils taught with compugraphics and those taught with ordinary chalkboard drawings and sketches.

This hypothesis of no significant effect was rejected. Consequently, it could be deduced from the study that the use of compugraphics software improved the performance of pupils at primary school level. This hypothesis of no significant effect was rejected. Therefore there is a significant difference in the performance of pupils group taught with computer graphics and those taught without it.

H_0 : There is no significant gender difference in the performance of pupils taught with compugraphics. To test this hypothesis, the mean scores of the experimental groups, (male and female) pretest and posttest were computed and compared.

Table2: Mean, standard deviation and t-test result of EG male and female posttest

Test	Group	N	df	Mean (X)	SD	t-value calculated	t-value critical	Significant Level
	E.G. (male)	10		19.9	1.45			
Pretest			18			0.65	2.10 ^{ns}	0.05
	C.G. (female)	10		20.4	1.96			
	E.G. (male)	10		19.8	1.75			
Posttest			18			1.45	2.10 ^{ns}	0.05
	C.G. (female)	10		20.9	1.65			

ns – Not significant at 0.05 level

C.G.- Control group

s – significant at 0.05 level

E.G.- Experimental group

Table II shows that there was no significant gender difference in the performance of pupils during the pretest ($t_{\text{calc}}=0.65$, $t_{\text{crit}}=2.10$, $Df=18$, $P \leq 0.05$). However, in the posttest, there was no significant gender difference in the performance of the pupils ($t_{\text{calc}}=1.45$, $t_{\text{crit}}=2.10$, $df=18$, $P \leq 0.05$). The hypothesis of no significant effect was retained. Therefore, there is no significant difference in the performance of male and female pupils taught using compugraphics software.

Discussion of results

This study showed that the use of compugraphics in teaching Mathematics in nursery and primary schools has positive effects on the pupils' performance. This is because those taught with compugraphics performed significantly better than those taught without it. The findings confirmed the assertion of Onasanya, (2000) that compugraphics is better than conventional graphics in each of the attributes of media design (balance, composition, effectiveness, timeliness and creativity). It also confirmed the research by Udousoro and Abimbade (1997) and Adeniyi (1997) and Gambari (2003) that pointed out that students taught Mathematics and Physics with computer achieved higher cognitively than those taught without computer. The study also in agreement that computer stimulates learning, motivates learners, improve better

understanding and retention to achieve better performance

From the results in Table II, therefore, gender had no effect on the performance of pupils in Mathematics Achievement Test. In other words, compugraphics software packaged for teaching elementary science is gender friendly. This is in agreement with Ajiboye (1996), Gbodi (2006) and Gambari and Mogbo (2005) who conducted similar studies and their finding were in consonance with this study. They found no significant main effect of sex on students' achievement in disciplines like social studies, geography and physics respectively. It is hoped that with further encouragement of female education, they (female pupils) could perform even better than their male counterparts.

Implications for Nigerian Education System

Pupils with positive attitude to science at early life derives joy and satisfaction from knowing and discovering scientific ideas. Therefore the teachers in Nursery and Primary schools should strive to achieve this in pupils and there is no other way to do this than effective design and develop instructional materials for classroom use. Pupils in nursery and primary schools are likely to do better if computer software of the type used in this is employed in teaching them. Also the use of compugraphics for

teaching some scientific concepts in nursery and primary level has the potential to make learning more interesting and permanent and could also serve as a motivator for learning. In addition, the use of instructional media such as the compugraphics used in this study could minimize gender differences in the science achievements of primary school pupils and hence improve the performance of the students (especially the females) in science.

Conclusion

From the findings of this research work, the following conclusions were drawn:

- (i) It is an interesting and useful experience to develop a computer graphics using various Artistic software like Instant Artists, Harvard Graphics, Clip Art and many others for teaching for teaching solid geometrical concepts in nursery and primary schools.
- (ii) Instructional strategies that teachers employ in teaching science subjects at nursery and primary school level have significant effects on pupils' achievement. The findings of the present study showed that better performance in elementary science was achieved through the use of compugraphics.
- (iii) The male and female pupils were affected positively and equally by the use of compugraphics software in teaching Mathematics. This showed that the effect of compugraphics is not gender dependent.

Recommendations

- (i) The use of compugraphics for teaching and learning in our nursery and primary schools should be encouraged.
- (ii) Teachers should try their best to be computer literate and develop computer software for their lessons.
- (iii) Emphasis should be shifted from acquiring instructional materials to development and improvisation,

since this encourages deeper content mastery, flexibility and versatility.
(iv) Universal Basic Education should endeavor to provide to privately owned and nursery and primary schools and public primary schools.

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