EFFECT OF COMPUTER ANIMATION ON STUDENTS' ACADEMIC ACHIEVEMENT AND RETENTION IN BASIC SCIENCE AND TECHNOLOGY IN UKANAFUN LOCAL GOVERNMENT AREA, AKWA IBOM STATE.

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Abstract
The study examined Effect of Computer Animation on Students' Academic Achievement and Retention in Basic Science and Technology. The study adopted Quasi Experimental design of pretest and posttest involving two distinct groups which were Computer Animation with Text (CAWT) and Computer Animation with Narration (CAWN). The population comprised of 980 students from the six (6) public schools. A total of 90 students formed the sample of the study (40 male and 50 female). The instrument for data collection was Basic Science and Technology Achievement Test (BSTAT) and Basic Science Retention Test (BSTRT). The instrument was validated by two lecturers in Science Education Department and trial-test using twenty-five (25) students which were not part of the sample of the study. Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance. It was revealed that the two modes of computer animation do enhance students' academic achievement in Basic Science and Technology. It was also revealed that there is a significant difference in retention mean score of basic science and technology students taught using Computer Animation with Text (CAWT) and those using Computer Animation with Narration (CAWN). It was recommended among others that teachers should use computer animation with narration and text in presentation of their lesson content for high academic achievement and experimental or active learning.

Keywords: Animation, Achievement, Basic Science, Narration and Technology

Introduction

Science and technology constitute the fountain of national growth, development and productivity. Science as a discipline is considered as the systematic study of knowledge of man and his environment which depends on seeing and testing of facts. Science and technology have been instrumental in shaping and improving the life of humanity. Itighise (2024) opined that science is the foundation of sustainable development and a key to national economic growth and prosperity. Through science and technology, modern gadgets in all aspects of human endeavors have been invented, like electricity, aircraft, television, computers, medical kits, agricultural machines among others. Thus, science and technology is undeniably the bed rock of sustainable economic growth and development of any nation.

Federal Government of Nigeria places much emphasis on the teaching and learning of Basic science and Technology in schools especially at the basic education level. Consequently, Basic Science and Technology was introduced at the junior school level as the foundation to other sciences. Federal Ministry of Education (FME, 2012) listed the objectives of teaching Basic Science and Technology include; to acquire basic knowledge and skills in science and technology; to enable the learners develop interest in science and technology; apply scientific and technological knowledge and skills to meet contemporary societal needs. The broad objectives of Basic Science and Technology subject is geared towards promoting creativity and

critical thinking in the learner, helping the learner to appreciate the contemporary and changing world for better, developing the spirit of entrepreneurship among others.

Itighise (2021)., Adie, Obi, Okri and Ogbe (2020) affirmed that challenges of the 21st century, with its complex environmental, social and economic pressures require young people to be creative, innovative, enterprising and adaptable with confidence and skills to use their critical and creative thinking purposefully. The attainment of the Basic Science and Technology objectives will help in laying a sound foundation for future engineers, physicians, computer scientist, architects and others, who will propel the nation to greatness among developed nations. It will also build a nation that the citizens will be free from drug abuse, with a resultant effect of a crime free society. Babayemi, Itighise and Raimi (2022) revealed that teachers have technological challenges and if teachers are prepared in the use of technology, it will influence school curriculum globally. Akpan and Itighise (2019) commented that the application of Information and Communication Technology in teaching and learning helps teachers to take care of student's individual ability by encouraging the use of different methods of teaching and learning materials, thus de-emphasizing teacher-centred and theoretical instructional delivery process of Basic Science and Technology. Itighise (2024) maintained that the introduction of Information and Communication Technology is an innovation method of disseminating knowledge to reach teacher trainees in diverse and distant locations.

It is noted that despite the efforts of Basic Science and Technology teachers, the results of Basic Science and Technology in external examination was not satisfactory as reported by National Examinations Council (NECO, 2022). The broad aim and expectations of any teaching and learning programme is productivity and positive evaluated end-product (achievement). This below average performance in science subjects especially Basic Science and Technology has raised a concern of the researcher. The question now is: Can computer animation enhance students' academic achievement and retention in Basic Science and Technology?

The work of Etim, Itighise and Ema (2016) revealed that the use of slow-motion educational animation enhances academic performance in Business studies when compared to expository teaching method. Animation refers to computerized simulation of processes using images to form a synthetic motion picture (Etim, Itighise and Ema, 2016). The term "to anime" comes from the latin work "animus" which translates into "animate", "giving life", "breath". Another meaning of the word "animus" could define animation as a reflection principle namely "to help you think", "to control one's emotions". Animation with Text (AT) is a broad term in computer graphics that refers to creating moving letters, words or paragraphs using computer software. It relates to creating text that moves in some fashion across the screen, within an area, or by following a pattern of motion. Animation with Narration (AN) focuses on experimentation with forms of storytelling in a range of genres. It is a process of putting still images together in a sequence or manner so they will appear one after the other creating the illusion movement.

