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Effect of Animated Instructional Software on Students' Academic Achievement in Motor Vehicle Maintenance Work in Government Technical Colleges in Rivers State for Sustainable Economy

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Abstract

The study investigated the effect of animated instructional software on students' academic achievement in motor vehicle maintenance work (MVM) in Government Technical Colleges in Rivers State, Nigeria for sustainable economy. The study adopted quasi-experimental non-randomized control group design. The population of the study was 95 MVM students from the three Government Technical Colleges in Rivers State that offers motor vehicle maintenance work (MVM). A sample of 75 respondents was drawn using a random sampling technique. Three objectives, three research questions, and three hypotheses guided the study. The instruments used for data collection was Motor Vehicle Maintenance Work Achievement Test (MVMAT) which has thirty (30) multiple choice questions with four options A-D developed by the researcher and validated by three experts of which two are from Department of Industrial Technical Education, Ignatius Ajuru University of Education, Port Harcourt and one from Department of Measurement and Evaluation, Rivers State University, Port Harcourt. The reliability of the instrument was determined by a pre-test on 10 respondents from Government Technical College, Owerri, Imo State, who are not part of the population and produced a reliability coefficient of.74 after subjecting student's responses to the Kudar-Richardson (KR_{-20}) formula. Mean and standard deviation were used to analyze data from the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses of the study at .05 level of significance. The study revealed that the use of animated instructional software in the teaching of MVM aided the academic achievement of students, as those in the experimental group performed better than those in the control group. The study recommends, among others, that animated instructional software should be adopted by curriculum designers and NBTE for technical teachers who will be trained in the usage of the software and should be adequately supervised for effective implementation in instructional delivery.

Keywords: Animated Software, MVM, Students, Academic Achievement, Sustainable Economy.

Introduction

Technology is essential to progress because it uses scientific knowledge to address real-world challenges, improve people's lives and meet human needs via the use of technical innovations (Odogwu, 2005). If a country wants to become really great, it must prioritize and invest in the technical advancement of all its resources. The exposure to technological education is crucial to building a prosperous and progressive society (Enahoro, 2008). Given that "technology is the knowledge and creative process by which people utilize tools, resources, and systems to solve problems and enhance control over the natural and man-made environment in an effort to improve the human condition," it is not surprising that many countries have incorporated technology education into their general school curricula (UNESCO, 2011) as well as the use of animation.

Animation is Computer Aided Instruction (CAI) software that uses guided experiences to mirror, foresee, or intensify real-world situations (Kanner, 2007). It has been found that animation is crucial to the teaching and learning process. The use of animation to impart educational material depends on the teachers' familiarity with the rules and best practices governing its use, the characteristics of the students, and the lesson's goals (Ochogba, 2021). Students can gain experience and take into consideration their prior performance thanks to animated teaching software (Moore, 2009). The animation software makes a point of emphasizing that this is not a game with victors and losers (Brozik & Zapalska, 2003). The exercise's goals are to examine decision-making processes and evaluate the effect of certain decisions. Well-designed animation software is comprehensive enough to examine a wide range of the issues at hand. Animations are thought to be useful in the process of raising students' self-efficacy. Animations get students more interested, give them chances to talk to each other, help them come up with new ideas and concepts, and let them solve problems in a realistic but controlled setting. Animation method is more superior to other teachiing method in terms of student achievement and retention (Nwodo, 2015). The use of animated teaching strategy increases students' achievement (Abdullahi, 2010). Furthermore, animated teaching software makes students in experimental group to perform better than their counter-part in control group (Odika, 2022).

