

**COMPUTER ANIMATION INSTRUCTIONAL PACKAGE AND BIOLOGY  
STUDENTS' ACADEMIC PERFORMANCE IN AKPABUYO LOCAL GOVERNMENT  
AREA, OF CROSS RIVER STATE.**

**BY**

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**ABSTRACT**

*This study centers on using computer animation instructional package in teaching biology in Akpabuyo Local Government Area of Cross River State. Two research questions and two research hypotheses guided the study. The population comprised all 287 SS1 biology students in the 2017/2018 session in all the public secondary schools in Akpabuyo Local Government Area of Cross River State. Descriptive statistics of mean and standard deviations were used to analyze data generated to answer the research questions. Analysis of Covariance (ANCOVA) was used to test hypothesis 1 and 2 at 0.05 level of significance. The study utilized two researcher developed instruments -the biology performance test(BPT) and the Computer animation instructional package(CAIP) which was used to gather data for the study. The instrument was face validated with a reliability coefficient of .79. Also, the Computer Animation Instructional Package (CAIP) yielded a reliability coefficient .80. The findings of the study revealed a significant difference in the academic performance of students taught digestion using Computer Animation Package and those taught using the conventional expository method in favour of those taught using Computer Animation Package. There is no significant difference in the academic performance of students when taught digestion with or without computer animation package given their mental ability level. Some recommendations were made to include that Computer animation instructional package is an effective instructional tool than traditional classroom teaching. Therefore, computer animation should be used as a communication medium to enhance the teaching and learning of biology as well as improve their performance in all subjects.*

**KEY WORDS: Computer Animation Packages, Instructional Packages Tools,**

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## INTRODUCTION

One of the key innovations that Educational Technology has made available is new forms of representations such as multimedia and virtual reality in which the dynamics of technology have created a complete new world of learning in recent times. According to Willis and Reiber (1991), every country of the world is embracing new technologies in order to stay current and be relevant in professional fields like medicine, transportation, manufacturing, entertainment and education. In a relatively short period of time, computer technology has increasingly changed the ways in which we teach and learn. The use of technology has made the process of teaching and learning more enjoyable through Information Communication Technology tools. Such tools provide both students and teachers with more opportunities in adapting learning and teaching to meet individual needs and the society at large. (Mikre,2011). Information technology tools have revolutionized the way people work and have transformed educational systems by giving easy access to information, creating greater interest in learning content and increase in retention.

Computer animation is considered as one important Information Communication Tool available for teachers to promote effective learning. It helps learners visualize things which cannot be seen easily in the real world. It helps to clarify relationships through visual means and help students understand the inner life and movement of an object. Animation is simply a method in which pictures are manipulated to appear as moving images. It is the use of drawings, cartoons and other graphic materials to create motion pictures on the computer screen. They are forms of dynamic representation that display processes that changes overtime. For e.g. they can show the flux of high and low pressure areas in a weather map, display blood pumping around the heart or the movement of molecules. Animations are used for a variety of reasons across a whole range of topics. They are often utilized when there is need to show learners things not easily seen in real world such as the movement of atoms in a gas or the shifting movement of the continent.

Animations can help students understand complex ideas more easily which are more motivating for learners and they can communicate ideas and process that change over time which reduces the abstractions associated with the temporal transitions of the process (Reiber, 1991). Animation stimulates student's active and intellectual learning by involving students in their learning so students can remember what they learn, apply, analyze, evaluate and achieve higher levels of learning outcomes (Younis, 2017).

Animations are valuable aids in supporting the visual aspects of long-term memory. Furthermore, by combining narration and animation, active processing of the visual and verbal pathways enables students to construct mental modules, these mental modules are incorporated within students' prior knowledge, so that meaningful learning occurs . It is through this active meaningful learning that students achieve better outcomes in different levels of cognitive domains (Kasaji, 2010).

The age we are in is a computer age and many students are not ready to sit down and listen for an hour lesson but they can sit several hours watching cartoons, films and movies. There is need to shift from the orthodox teaching approaches to one which can employ the powerful tools of ICT to tap more teaching and learning potentials in teachers and students.

For decades now, students' difficulties in learning Biology concepts have been investigated by several researchers worldwide. Sert-Cibik, Diken and Darcin (2008) concluded that biology is a more interrelated science field with respect to concepts. Students have problems learning some biology concepts meaningfully and have resorted to memorizing these concepts. Biology topics including water transports in plants, protein synthesis, respiration and photosynthesis, gaseous exchange, energy, cells mitosis and meiosis, the human organ among others can be perceived as difficult to learn by secondary school students (Limer,2012).