Computer Animation foster learning and help students to see different aspects of a subject. Computer animation is one of the many instructional strategies that have proved effective in integrating different types of media and bringing out a better learning outcome. Turel and Johnson in Itighise (2016) comments that instructional delivery with the use of computer animation embraces all human interactive skill employed by the teachers to promote learning in the classroom situation thereby improved learners' performance.

Theoretically, this study focuses on Dual Coding Theory by Allan Paivio (1971). Piavio introduced Dual Coding Theory (DCT) of memory and cognition, as evolving from his specific experiments, on the role of imagery in associative learning. According to Piavio (1971), mental images are analogue codes, while the verbal representations of words are symbolic codes. Analogue codes represent the physical stimuli observed in our environment, such as trees and rivers. Theses codes are a form of knowledge representation that retains the main perceptual features of what is being observed symbolic codes on the other hand, are forms of knowledge

representation chosen to represent something arbitrarily, as opposed to perceptual. Dual Coding Theory support the use of animation (with text and narration), as well as still illustration and their effects on learning. According to the theory, information is processed and represented by two separate codes known as verbal codes and non-verbal codes. The theory argues that humans understand the world around them through language and non-verbal objects and occurrence. Hence, picture would be encoded by a visual encoding mechanism and a passage of text by a verbal mechanism. Images are also often ended verbally as well as picture which means that visually presented information is more likely to be recalled because it has been encoded twice. However, it was reported that pictures are easier to remember than words and that information coded in both system is easier to remember than information coded only in the verbal system.

One of the variables considered in this study is students' knowledge retention. Retention is the ability of students to recall information or knowledge gained after learning. Numgwo, Emmanuel and Joseph (2016) defined retention as the ability to elicit performance and hold such performance after duration of time. Retention is a very vital component of the education process which tells the worth of a student in subjects' areas in terms of skills and knowledge acquired overtime. Retention as the ability to store information which can be easily recalled from the short-term memory and long-term memory. Several studies have reported that factors such as effectiveness of the teaching methods and students' engagement in the teaching-learning process have influence on retention ability of students (Jude, 2022; Adamu; 2021; Abdullahi, Jibrin, Dauda & Danjuma, 2021; Abasi, Okri, & Adie, 2022). The inability of the students to retain and put in practice what is learned has adverse consequence on the nation's scientific and technological advancement. The teaching methods that provide opportunities for students to apply their knowledge in real-world scenarios can help solidify their understanding and retention of the concept learned. There is therefore, the need to explore innovative and effective methods of teaching the concept of excretion in Basic Science and Technology in order to enhance students' retention in the subject as well as influence of gender.

Gender is one of the factors that may influence students' academic achievement in Basic science and technology and science in general. Gender is an ascribed attribute that socially differentiate feminine from masculine. Oludipe (2018) posit that gender equality has been a conflicting issue in basic science and technology achievement. Gender according to Umanah and Sunday (2022) is a psychological term describing behaviour and attribute expected of individuals on the basis of being male or female. Several studies have investigated the influence of gender on students' academic achievement in science subjects. Uloko and Usman (2018) and Gongden (2016) reported that male students achieved higher than their female counterparts in scientific activities while Dinah (2023) reported that female students performed higher than their male counterparts. However, Umanah and Sunday (2022)., Adie, Inah, Ibu, Anditung & Igyo (2022) reported no significant difference in the mean performance scores of male and female students. However, with the contradictory reports on the influence of gender on students' academic achievement, this study therefore sought to investigate the influence of gender on students' academic achievement when taught the concept of excretion in Basic Science and Technology using Animation with text and Animation with narration. Computer animation utilization could create greater classroom enjoyment and motivation particularly on the part of extrinsically motivated learners and can in turn lead to less student absence mindedness in class. It is against this background the study seeks to examine the efficacy of computer animation with text and narration on students' academic achievement and retention in Basic Science and Technology. The purpose of the study was to:

1. determine the different between the mean achievement scores of students taught Basic Science and Technology using Computer Animation with Text (CAWT) and those taught using Computer Animation with Narration (CAWN)?

2. examine the different between the mean achievement scores of male and female students taught Basic Science and Technology using Computer Animation with Text (CAWT) and those taught using Computer Animation with Narration (CAWN)?
3. determine the different between the mean retention Scores of students taught Basic Science and Technology using Computer Animation with Text (CAWT) and those taught using Computer Animation with Narration (CAWN)?

