COMPUTER ANIMATIONS AND PUPILS' ACADEMIC PERFORMANCE IN BASIC SCIENCE AND TECHNOLOGY IN AKWA IBOM SOUTH SENATORIAL DISTRICT

By

Dr. Nsima F. Ikoh
Department of Early Childhood and Special Education
University of Uyo, Uyo.

Blessing Uwot Peter
Department of Early Childhood and Special Education
University of Uyo, Uyo.
And

Dr. Immaculata G. Umoh
Department of Early Childhood and Special Education
University of Uyo, Uyo.

ABSTRACT

The study investigated computer animations and pupils' academic performance in Basic Science and Technology in Akwa Ibom South Senatorial District. Quasi experimental research design was used for the study. A sample size of 210 primary-four pupils was selected for the study using multistage sampling techniques. Basic Science Performance Test (BSPT) was used for data collection. Four research questions and four hypotheses were formulated and used for the study. Research questions were answered using mean and standard deviation while null hypotheses were tested using ANOVA. Findings of the study showed that there was significant effect of computer animations strategies on pupils' academic performance in basic science and technology concepts. Based on the findings, it was recommended that computer animation strategies should be used to illustrate dynamic science concepts. Teachers should be trained on how to use computer animation facilities.

KEYWORD: Computer Animations, Pupils Academic Performance, Basic Science, Technology, Akwa Ibom and South Senatorial District

INTRODUCTION

Science and Technology form the foundation for sustainable development by protecting human societies from ignorance, illiteracy, diseases and poverty. Science is the systematic study of the physical world. It is the body of knowledge which has been acquired through experimentation (Urevlov, 2009). The word science is derived from a Latin word “scientia” which literally means knowledge. Science is a human activity where people are actively searching for and verifying knowledge. The application of scientific knowledge is what is referred to as ‘technology’. Technology is used for communication, transportation, manufacturing, surgical operation, learning and teaching process and accomplishing daily life task (Odunisi, 2011).

The basic philosophy of science education in Nigeria includes:

- To equip the learner to utilize science for self-realization.
- To equip learners with intellectual knowledge, skills, and scientific attitudes this will enable them to contribute significantly to the development of the society.
- To prepare the young children for higher education.

The Federal Government of Nigeria (2014) stated the specific rationale for teaching basic science and technology at the primary level of education as follows: to prepare pupils for useful living in the society, provide an increasing number of primary school pupils with the opportunities of education with high quality irrespective of sex, social, religious or ethnic background to diversify the curriculum to cater for differences in talent, opportunities and roles possessed by or open to student, to equip pupils to live effectively in the modern age of science and technology and to raise a generation of people who can think of themselves, respect the views and teaching of others, respect the dignity of labour and appreciate the values specified. Despite the current efforts in the field of teaching and learning Basic Science and Technology, a number of factors still militate against effective teaching of Science and Technology. Some of the factors as observed by Aderogba (2012) include; inadequate number of textbooks in science and technology, lack of instructional materials (media), high cost of setting up science and technology laboratories in schools, inadequate number of trained teachers, poor funding of school, effect of cultural beliefs and the use of inappropriate teaching methods. Usman (2010) asserted that pupil’s poor performance in science and technology in schools is attributed to poor methodology of teaching and lack of adequate instructional materials. Science and technological concepts such as the solar system, atom in a gas, digestive system, human cell, respiratory system, human heart, circulatory system and many more are dynamic in nature, they cannot be seen with the physical eyes and the use of static instructional materials like wall chart and conventional method of teaching such as discussion method (talk and chalk) cannot