Some other reasons for the learning difficulties have been attributed to the nature of the topic, teachers' style of teaching, students' learning and studying habits, students negative feelings and attitudes towards the topic and lack of resources as well as the nature of science itself and its teaching methods. Most Biology teachers usually prefer to employ mainly traditional teaching approaches and techniques and as such Biology lessons are mainly run in a teacher-centered manner transferring the knowledge that they find and what is written in textbook without conducting student-centered teaching activities (Lin,2006).

To arrest this problem, the panacea is the teacher and the teaching methods. Teachers' competencies and knowledge in Biology as a subject is crucial for enhancing students' learning (Lin, 2012). From the foregoing, it is evident that achieving students' performance in Biology has been difficult. Thus, it becomes necessary to investigate strategies teachers can use to improve the teaching of Biology in SS1 because mental models of key concepts into a coherent conceptual framework are the foundation for Biology learning.

Biology, which is an integral part of science and focuses on living things (plants and animals), is a highly popular subject amongst Senior Secondary Students in Nigeria. In the Nigerian educational system, it is compulsory that every student in the Senior Secondary School studies at least one science subject. Over the years, the trend has been that most students choose biology over the other science subjects such as Chemistry, Physics, and so on. This notwithstanding, students still perform poorly in biology.

Further investigations have shown that many of the Biology topics are taught mostly with only textbooks. This presents difficulties in understanding for students and most of these difficult topics end up being neglected by teachers because the topics are abstract and the processes involved are not physically observable. Lack of interest in biology could be attributed to the fact that the concept is complex and abstract which makes it difficult for students to retain what they were taught after a period of time. Hence, it could be imputed that the nature of instruction could lead to variations in students' performance. However, for learners to improve in Biology, teachers must embrace the 21<sup>st</sup> century skills by employing new techniques, methods and media which will make learning active, interesting and participatory. One of such media that can be internalized by teachers during instruction is Computer Animation. Its combination of drawings, models, inanimate objects, moving diagrams and cartoons which contain series of interactive slides with animations and graphics makes complex or abstract concepts simple, real & authentic for learners. By this learners are fully engaged with full attention, body, mind and emotion thereby making learning more permanent on the part of the learners. It is against this backdrop that the researcher poses the question: "Can computer animation instructional package be used to improve the Biology performance of senior secondary 1 students in Akpabuyo Local Government Area of Cross River State?"

## OBJECTIVES OF THE STUDY

This study determined the effect of computer animation instructional package on students' academic performance in Biology in Akpabuyo Local Government Area of Cross River State. The study is designed to achieve the following specific objectives.

1. To determine the effect of the utilization of computer animation instructional package on students' academic performance in Biology.
2. To find out if students' mental ability level towards the utilization of computer animation instructional package affect their academic performance in Biology.

## RESEARCH QUESTIONS

The study was based on the following research questions:

1. How does the use of computer animation instructional package affect the academic performance of students in Biology?
2. How does the use of computer animation instructional package affect the academic performance of students of different mental ability levels in Biology?

## RESEARCH HYPOTHESES

The following null hypotheses were formulated to guide the study:

**HO1:** There is no significant difference between the performances of biology students taught Biology using computer animation instructional strategy with those taught using lecture method.

**HO2:** There is no significant difference in performance of students of different mental ability levels when taught with or without computer animation instructional package.

## THEORETICAL FRAMEWORK OF THE STUDY

### The Dual coding theory of Memory & Cognition (by Paivio, 1971)

The theoretical framework of this study is anchored on the dual coding theory of memory & cognition hypothesized by PAIVIO,1971. According to the theoretical assumptions of dual coding theory, words and external pictures activate the coding system in an additive way (Paivio, 1971). In addition, when information is dual-coded, the probability of retrieval is increased. Dual coding theory further assumes that words and pictures activate mental processing in different ways. In the computer-based multimedia learning environment, dual coding theory has been extensively applied in guiding research with computer-generated static or animated displays.

Exposing students through computers with diagrams and text will enable them to take greater advantage of their capability to process information on two levels of stimulating the visual systems and by reducing the load placed on the verbal processing system, hence, enhancing performance.

## RESEARCH METHODS

Quasi- Experimental design using pre-test, post-test non-randomized control group design was used for the study.