Students at technical colleges get comprehensive vocational education that prepares them for entry-level or advanced careers in a wide range of industries and fields (Yusuf, 2019; Odogwu, 2005). Okoro (2006) argues that technical colleges in Nigeria are the key institutions for teaching the sub-professional craftsman and technician skills, knowledge, and attitude. Students who have completed their junior year of high school have the option of enrolling in a full three-year vocational program at a community or technical college. Students who complete eighth grade have the option of attending a two-year or four-year community or technical college for a vocational training programme. While the National Board for Technical Education's (NBTE) (2011) report supervision regulates the quality of academic programmes in technical colleges, the National Business and Technical Examinations Board (NABTEB) is in charge of the examination and certification of

occupational trades leading to the awarding of the National Technical Certificate (NTC) and Advance Nation Diploma (AND) (ANTC). Construction, beauty culture, computer craft practice, electrical engineering, woodworking, printing, textiles, hospitality, agriculture, automobile electrical work, automobile body repair and spray painting, component machining, mechanical engineering craft practice, welding and fabrication, and instrument making, motor vehicle maintenance (MVM) are just some of the many trades taught at Nigeria's technical colleges (Federal Government of Nigeria, 2013).

Motor Vehicle Maintenance (MVM) work is one of the vocational training/courses/trades offered in the Technical Colleges in Nigeria. Generally, MVM offers practical skills leading to the production of craftsmen, technicians, and other skilled personnel who will be enterprising and self-reliant (National Board for Technical Education; NBTE, 2001). Its curriculum programme is generally alienated into three components to be precise; General Education, Trade Theory, and Supervised Students Industrial Work Experience Scheme (SIWES) (Ogundu, 2018). The general education section of the curriculum is aim at providing the students with complete secondary education in subjects like English language, economics, physics, chemistry, biology, entrepreneurial studies, and mathematics (NBTE, 2011). The trade theory module exposes students to procedural principles/ethics of different automobile systems and the technical capability for the maintenance of the various automobile systems. Also, supervised students industrial work experience scheme (SIWES), provides students the opportunity to interface with the reality of the world of automobile technology, its functions, maintenance and repair (Ugwuanyi, 2010; Akerejola, 2008). In order to translate the focal point of the automobile technology trade into reality, practical teaching and learning will be made the pathway to acquisition of knowledge, skills, and attitude (Asuquo, 2011). The vehicle parts/systems which must be properly assembled by MVM students on graduation includes but not limited to starting system, charging system, ignition system, fuel system, transmission system, lubrication system, brake system and suspension system.

Starting system includes the battery, starter motor, solenoid, ignition switch and in some cases, a starter relay. An inhibitor or a neutral safety switch is included in the starting system circuit to prevent the vehicle from being started while in gear. When the ignition key is turned to the start position, current flows and energizes the starter's solenoid coil. The energized coil becomes an electromagnet which pulls the plunger into the coil. The plunger closes a set of contacts which allow high current to reach the starter motor as linked with charging system.

Charging system consists of an alternator (generator), drive belt, battery, voltage regulator and the associated wiring. The charging system, like the starting system is a series circuit with the battery wired in parallel. After the engine is started and running, the alternator takes over as the source of power and the battery then becomes part of the load on the charging system which was possible due to ignition system.

Ignition system is one of the most important systems used in the internal combustion (IC) engines. The spark-ignition engine requires some device to ignite the compressed air-fuel mixture. It is a part of the electrical system which carries the electrical current to a spark (current) plug. An ignition system in the vehicle supplied high voltage surges of current (as high as 30,000 volts) to the spark plug (Melior, 2007; Bonnick, 2001). These surges produce the electric sparks at the spark plug gap. Spark ignites to set fire to the compressed air-fuel mixture in the combustion chamber. The sparking must take place at the correct time at the end of the compression stroke in every cycle of operation (Wilcox, 2013). At high speed or during part throttle operation, the spark is advanced, so that it occurs a bit earlier in the cycle.

Academic achievement refers to how well a student is accomplishing his or her tasks of studies and varies among scholars, policymakers and other educational stakeholders. Academic achievement is the outcome of education - the extent to which a student, teacher or institution has achieved their educational goals (Ezeudu in Odika, 2022) whereas, Students' academic achievement connotes performance in school subject as symbolized by a mark or score on an achievement test. Academic achievement of student is defined as the learning outcomes of the students, which include the knowledge skills interested on, ideas acquired and retained through his course of study within and outside the classroom situations (Epunam in Odika, 2022).