adequately explain these dynamic/abstract phenomena for pupils to understand. Computer animation, an information technological tool tends to have greater advantage of delivering better presentation of these dynamic concepts by giving visual and auditory explanation on how these concepts are in real life. Moreno (2005) defined computer animation as a stimulated motion of pictures depicting movement of drawn objects. It is an act of creating moving images (illusion of movement, moving things that cannot move on its own) via the use of computer graphics. Computer animations stimulate more than one sense organ at a time and therefore make the teaching process more attention getting and attention holding. to animate means “to give life to”. Animating is the process of moving things which cannot move itself. Various forms of educational computer animation can be used as instructional media to illustrate and visualize science and technological concepts to children. Examples of such educational computer animation are; cartoon animation, model animation, puppet animation, flip book animation and diorama animation. A cartoon animation is a film made by photo graphing series of cartoons drawings to give illusion of movement when projected in a rapid sequence, television or computer screen. Model animation is a form of stop motion animation designed to merge with live action footage to create the illusion of a real-world fantasy sequence. Puppet animation is a development of object animation, rather than using objects in different frames. Puppets are moved in different frames to stimulate illusion of movement. Flip book animation is also known as “kineograph” it is a type of animation created by viewing a series of illustration of an animated scene bound together in a sequence so that an illusion of movement can be impacted by flipping them rapidly from one page to the next. Diorama animation is a three-dimensional miniature of life-size scene in which figures, wildlife and other objects are arranged in a naturalistic setting to illustrate an academic subject, plot of story, or event in a history. Thus, this study incorporates the use of computer animation as an instructional strategy in teaching pupils’ basic science and technology in Akwa Ibom South Senatorial Districts.

STATEMENT OF THE PROBLEM

The researchers observed poor academic performance among primary school pupils in basic science and technology. Pupils sometimes memorize scientific concepts without having deep understanding of these concepts. The use of static instructional materials like wall charts and conventional method of teaching such as discussion method (talk and chalk) to teach science and technological concepts that are dynamic and abstract such as atom in gas, digestive system, solar system results in poor performance in basic science and technology.

PURPOSE OF THE STUDY

The study sought to:

- Determine the effect of cartoon animation strategy on pupils' academic performance in basic science and technology concepts.
- Determine the effect of model animation strategy on pupils' academic performance in basic science and technology concepts.
- Determine the effect of puppets animation strategy on pupils' academic performance in basic science and technology concepts.
- Determine the effect of flipbook animation strategy on pupils' academic performance in basic science and technology concepts.

RESEARCH QUESTIONS

The following research questions guided the study:

- What is the effect of cartoon animation on pupils' academic performance in basic science and technology concepts?
- What is the effect of model animation on pupils' academic performance in basic science and technology concepts?
- What is the effect of puppets animation strategy on pupils' academic performance in basic science and technology concepts?
- What is the effect of flipbook animation strategy on pupils' academic performance in basic science and technology concepts?

RESEARCH HYPOTHESES

The following null hypotheses were formulated and tested at 0.05 level of significance.

- Ho1: There is no significant effect of cartoon animation strategy on the academic performance of pupils in basic science and technology concepts.
- Ho2: There is no significant effect of model animation strategy on the academic performance of pupils in basic science and technology concepts.
- Ho3: There is no significant effect of puppet animation strategy on the academic performance of pupils in basic science and technology concepts.
- Ho4: There is no significant effect of flipbook animation strategy on the academic performance of pupils in basic science and technology concepts.

RESEARCH METHODS

Design of the Study

The study employed quasi-experimental control group design. Pretest and post-test were used for the study.

AREA OF STUDY

The study area was Akwa Ibom South Senatorial District.

POPULATION OF THE STUDY

The population of the study comprised all the 38,196 primary four pupils (18,326 males and 19,870 females) in 257 public primary schools in the 11 Local Government Areas of South Senatorial District of Akwa Ibom State (SUBEB, 2016).

SAMPLE AND SAMPLING TECHNIQUE

A sample size of 210 primary four pupils was used for the study. A multi-stage sampling technique involving stratified sampling, purposive sampling and random sampling techniques was adopted for the study. Three Local Government Areas out of the eleven were randomly selected through balloting and two schools were randomly drawn from each local government. One class of primary four pupils were purposively selected from each school. Each class consisted of 35 pupils. Four classes were used as experimental groups and one class as a constant control group.

INSTRUMENTATION

The instrument used for data collection was Basic Science and Technology Performance Test (BSTPT) designed by the researcher to measure pupils' academic performance in the five selected lessons from basic science and technology primary four curriculum taught within the six weeks. The BSTPT consisted of 50 objective (multiple types) test items, each with four alternatives (A – D). each test item carried two marks, making it a total of 100 marks.