The pre-test provided a check on the non-random assignment of subjects to groups. Moreover, comparison on the basis of pre-test performance provided further process of equating the research groups while the use of control group provided basis for comparison of students' performances based on treatments given. Structurally, the design is represented thus:

E1: O1 x O2

C O3 x O4

Where E1=Experimental group

C = Control group

O1 and O3 = Pre-test measurements

O2 and O4 = Post-test measurements

X =Treatment

The dependent variable of this study is “students’ academic performance in Biology and the main independent variable is the instructional method while the intervening variables are:

- Students’ mental ability level

The target population of the study consisted of all the 287 Biology students in the 2017/2018 session in all the public secondary schools in Akpabuyo Local Government Area of Cross River State. Purposive Sampling Technique was used to select two intact classes of 22 and 28 Senior Secondary one students and two intact classes of 26 and 24 Senior Secondary one students’ making a total of 100 students. The instrument for data collection was the Biology Performance Test (BPT) and Computer animation instructional package (CAIP). In addition to the instruments for data collection, computer Animation instructional package was prepared by the researcher for classroom instruction on the topic ‘The Human Digestive System’ which was adapted by Maxus Education and uploaded on [www.ikenstore.com](http://www.ikenstore.com). The animated package was designed and produced using macromedia flash 8.0 and Microsoft PowerPoint 2007. The Instrument was face validated by experts and data obtained were analyzed using Kuder Richardson Formula (K-R20) with a reliability coefficient of .79. Also, the Computer Animation Instructional Package (CAIP) yielded a reliability coefficient .80. Data were analyzed using mean and standard deviation to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance.

## RESULTS

### RESEARCH QUESTION 1

What is the difference in academic performance of student using Computer Animation package and those using traditional methods?

**Table 1: Summary of the standard deviation of the pretest and post test score of students' academic performance in biology by treatment group**

Teaching Strategies	N	Pretest X	S.D	Post test X	S.D	Mean Difference
Computer Animation	50	16.0000	4.07080	24.0800	2.20241	8.0800
Traditional	50	10.2000	5.26831	12.1400	5.23337	1.9400
Total	100	26.2	9.33911	36.22	7.43578	10.02

Data in Table one revealed that the mean of the pretest and post test score of students in the Computer Animation group ( $x=16.000$ ,  $24.080$ ) with a mean difference of  $8.080$  are higher than the means of pretest and post test score of students in the traditional group ( $x=10.200$ ,  $12.140$ ) with a mean difference of  $1.940$ . The standard deviation scores reveal variability in students' academic performance. This implies that students taught with Computer Animation package exhibit positive performance than students taught without Computer Animation package.

### HYPOTHESIS ONE

There is no significant difference in academic performance of biology students when taught using Computer Animation Package and those not using Computer Animation Package.

**Table 2: Summary of Analysis of Covariance (ANCOVA) of Students' Post-Test Academic performance by treatment Groups with pre test as covariate**

Source of variations	Sum of Squares	D/F	Mean Square	F-cal	Sig.	Decision at $p<0.05$ level
Main Effects						
Instructional Strategies	1374.754	1	1374.754	145.571	.000	Significant
Error	916.053	97	9.444			
Total	37941.000	100				

$P<.05$

Data in Table 2 revealed that the instructional strategies (Computer Animation) main effect on Students' Academic performance in Biology is significant at  $p<0.05$  alpha level. The result shows F-value of  $145.571$  at D/F (1, 97); and a p-value of  $.000$ . Since  $P<0.05$ , the null hypothesis which states that there is no significant difference in academic performance of students when taught using Computer Animation Package and those not using Computer Animation Package, is therefore rejected. There is a significant difference in the academic performance of students

when taught using Computer Animation Package and those taught not using Computer Animation Package

### RESEARCH QUESTION TWO

What is the difference in the academic performance of biology students' when taught with Computer Animation package and expository method based on their different mental ability level?

**Table 3: Summary of the mean and standard deviation of the pretest and post-test score of students' academic performance in biology based on their different mental ability level.**

Teaching Strategies	Mental Ability	N	Pretest X	S.D	Post test X	S.D	Mean Difference
<b>Computer Animation</b>	High	40	15.8250	4.20554	23.9750	2.25874	8.1500
	Low	10	16.7000	3.59166	24.5000	2.01384	7.8000
	<b>Total</b>	<b>50</b>	<b>32.525</b>	<b>7.7972</b>	<b>48.475</b>	<b>4.2726</b>	<b>15.95</b>
<b>Traditional</b>	High	25	10.8800	5.93942	12.3600	5.21920	1.2000
	Low	25	9.5200	4.51959	11.9200	5.34571	2.2889
	<b>Total</b>	<b>50</b>	<b>20.4000</b>	<b>10.45901</b>	<b>24.2800</b>	<b>10.5649</b>	<b>3.4889</b>

In Table 3, the mean scores of students' with high mental ability in the experimental (Computer Animation Package) group, in pre test and post test indicate that those with high mental ability had mean scores of (X= 15.8250, 23.9750) with a mean difference of 8.1500, while those with low mental ability had (X= 16.7000) with a mean difference of 7.8000. The mean scores of students with high mental ability in the control (Traditional Method) group in pretest and post-test indicate that those with high mental ability had mean scores of (X= 10.8800, 12.3600) with a mean difference of 1.2000, while those with low mental ability had (X= 9.5200, 11.9200) with a mean difference of 2.2889.