Sustainable Economy is the practices that support long-term economic growth without negatively impacting social, environmental, and cultural aspects of the community. It is the meeting of the economic needs of the present without diminishing the economic needs of the future.

Sustainable economic is the process in which the exploitation of natural resources, the direction of investment, the orientation of technological development, and institutional change or reform are all in coordination and harmony and enhance both the current and future potential for meeting human needs. Economic development without sustainability is not efficient or effective in the long run. Moreso, development requires a new approach to economic life, in terms of both production and consumption. It asks to seek new levels of efficiency, to produce more with fewer resources and less waste. We must explore how goods are produced, marketed, delivered, and thrown away, and consider the impact of economic development on natural and biological processes to see how the production process can be improved. Economics is the study of how society allocates resources to satisfy human needs. An analysis of how the economic system allocates scarce resources to differing and competing ends must include both the flow of natural and environmental resources into the production process and the flow of wastes from the production and consumption processes back to the natural environment. The quality of the natural environment directly affects the standard of living of society. Nevertheless, economic growth can be achieved only through the synergy of pluralistic institutions, technological innovations, and the market economic system.

Statement of the Problem

Motor vehicle maintenance work (MVM) are vocational and technical trades aimed at producing competent motor vehicle mechanics with sound practical knowledge and diagnosing skills having the ability to carry out repairs and maintenance on modern vehicles. MVM graduates upon completion of the trade employability modules have the opportunity to set up self-governing motor mechanic enterprise as self-employed and be able to employ others. However, Amen in Odika (2022) observed a decline in students' academic achievement which can be attributed to so many factors which include inadequate qualified MVM teachers without practical knowledge, diagnosing skills and ability to carry out repairs, poor communication skills, poor knowledge of the subject matter, non-exposure to field trip on modern vehicles, above all, poor instructional materials on delivery techniques or teaching methods.

Researchers have revealed that the use of animated instructional software has a tremendous effect in other subject area (Yusuf, 2019). Therefore, the study seeks to identify if animated instructional software can enhance MVM students' academic achievement for sustainable economic inclusive.

Aim and Objectives of the Study

The aim and objectives of this study is to determine the effect of animated instructional software on MVM student's academic achievement for sustainable economic inclusive. Specifically, the study sought to:

1. Determine the effect of animated instructional software on MVM student's academic achievement when taught starting system.
2. Ascertain the effect of animated instructional software on MVM student's academic achievement when taught charging system.
3. Ascertain the effect of animated instructional software on MVM student's academic achievement when taught ignition system.

Research Questions

The following research questions were formulated to guide the study:

1. What is the effect of animated instructional software on MVM student's academic achievement when taught starting system?
2. What is the effect of animated instructional software on MVM student's academic achievement when taught charging system?
3. What is the effect of animated instructional software on MVM student's academic achievement when taught ignition system?

Hypotheses

The following hypotheses were formulated to guide the study and were tested at .05 level of significance**:**

Ho_1: There is no significant difference between the mean ratings of the respondents on students' academic achievements in MVM when taught starting system with animated instructional software and those taught without animated instructional software

Ho2: There is no significant difference between the mean ratings of the respondents on students' academic achievements in MVM when taught charging system with animated instructional software and those taught without animated instructional software

Ho3: There is no significant difference between the mean ratings of the respondents on students' academic achievements in MVM when taught ignition system with animated instructional software and those taught without animated instructional software

Methodology

Design

The design of the study adopted quasi-experimental design. This design is often used in classroom experiment, when experiment and control groups are assembled as intact classes and no possibility of randomization (Ali, 2006). Therefore, an intact class is used and there is no random assignment of research subjects. The type of quasi experimental design used was the non-equivalent control group which involves two groups. The design took the following form as represented in the Table 1 below:

Table 2

Group	Pre-test	Treatment	Post-test	Interest
EG	o_1	X	o_2	o_3
CG	o_1	-X	o_2	o_3

Where:

EG =Experimental Group; CG=Control Group; O_1= Pre-Test; O_2= Post-Test; O_3= Interest Test Scores; X= Treatment; -X= No Treatment

Population and Sample

The target population for the study was 95 MVM students from the three Government Technical Colleges in Rivers State that offers MVM. They are GTC Port Harcourt, GTC Tombia and GTC Ahoada. The sample was 75 MVM students from two Government Technical Colleges (GTC Port Harcourt having 48 students and GTC Ahoada with 27 students) respectively that was randomly selected. The students from these colleges were considered suitable for the research work since they are train to become experts in the field and will constantly make contact with modern vehicles.