VALIDITY OF THE INSTRUMENT

BSTPT was validated by the researcher's supervisors, three experts in science education, two experts in educational instructional design, three experts in computer science, two experts in educational research, all from the University of Uyo, Uyo.

RELIABILITY OF THE INSTRUMENT

To determine the reliability of the instrument (BSTPT), a pilot study was done with a group of 35 primary school pupils that were not part of the study sample. The

first test was given and after two weeks interval, the second test was administered in line with Uzoagulu (2011) recommendation of the use of two weeks interval for pilot study procedure. The results of the two tests were compared and correlated using Kuder Richardson 21 formula. From the result obtained, reliability of the instrument was found to be .89. This implies that the instrument was reliable for data collection.

EXPERIMENTAL PROCEDURE

In the administration of the treatment, Basic Science Performance Test (BSPT) was used for both the pretest and the post-test. The study had one constant control group and four experimental groups. The experimental groups were taught four selected basic science and technology concepts using computer animations for six weeks, while the control group was taught the same concepts using the discussion method. Each experimental group used a specific animation strategy. The researchers with the help of the research assistants did all the teaching for both groups. After six weeks of teaching, a post-test (BSTPT) was given to the two groups. The scripts were marked over 100% (50 questions, each carrying two marks).

METHOD OF DATA COLLECTION

A pretest was given before administering the treatment and after teaching the pupils for six weeks, they were given a post-test. BSTPT was the instrument used for data collection both at the pre-test and post-test levels. The researchers marked pupils' scripts and took the scores for analysis.

METHOD OF DATA ANALYSIS

The statistical tools used for answering research questions were mean and standard deviation. Hypotheses were tested using ANCOVA at 0.05 level of significance.

RESULTS AND DISCUSSION

Research Question One

What is the effect of cartoon animation strategy on pupils' academic performance in Basic Science and Technology concepts?

Table 1: Effect of cartoon animation strategy on pupils' academic performance in Basic Science and Technology concepts

PRETEST SCORES					POST-TEST SCORES			
Group	N	X	SD	MD	N	X	SD	MD
Cartoon								
Animation (Experimental)		35	425	5.7	0.7	3577.0	11.8	8.5
Discussion (Control)		35	43.2	63	35	68.5	11.2	
Total	70	42.9	6.0	70	72.8	11.5		

Pupils taught basic science and technology concepts using cartoon animation strategy had the post-test mean score of (X) 77.0 and standard deviation SD) of 11.8 while those taught using the conventional method (discussion method) had the post-test mean score of (X) 68.5 and standard deviation (SD) of 9.0. The post-test means score of the experimental group (X = 77.0) i.e., those taught using cartoon animation strategy was higher than the post-test mean score of the control group (X= 68.5). This implies that there was an effect of cartoon animation strategy on pupils' academic performance in basic science and technology concepts.

Research Question Two

What is the effect of model animation strategy on pupils' academic performance in basic science and technology concepts.

Table 2: Effect of model animation strategy on pupils' academic performance in Basic Science and Technology concepts

PRETEST SCORES					POST-TEST SCORES			
Group	N	X	SD	MD	N	X	SD	MD
Model								
Animation (Experimental)		35	38.1	6.5	0.2	3583.8	11.2	15.3
Discussion (Control)		35	37.9	7.2	35	68.5	9.01	
Total	70	38	6.9	70	76.2	12.7		

Pupils taught basic science and technology concepts using model animation strategy (X=83.8; SD=11.2) was greater than the post-test means scores performance of pupils in the control group (X=68.5; SD=11.2). This means that the pupils taught basic science and technology concepts using model animation strategy had positive effect on their academic performance than those taught using the discussion method (conventional method).

Research Question Three

What is the effect of puppet animation strategy on pupils' academic performance in basic science and technology concepts?

Table 3: Effect of puppet animation strategy on pupils' academic performance in Basic Science and Technology concepts

	PRETEST SCORES				**POST-TEST SCORES**			
Group	N	X	SD	MD	N	X	SD	MD
Puppet								
Animation (Experimental)		35	39.2	8.1	0.3	35	79.5	11,9
Discussion (Control)		35	38.9	7.5	35	68.5	9.0	11.0
Total	70	39.1	7.8	70	74.0	11.8		

Pupils taught basic science and technology concepts using puppet animation strategy had the mean performance scores of 79.5 and the standard deviation of 11.9, while those taught using discussion method had the mean performance score of 68.5 and standard deviation of 9.0. Puppet animation strategy had effect on pupils' academic performance in basic science and technology concepts.