A comparison of the mean gain scores shows that the use of computer animation instructional package does not seem to affect the scores of students of high and low academic ability levels differently. This is shown by close difference in mean of 8.1500 and 7.8000 for high and low cognitive ability respectively. Therefore, mental ability level does not affect students' scores when taught with or without computer animation instructional package.

### HYPOTHESIS TWO

There is no significant difference in the academic performance of students' mental ability when taught with Computer Animation Package and Expository Methods

**Table 4: Summary of Analysis of Covariance (ANCOVA) of Students' post test academic performance by instructional Strategies and Students' mental ability with pre test as covariate**

Source of variations	Sum of Squares	D/F	Mean Square	F-cal.	Sig.	Decision at p<0.05 level
Main Effects						
Teaching Strategies	1114.743	1	1114.743	115.762	.000	
Mental Ability	.612	1	.612	.064	.802	
2-way interaction						
Teaching Strategies *mental Ability	.366	1	.366	.038	.846	Not Significant
Error	914.813	95	9.630			
Total	37941.000	100				
P<.05						

**Table 4** showed that the F-ratio for the main effect of Students' mental ability level when taught with Computer Animation and Expository Methods at D/F(1, 95) is .366, while its corresponding calculated level of significance is .846 alpha. The level of significance of 0.846 is greater than 0.05, i.e  $p > 0.05$ , indicating that there is no statistically significant difference in students' mental ability level when taught using both Computer Animation and Expository methods. Hence, the null hypothesis which states that there is no significant difference in students' mental ability when taught with Computer Animation Package and Expository Methods is accepted. This implies that there is no significant difference in performance of students in biology based on their mental ability level.



## **DISCUSSION OF MAJOR FINDINGS**

### **Computer Animation Instructional Package and Students' Academic Performance in Biology**

The findings from results in Table 1 and 2 showed that there was a significant difference between the performances of students taught biology using computer animation package and those taught using conventional expository method. This study supports earlier studies of (Younis, 2017) that Animation stimulates student's active and intellectual learning by involving students in their learning so students can remember what they learn, apply, analyze, evaluate and achieve higher levels of learning outcomes.

### **Computer Animation Package, Students' Mental Ability Level and their Academic Performance in Biology**

The findings from Tables 3 and 4 showed that there was no significant difference between the performances of students' taught biology using computer animation package and those taught using the conventional expository method given their mental ability levels. Both the high and low ability learners in the computer animation package group had comparable performance. This can be attributed to the use of drawings, models, inanimate objects, moving diagrams and cartoons which were all incorporated in the instructional package. The design elements were able to mediate between the experiences of the low learners and thus spur them up to understand the lessons as good as their higher ability counterparts. Again, both high ability and low ability learners in the control group had comparable performances with the experimental group. This observation indicates that instructional strategy has no effect on students' mental ability level. This study supports earlier studies of (Kasaji, 2010) who opined that animations are valuable aids in supporting the visual aspects of long-term memory. Furthermore, by combining narration and animation, active processing of the visual and verbal pathways enables students to construct mental modules, these mental modules are incorporated within students' prior knowledge, so that meaningful learning occurs. It is through this active meaningful learning that students achieve better outcomes in different levels of mental domains.

## **CONCLUSION**

Computer Animation Instructional Package enhances students' academic performance in Biology better than traditional method. Since the findings revealed a significant effect on the use of computer Animation Instructional Package on students' academic performance in Biology, modalities should be put in place to utilize computer animation in Biology instructions.

## **RECOMMENDATIONS**

Based on the findings of the research, the followings recommendations are necessary;

1. Computer animation instructional package is an effective instructional tool than traditional classroom teaching. Therefore, computer animation should be used as a communication medium to enhance the teaching and learning of students as well as improve their performance in all subjects.
2. Workshops for practicing teachers should be organized by government through the Ministry of Education to train and retrain teachers on the use of computer animation and multimedia in teaching and learning Biology as well as provide computer sets and other software programming tools that will enhance the use of computer animation in schools.

3. Students should explore the opportunities offered by computer animation instructional package to engage in individualized study.

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