Research Questions

The study sought to provide answers to the following Research questions.

1. What is the different between the mean achievement scores of students taught Basic Science and Technology using Computer Animation with Text (CAWT) and those taught using Computer Animation with Narration (CAWN)?
2. What is the different between the achievement scores of male and female students taught Basic Science and Technology using Computer Animation with Text (CAWT) and those taught using computer Animation with Narration (CAWN)?
3. What is the different between the mean retention Scores of students taught Basic Science and Technology using Computer Animation with Text (CAWT) and those taught using Computer Animation with Narration (CAWN)?

Hypotheses

Three research hypotheses were formulated to efficiently guide the study.

1. There is no significant difference in the mean achievement scores of students taught Basic Science and Technology using Computer with Animation with Text (CAWT) and those taught using Computer Animation with Narration (CAWN)
2. There is no significant difference in the achievement scores of male and female students taught Basic Science and Technology using computer Animation with Text (CAWT) and taught using Computer Animation with Narration (CAWN)
3. There is no significant difference in the mean retention Scores of students taught Basic Science and Technology using Computer Animation with Text (CAWT) and those taught using Computer Animation with Narration (CAWN)

Methodology

The research design adopted for this study was Quasi Experimental design of pretest and posttest groups. The two groups were named experimental group one and the experimental group two respectively. The experimental group one exposed the students to learning activities using Computer Animation with Text (CAWT), while the experimental group two was taught using Computer Animation with Narration (CAWN). The population comprised of 980 Junior Secondary School students from the six (6) public schools during 2022/2023 academic session. Simple random sampling technique was employed to select 2 schools out of 6 public secondary schools in the study area. Intact class of JSS 2 students in each of the selected schools was used with a total of 90 students (40 males and 50 female).

The instrument for data collection of the study was Basic Science and Technology Performance Test (BSTPT) and Basic Science and Technology Retention Test (BSTRT). The BSTPT consisted of 20 multiple choices questions based on the lesson, covering different domain of Excretion from JSS 2 scheme of work. Analysis of Covariate (ANCOVA) was used in testing the three null hypotheses at 0.05 level of significance.

Results

The results of this study was analysis using the three null hypotheses at 0.05 level of significance.

Hypothesis One: There is no significant difference in the mean achievement scores of students taught Basic Science and Technology using Computer with Animation with Text (CAWT) and those taught using Computer Animation with Narration (CAWN)

Table 1: Result of Analysis of Covariance (ANCOVA) on the difference in mean performance scores of Basic Science and Technology students taught using CAWT and those taught using CAWN

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	3925.363[a]	2	1962.681	8.782	.000
Intercept	43561.606	1	43561.606	194.925	.000
Pretest	745.085	1	745.085	3.334	.071
Instructional_Packages	3270.759	1	3270.759	14.636	.000
Error	19442.693	87	223.479		
Total	344375.000	90			
Corrected Total	23368.056	89			

a. R Squared = .168 (Adjusted R Squared = .149)

Table 1 presents the result of Analysis of Covariance (ANCOVA) on the difference in mean performance scores of Basic Science and Technology students taught using CAWT and those taught using CAWN. The above shows that there is significant difference in mean performance scores of Basic Science and Technology students taught using CAWT and those taught using CAWN in favour those taught with CAWN $\{(F_{1, 89}) = 14.636, P< 0.05.\}$ for instructional packages. This implies that the null hypothesis one of this study is rejected at 0.05 level of significance. This shows that computer animation with narration was much more effective in enhancing the academic performance of students in Basic Science and Technology.

Hypothesis Two: There is no significant difference in the achievement scores of male and female students taught Basic Science and Technology using Computer Animation with Text (CAWT) and those taught using Computer Animation with Narration (CAWN)

Table 2: Result of Analysis of Covariance (ANCOVA) on the difference in mean performance scores between male and female Basic Science and Technology students when taught using CAWT and CAWN

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	656.935[a]	2	328.468	1.258	.289
Intercept	43876.501	1	43876.501	168.079	.000
Pretest	656.036	1	656.036	2.513	.117
Gender	2.331	1	2.331	.009	.925
Error	22711.120	87	261.047		
Total	344375.000	90			
Corrected Total	23368.056	89			

Table 2 shows the summary of result of Analysis of Covariance (ANCOVA) on the difference in mean performance scores between male and female Basic Science and Technology students when taught using CAWT and those taught using CAWN. The table show that the calculated p-value (.925) of gender is greater than 0.05, $\{(F_{1, 89}) = .009, P> 0.05.\}$. This result implies that there is no significant difference in mean performance scores between male and

female Basic Science and Technology students when taught using CAWT and those taught using CAWN. Hence, the null hypothesis two was accepted at 0.05 level of significance.