Research Question Four

What is the effect of the flipbook animation strategy on the academic performance of pupils in basic science and technology concepts?

Table 4: Effect of flipbook animation strategy on pupils' academic performance in Basic Science and Technology concepts

	PRETEST SCORES				**POST-TEST SCORES**			
Group	N		X	SD	MD	N	X	SD	MD
Flipbook								
Animation (Experimental)			35	41.0	5.9	0.1	35	78.5	10.9
Discussion (Control)			35	40.9	7.9	35	68.5	9.01	10.0
Total	70	41	6.6	70	73.5	11.1			

The post-test mean scores performance of pupils taught basic science and technology concepts using flipbook animation strategy (X=78.5) were greater than the mean score performance of those taught using discussion method (X=68.5). This

showed that flipbook animation strategy had positive effect on pupils' academic performance in basic science and technology concepts.

TESTING OF HYPOTHESES

Hypothesis One

There is no significant effect of cartoon animation strategy on the academic performance in basic science and technology concepts.

Table 5: Summary of Analysis of Covariance (ANCOVA) on effect of cartoon animation strategy on the academic performance of pupils in Basic Science and Technology concepts.

Source of Variation	Type III Sum of Square	DF	Mean Square	F.	P Value
Corrected Model	7304.77	2	3652.39	169.75	.000
Intercept	1571.442	1	1571.442	73.04	.000
Pretest Score	6036.145	1	6036.145	280.34	.000
Groups	1195.181	1	1195.181	55.549	.000
Error	1441.570	67	21.56		
Total	379444.600	70			
Corrected Total	8746-343	69			

R Square = .835 (Adjusted R Squared = .830) *Significant at .05 alpha level

The result shows that calculated F-value of 55.549 and the probability value of .000 for the groups. Since the P-value = .000 is less than 0.05 level of significance at the degrees of freedom 1 and 67, the null hypothesis was rejected. This implies that there was a significant effect of cartoon animation strategy on the academic performance of pupils taught basic science and technology concepts.

This result indicates that pupils taught basic science and technology concepts using cartoon animation strategy with the mean performance score 77.2 performed significantly better than those taught using the discussion method with the mean performance score of 68.5

Hypothesis Two

There is no significant effect of model animation strategy on the academic performance of pupils in basic science and technology concepts.

Table 6: Summary of Analysis of Covariance (ANCOVA) on effect of model animation strategy on the academic performance

Source of Variation	Type III Sum of Square	DF	Mean Square	F.	P-Value
Corrected Model	6878.334		23439.167	54.189	.000
Intercept	4134.443	1	4134.443	65.144	.000
Pretest Score	2804.676	1	2804.676	44.192	.000
Groups	3836.431	1	3836.431	60.448	.000
Error	4252.238	67	63.466		
Total	416972.000	70			
Corrected Total	11130.572	69			

a. R Square = .618 (Adjusted R Squared = .607) *Significant at .05 alpha level

The result indicates the calculated F-value of 60.448 and the probability value of .000 for the groups. Since the P-value = .000 is less than the 0.05 level of significance, the null hypothesis was rejected. Hence, there was a statistically significant effect of model animation strategy on pupils' academic performance in basic science and technology concepts. Pupils taught basic science and technology concepts using model animation strategy with the mean performance scores of 83.8 performed significantly better than those taught using discussion method with the mean performance scores of 68.5.

Hypothesis Three

There is no significant effect of puppet animation strategy on pupils' academic performance of basic science and technology concepts.