Instrumentation

The instrument that was used for data collection is Automobile Achievement Test (AAT) developed by the researchers. The AAT is a thirty (30) item instrument made up of multiple-choice questions with four options A-D. The multiple-choice test was developed from the

unit of the content areas of the topics selected for the study. In the construction of the instrument, a well-constructed table of specification was used as measures were taken to ensure that the necessary psychometric properties were well established. The psychometric properties of AAT items were determined by individual item analysis which according to Okoro in Odika, (2022), is judged suitable if it meets the following conditions:

i. Have a difficulty index of between +20 to 80
ii. Have a discrimination index of +0.2 and above
iii. Have all its distractor negative indices.

Validation of the Instrument

The psychometric indices of the AAT were determined by individual item analysis. This was done by computing the difficulty index, discriminating index and distractive index of the test items using Microsoft Excel 2007. The validation of the instruments took the form of face and content validation. Three experts carried out the validation of the instruments of which two are from Department of Industrial Technical Education, Ignatius Ajuru University of Education, Port Harcourt and one from Department of Measurement and Evaluation, Rivers State University, Port Harcourt. This instrument for validation was subjected to criticism and vetting with respect to clarity of questions asked, relevance, suitability, repetition, set objectives, use of language, proper wording of the items, appropriateness and adequacy of the questions to the students' level of understanding and ambiguity and experience and agreement of items with the test blue print consequently, they made some comments which formed the basis for modifying some items as demanded by the researcher. After the validation, the instrument was overhauled completely to reflect the specialist's contributions. The items were therefore reorganized at the end of the face validation. Moreso, the automobile lesson plans used for the study was developed by the researchers. The lesson plans incorporate the use of animated instructional software.

Reliability of the Instrument

The reliability of the instrument was determined by a trial test of the AAT which was administered on 10 MVM students of GTC, Owerri, Imo State who were not part of the population nor sample. The reliability coefficient of AAT was found to be .74 by subjecting student's responses to Kudar-Richardson ($KR\text{-}_{20}$) formula which shows that the instrument was reliable.

Control of Extraneous Variables

The following measures were adopted by the researchers to ensure that extraneous variables which might affect the result of the study were controlled. These variables include: experimental bias (use of regular class teacher), teacher variable (error of teacher difference), inter group variable (use of analysis of covariance - ANCOVA) and subject interactions.

Experimental Procedure/Administration

The experimental groups (taught with animated instructional software) and the control groups (taught without animated instructional software) were randomly assigned to treatment conditions. Use of ballot was adopted to randomly select the experimental and the control groups. Before the treatment, the pre-test which was the achievement test on the topics were administered to the two groups. The test was administered by regular automobile teachers in the sample schools who have undergone the researcher's training. The pre-test is used to:

- Determine the students' initial knowledge of the materials they would learn later;
- Determine the comparability of the two groups (experimental and control) with respect to their achievement in the pre-test scores.

The pre-test was administered in the first week to all groups. Three weeks after, the post-test was also administered to the two groups. The same questions used for the pre-test were as well used for the post-test for the two groups, but the questions were re-arranged. The reason for the re-arrangement of the questions was for the students not to discover that the same questions were used for the pre-test.

After the pre-test, the experiment commenced. The main treatment for the study was the teaching of starting, charging and ignition systems to MVM students, using demonstration teaching methods with lesson plans prepared with animated instructional software for experimental group and without animated instructional software for control group.