Hypothesis Three: There is no significant difference in the mean retention Scores of students taught Basic Science and Technology using Computer Animation with Text (CAWT) and those taught using Computer Animation with Narration (CAWN)

Table 3: Result of Analysis of Covariance (ANCOVA) on the difference in mean retention scores of Basic Science and Technology students taught using CAWT and those taught using CAWN

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7410.774[a]	2	3705.387	35.852	.000
Intercept	6975.921	1	6975.921	67.496	.000
Posttest	3343.829	1	3343.829	32.353	.000
Instructional Packages	1439.581	1	1439.581	13.929	.000
Error	8991.726	87	103.353		
Total	345825.000	90			
Corrected Total	16402.500	89			

Table 3 shows the summary of result of Analysis of Covariance (ANCOVA) on the difference in mean retention scores of Basic Science and Technology students taught using CAWT and those taught using CAWN. The above shows that there is significant difference in mean retention scores of Basic Science and Technology students taught using CAWT and those taught using CAWN in favour those taught with CAWN $\{(F_{1,\ 89}) = 13.929,\ P < 0.05.\}$ for instructional packages. This implies that the null hypothesis three of this study is rejected at 0.05 level of significance. This shows that Computer Animation with Narration(CAWN) was much more effective in enhancing the academic retention of students in Basic Science and Technology.

Discussion of Findings

Hypothesis one ascertained the difference in the mean achievement scores of students taught Basic Science and Technology using Computer with Animation with Text (CAWT) and those taught using Computer Animation with Narration (CAWN). The result showed that there is a significant difference in the mean performance scores of Basic Science and Technology students taught using Computer Animation with Text (CAWT) and Computer Animation with Narration(CAWN) in favour of Computer Animation with Narration (CAWN). This finding could be attributed to the fact that the addition of narration provided opportunities for students to understand the concept and apply their learning to real-world contexts. This is supported by Etim, Itighise and Ema (2016) whose findings revealed that students using animation-based performed significantly better than those taught without animation. Nwoye, Osita, and Okeke (2020) support the findings that computer assisted instruction enhance academic performance and retention of lesson concept.

Hypothesis two determined the difference in the achievement scores of male and female students taught Basic Science and Technology using Computer Animation with Text (CAWT) and those taught using Computer Animation with Narration (CAWN). The result revealed that both male and female was at the same pace. The finding could be attributed to the fact that both male and female students' prior knowledge was aroused for active engagement and participation in the teaching-learning process which led to improvement in their academic achievement. The finding is in line with the view of Ibraham and Gana (2019) that there is no significant

difference between the mean achievement scores of male and female students taught basic science and technology using animation instructional package.

Hypothesis three ascertained difference in the mean retention Scores of students taught Basic Science and Technology using Computer Animation with Text (CAWT) and those taught using Computer Animation with Narration (CAWN). The result indicated that those taught with Computer Animation with Narration maintain higher retention abilities. With the result, the null hypothesis was rejected and the alternative which states that there is a significant difference in retention mean score of basic science and technology students taught using Computer Animation with Text (CAWT) and those using Computer Animation with Narration (CAWN). This finding could be attributed to the fact that the additional stage of narration was much more effective in enhancing the retention abilities of students in Basic Science and Technology. The findings of the study agreed with Obinna, Adana and Chinaza (2021) who finding revealed high retention in chemistry when taught using computer animated media instructional strategy.

Conclusion

Based on the findings of the study, it was concluded that the two modes of computer animation, Computer Animation with Narration (CAWN), and Computer Animation with Text (CAWT) do enhance students' academic performance in Basic Science and Technology in secondary schools in Ukanafun Local Government Area. It was also observed that male and female students when taught using Computer Animation with Narration (CAWN) and Computer Animation with Text (CAWT) was at the same pace academically and that there was high retention of lesson content when applying Computer Animation with Narration (CAWN) in instructional delivery process.

Recommendations

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

1. Teachers should use Computer Animation with Narration and Computer Animation with Text in presentation of their lesson content for high academic performance and experimental or active learning.
2. Curriculum planner should incorporate Computer Animation with Narration and Computer Animation with Text in the curriculum to prepare teachers and ensure gender friendly environment lesson delivery in secondary schools for practical experiences.
3. Government needs to made computer available in government schools at all levels so that learners can access it and use it without stress for high retention of lesson content.

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