Table 7: Summary of Analysis of Covariance (ANCOVA) on effect of puppet animation strategy on the academic performance of pupils in Basic Science and Technology concepts

Source of Variation	Type III Sum of Square	DF	Mean Square	F.	P – Value
Corrected Model	8121.022	2	4060.511	175.408	.000
Group	1532.827	1	1532.827	66.216	.000
Pretest Score	6014.508	1	6014.508	259.818	.000
Groups	1891.167	1	1891.167	81.696	.000
Error	1550.978	67	23.149		
Total	392.99	2.00	70		
Corrected Total	9672.000	69			

a. R Square = .540 (Adjusted R Squared = .835) *Significant at .05 alpha level

The result indicates calculated F-value of 81.696, and the probability value of .000 for the two groups. Since the P-value = .000 is less than .05 level of significance at degrees of freedom of 1 and 67, the null hypothesis was rejected. Hence, there was a significant effect of puppet animation strategy on the academic performance of pupils in basic science and technology concepts. Pupils taught basic science technology concepts using puppet animation strategy with a mean pretest score of 79.5 performed significantly better than those taught using the discussion method with the mean post-test score of 68.5.

Hypothesis Four

There is no significant effect of flipbook animation strategy on pupils' academic performance in basic science and technology concepts.

Table 8: Summary of Analysis of Covariance (ANCOVA) on effect of flipbook animation strategy on the academic performance of pupils in Basic Science and Technology concepts

Source of Variation	Type III Sum of Square	DF	Mean Square	F.	P – Value
Corrected Model	4380.239	2	2190.119	35.536	.000
Intercept	3687.259	1	3681.259	59.828	.000
Pretest Score	2650.181	1	2650.181	43.001	.000
Groups	1654.718	1	1654.718	26.849	.000
Error	4129.247	67	61.631		
Total	386520.000	70			
Corrected Total	8509.486	69			

a. R Square = .515+ (Adjusted R Squared = .500) *Significant at .05 alpha level

The result shows the calculated F-value of 26.849 and the probability value of .000 for the two groups since the P-value = .000 is less than 0.05 level of significance, the null hypothesis was rejected. Hence, there was a statistically significant effect of flipbook animation strategy on pupils' academic performance in basic science and technology concepts. Pupils taught basic science and technology concepts using flipbook animation strategy with the mean performance score of 78.5 performed significantly better than those taught using discussion method with the mean performance scores of 68.5.

DISCUSSION OF THE FINDINGS

The result of the study showed that pupils taught basic science and technology concepts using cartoon animation strategy performed better than those in the control group. The reason for the observed results might be that cartoon animation strategy offers both audio and visual messages and these appeals to the sense of sight and hearing simultaneously. This finding is in line with findings of Meyer (2005) who found out that, pupils learn better when words are presented as spoken text rather than printed text and picture are presented simultaneously with narration.

The findings of the study showed that pupils taught basic science and technology concept using model animation strategy had higher mean scores performance than those taught using discussion method. This could be because model animation strategy enhances visual imagery, stimulate learners' interest and assist the teacher to effectively convey the contents of the lesson to the learners in order to achieve better performance. This finding is in line with the findings of Joshua (2016) who stated that the use of model animation enhances student performance in science.

Pupils taught basic science and technology concepts using puppet animation strategy had higher mean scores than those taught using discussion method, the reason being that learners are able to visualize the dynamic phenomena which might be invisible, receive immediate feedback, self-pacing learning reinforcement. This finding is in consonance with similar findings by Kearsley (2012) who stipulated that puppet animation facilitates learners' self-esteem, motivation and encoding process and improves learners' performance in science.

The result of the study showed that pupils taught basic science and technology concepts using flipbook animation strategy had higher mean scores performance than those taught using discussion method. This could be because flipbook animation strategy presents instructional materials in a sequential order and not in a holistic approach. Flipbook animation strategy emphasizes only the major point thereby giving less room for irrelevant words/pictures/sounds. This finding is in agreement with Adeniyi (2007) who stated that pupils taught basic science and technology using flipbook animation strategy tends to understand complete system and process better.

CONCLUSION

Based on the findings of this study, the conclusion reached was that computer animation strategies had significant effect on pupils' academic performance in basic science and technology concepts.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made:

- Professional bodies such as Teachers Registration Council of Nigeria and Nigeria Union of Teachers should ensure that in-service re-training opportunities are provided for teachers on the use of computer animation strategy in teaching basic science and technology.
- Government and school proprietor/proprietresses should provide multimedia facilities such as projector, interactive whiteboard and computer in schools to enable the effective utilization of computer animation.
- School administration/management should provide internet services and adequate power supply in schools to enable teachers access computer animation software and project their presentation.

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