After the treatment, the post-AAT was administered to the students (both the control and experimental groups). The scripts (pre-tests and post-tests) were marked by the researchers and the students' scores recorded and used for data analysis.

Method of Data Collection and Analysis

The pre-AAT was administered to the students before the treatment which lasted for three weeks. At the end of the treatment, a parallel test (post-AAT) was administered. The scores generated from the pre-test and post-test administered to the MVM students of the GTCs using Automobile Achievement Test (AAT) was used for the data collection for the research work. The scores for both the experimental and control group was recorded accordingly. The test items in the pre-AAT and post-AAT were scored one mark each. The maximum mark is 30 while the lowest mark is zero (0).

The researcher used mean and standard deviation to analyze the data obtained and provide answers to the research questions. Analysis of Covariance (ANCOVA) was used to test the hypotheses formulated for the study at .05 level of significance. Since the research involves pre-test and post-test of intact classes, the statistical technique adopted for analyzing the hypotheses (ANCOVA) enable the researchers to take care of the errors or adjust initial group differences (Non-equivalence) in ability levels among the research subjects. Using ANCOVA helped to compare the mean of the two groups as the pre-test scores were used

as covariates for achievement. Moreso, all data analysis in this study was carried out with the help of statistical package for social sciences (SPSS) and Microsoft Office Excel 2007. Any Group with higher mean value irrespective of the closeness in the mean value of the other group would be taken to have performed better in AAT. However, if the value of P is less than .05 level of significance, the null hypothesis is rejected, but if the value of P is or greater than .05 level of significance, the null hypothesis is accepted.

Result Presentation and Discussion of Questionnaires

The results of the analysis of the study are presented in tables below according to research questions and hypotheses

Table 2: Mean and standard deviation of pretest and posttest scores of experimental and control groups in MVM when taught starting system

Groups	N	Pre-test		Post-test		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Experimental	48	3.83	.99	17.21	1.47	13.38
Control	27	3.52	1.39	5.19	1.39	1.67

The data as shown in Table 2 have the calculated pretest mean and standard deviation scores for experimental group to be 3.83 and .99 and a mean score of 17.21 and standard deviation of 1.47 in the posttest making a pretest/posttest mean gain in the experimental group to be 13.38. The control group had a mean score of 3.52 and a standard deviation of 1.39 in the pretest and a posttest mean score of 5.19 and a standard deviation of 1.39 with a pretest/posttest mean gain of 1.67. With this result, the students in the experimental group are of a better-quality in the achievement test (mean score) when compared with the students in the control group. This means that the use of animated instructional software alongside demonstration method is superior/better in automobile students' academic achievement when taught starting system. This finding is in-line with Ezeudu in Odika, 2022, which states that academic achievement is the outcome of education - the extent to which a student, teacher or institution has achieved their educational goals through animated instructional software. Again, Nwodo, (2015), added that animation method is more superior to other method in terms of student achievement and retention while Abdullahi, (2010) opines that the use of animated teaching strategy increases students' achievement.

Table 3: Mean and standard deviation of pretest and posttest scores of experimental and control groups in MVM when taught charging system

Groups	N	Pre-test		Post-test		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Experimental	48	3.79	1.18	17.54	1.50	13.75
Control	27	2.44	1.01	5.18	1.27	2.74

The data as shown in Table 3 have the calculated pretest mean and standard deviation scores for experimental group to be 3.79 and 1.18 and a mean score of 17.54 and standard deviation of 1.50 in the posttest making a pretest/posttest mean gain in the experimental group to be 13.75. The control group had a mean score of 2.44 and a standard deviation of 1.01 in the pretest and a posttest mean score of 5.18 and a standard deviation of 1.27 with a pretest/posttest mean gain of 2.74. With this result, the students in the experimental group are of a better-quality in the achievement test (mean score) when compared with the students in the control group. This means that the use of animated instructional software alongside demonstration method is superior/better in automobile students' academic achievement when taught charging system. This finding is in-line with Ezeudu in Odika, 2022, that states that academic achievement is the outcome of education - the extent to which a student, teacher or institution has achieved their educational goals through animated instructional software. Again, Nwodo, (2015), added that animation method is more superior to other method in terms of student achievement and retention while Abdullahi, (2010) opines that the use of animated teaching strategy increase students' achievement.

Table 4: Mean and standard deviation of pretest and posttest scores of experimental and control groups in MVM when taught ignition system

Groups	N	Pre-test		Post-test		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Experimental	48	3.38	1.31	17.71	1.54	14.33
Control	27	2.00	1.11	4.15	1.09	2.15

The data as shown in Table 4 have the calculated pretest mean and standard deviation scores for experimental group to be 3.38 and 1.31 and a mean score of 17.71 and standard deviation of 1.54 in the posttest making a pretest/posttest mean gain in the experimental group to be 14.33. The control group had a mean score of 2.00 and a standard deviation of 1.11 in the pretest and a posttest mean score of 4.15 and a standard deviation of 1.09 with a pretest/posttest mean gain of 2.15. With this result, the students in the experimental group are of a better-quality in the achievement test (mean score) when compared with the students in the control group. This means that the use of animated instructional software alongside demonstration method is superior/better in automobile students' academic

achievement when taught ignition system. This finding is in-line with Ezeudu in Odika, 2022, that states that academic achievement is the outcome of education - the extent to which a student, teacher or institution has achieved their educational goals through animated instructional software. Again, Nwodo, (2015), added that animation method is more superior to other method in terms of student achievement and retention while Abdullahi, (2010) opines that the use of animated teaching strategy increases students' achievement.

Testing of Hypotheses

ANCOVA was used in testing the null hypotheses for the study. The analysis was done using Statistical Package for Social Sciences (SPSS). The results are therefore presented below:

Hypothesis 1 (Ho_1): There is no significant difference between the mean ratings of the respondents on students' academic achievements in MVM when taught starting system with animated instructional software and those taught without animated instructional software

Table 5: Analysis of covariance (ANCOVA) for test of significance between the mean achievement scores of students taught with animated starting system software

Tests of Between-Subjects Effects					
Dependent Variable: Posttest					
Source of Variation	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2501.664[a]	2	1250.832	607.463	.000
Intercept	716.546	1	716.546	347.989	.000
Pretest	3.735	1	3.735	1.814	.182
Treatment	2429.662	1	2429.662	1179.959	.000
Error	148.256	72	2.059		
Total	15092.000	75			
Corrected Total	2649.920	74			
a. R Squared = .944 (Adjusted R Squared = .942)					

The data presented on Table 5 show the calculated value of F (1179.959) with associated probability value (P = .000) which is less than .05 level of significance. Therefore, the null hypothesis is rejected. The result indicated that there is a significant difference between the mean achievement scores of students taught starting system with animated instructional software and those taught without animated instructional software. Nwodo, (2015), added that animation method is more superior to other method in terms of student achievement and retention.

Hypothesis 2 (Ho_2): There is no significant difference between the mean ratings of the respondents on students' academic achievements in MVM when taught charging system

with animated instructional software and those taught without animated instructional software.

Table 6: Analysis of covariance (ANCOVA) for test of significance between the mean achievement scores of students taught with animated charging system software

Tests of Between-Subjects Effects					
Dependent Variable: Posttest					
Source of Variation	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2643.208[a]	2	1321.604	664.777	.000
Intercept	949.246	1	949.246	477.479	.000
Pretest	4.852	1	4.852	2.441	.123
Treatment	1873.600	1	1873.600	942.436	.000
Error	143.139	72	1.988		
Total	15644.000	75			
Corrected Total	2786.347	74			
a. R Squared = .949 (Adjusted R Squared = .947)					

The data presented on Table 6 show the calculated value of F (942.436) with associated probability value (P = .000) which is less than .05 level of significance. Therefore, the null hypothesis is rejected. The result indicated that there is a significant difference between the mean achievement scores of students taught with animated charging system with animated instructional software and those taught without animated instructional software. Abdullahi, (2010) opines that the use of animated teaching strategy increases students' achievement.

Hypothesis 3 (Ho_3): There is no significant difference between the mean ratings of the respondents on students' academic achievements in MVM when taught ignition system with animated instructional software and those taught without animated instructional software

Table 7: Analysis of covariance (ANCOVA) for test of significance between the mean achievement scores of students taught with animated ignition system software

Tests of Between-Subjects Effects					
Dependent Variable: Posttest					
Source of Variation	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3188.394[a]	2	1594.197	867.248	.000
Intercept	1301.612	1	1301.612	708.081	.000
Pretest	10.972	1	10.972	5.969	.017
Treatment	2312.823	1	2312.823	1258.183	.000
Error	132.352	72	1.838		
Total	15660.000	75			
Corrected Total	3320.747	74			
a. R Squared = .960 (Adjusted R Squared = .959)					

The data presented on Table 7 show the calculated value of F (1258.183) with associated probability value (P = .000) which is less than .05 level of significance. Therefore, the null hypothesis is rejected. The result indicated that there is a significant difference between the mean achievement scores of students taught with animated ignition system with animated instructional software and those taught without animated instructional software. Nwodo, (2015), added that animation method is more superior to other method in terms of student achievement and retention while Abdullahi, (2010) opines that the use of animated teaching strategy increases students' achievement.

Major Findings

MVM Students (experimental group) taught the topics using animated instructional software scored higher in AAT than the control group taught without animated instructional software thereby making significant differences to exist between experimental group and control group in favour of the experimental group with high mean scores (mean gain). This finding is in-line with Ezeudu in Odika, 2022, that states that academic achievement is the outcome of education - the extent to which a student, teacher or institution has achieved their educational goals through animated instructional software. Again, Nwodo, (2015), added that animation method is more superior to other method in terms of student achievement and retention while Abdullahi, (2010) opines that the use of animated teaching strategy increases students' achievement.

Discussion of Findings

Effect of animated instructional software on students' academic achievement in MVM

The findings of this study revealed that there is a significant difference between the AAT mean scores of experimental groups taught MVM topics using animated instructional software and the control group taught without animated instructional software. The AAT mean scores of students taught with animated instructional software was higher than the AAT mean scores of students taught without animated instructional software. This is in accordance with the findings of Odika (2022), Nwodo (2013), Abdullahi (2010), Yearwood (2005), and Eke (2004) who discovered that the used of animated instructional software is more effective in conjunction with demonstration teaching method in the subject area and that students' in experimental group performed better than their counter-part in control group. This finding therefore implies that though animated instructional software is not familiar and used in GTCs, it could be used to enhance student's academic achievement in MVM. This finding is also in-line with Eke (2004) who reported that students retain more when they are taught Biology with animated instructional delivering technique than when they are taught with other method. Abdullahi (2010), added that the use of animated teaching strategy increases students' achievement in civic education, while Nwodo (2013), established that animation method is more superior to lecture method in terms of student achievement and retention.

Conclusion

Animation is discovered to be very important in the teaching and learning process. If properly used, it provides a learning environment that will help learners to be more effective. Students taught MVM with animated instructional software achieved higher than those taught without animated instructional software. This suggests that animated instructional software in conjunction with demonstration method facilitates students' academic achievement more than any other method. Again, students that were exposed to animated instructional software retained more than those taught without animated instructional software. This indicates that animated instructional software in conjunction with demonstration method is an effective method of teaching.

Recommendations

i. Animated instructional software should be adopted by curriculum designers, National University Commission (NUC), National Commission for Colleges of Education (NCCE) and National Business and Technical Examinations Board (NABTEB), National Board for Technical Education's (NBTE), and teachers should be adequately supervised for effective implementation across the GTCs in Nigeria especially when animated instructional software is introduced into the school system.

ii. Teachers should be trained by the government on how to use animated instructional software in order to improve students' academic achievement in MVM courses. Again, State and Federal government should fund seminars and workshops on the use of animated instructional software.

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