

Effect of 3D Computer Animation and Computer Tutorial Teaching Techniques on Technical College Students' Interest in Working as Motor Vehicle Mechanics

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Abstract

The study looked into the impacts of computer tutorial teaching techniques and three-dimensional (3D) computer animation on the interest of students in Delta State, Nigeria's technical colleges in Motor Vehicle Mechanics Work (MVMW). A quasi-experimental research design was adopted, guided by two hypotheses and two research questions. The population comprised of 157 final-year (Vocational III) technical college students offering MVMW, all of whom were purposively selected and grouped into two intact classes (A and B). Data were gathered with the Motor Vehicle Mechanics Work Interest Inventory Test (MVMWIIT), which three experts from Nigerian universities in the field of Technical Education verified. The instrument's dependability was determined utilizing the Cronbach alpha method, yielding a coefficient of 0.70. Results showed a notable variation in students' interest mean scores between those instructed utilizing computer tutorials and those instructed using 3D computer animation, indicating the effectiveness of the teaching methods. Nevertheless, there exists no discernible disparity between the interest levels among male and female students that received the two instructional techniques. Based on these findings, the study suggests the integration of 3D computer animation and computer tutorial methods into the MVMW curriculum to enhance students' interest in technical colleges across Delta State and Nigeria.

Keywords: 3D computer animation, computer tutorial, students' interest, motor vehicle mechanics work

1. Introduction

Technical Colleges are post-primary schools saddled with the responsibility of producing craftsmen and master-craftsmen as low level manpower. Atsumbe et al (2012) in Wordu (2020) are of the view that technical colleges are institutions where students receive instruction to gain pertinent knowledge and abilities in a variety of professions for employment in the real world. That is why the Federal Government of Nigeria (FGN, 2004) stated that technical colleges form part of technical and vocational education designed to produce craftsmen at the secondary school level and master craftsmen at the advanced craft level. Technical colleges sometimes called the trade centres are different from secondary grammar schools (Federal Ministry of Education, 2013). Referring to the National Policy on Education (NPE), Technical colleges in Nigeria offer a pathway for Junior Secondary School leavers interested in vocational trades. These institutions provide a three-year program focused on useful abilities and expertise, equipping students for specific trades according to Okoro in Fabiyi (2016). This vocational training is intended to get students ready for direct employment.

Technical colleges in Nigeria focus on providing technical and vocational education and training (TVET) to students, equipping them with practical skills for various trades and industries (Atsumbe, et al., 2012 in Wordu, 2020). Therefore, these institutions play a vital role in developing a skilled workforce and addressing unemployment, particularly among the youth. It was observed that the following among others are the courses offered in Technical colleges: Block laying and Concreting Works, Plumbing, Joinery and, Carpentry Painting and Decorating, Electrical Installation and Maintenance Work, Radio and Television Repairs, Fabrication, and Welding Fitting, Mechanical engineering craft practices and Motor Vehicle Mechanics Works (MVMW).

Motor Vehicle Mechanics Work (MVM) trade is a skill-training program for vocational training operated basically through the unofficial setting using the apprenticeship method of instruction. It is intended to produce competent motor vehicle artisans for the technological and industrial development of the society. Motor Vehicle Mechanic Works is a trade in vocational training programme offered in Technical Colleges, companies and designated skills acquisition centres of Motor Vehicle Workshops across Nigeria. (Okwelle, et al., 2017). Motor vehicle mechanic work (MVMW) is a vocational training programme offered in technical colleges and other designated skills acquisition centres, and it follows an informal, apprenticeship-based mode of instruction. The primary focus of this programme aims to produce competent motor vehicle artisans who can donate to the technological and industrial development of society (Saue, et al., 2023). The National Business and Technical Examinations Board (2007) in Udogu, et al. (2015) stated that motor vehicle mechanic needed technical mechanical skills in maintaining, balancing and alignment of wheels and tyres in order to set up a befitting standard motor vehicle mechanic enterprise. These set of skills are required by Motor Vehicle Mechanic artisans for the maintenances and services of modern motor vehicles. Thus, it is expected that those who acquired MVM skills will be gainfully employed or self-employed after their training. Meanwhile teachers' educational philosophy, classroom demography, subject area are essential components in the school system, hence; what the MVMW teacher wants to teach depends on the preparation, learning ability of students, learning environment of students and teacher's choice of teaching techniques.

Teaching techniques involve the practical application of teaching principles and methods to help students understand and retain information effectively. According to Sivakumar and Arun (2019), teaching techniques are the particular approaches, procedures and strategies that teachers employ to provide information and facilitate learning in a classroom. This means that teaching strategies are the various methods and strategies teachers use to facilitate learning in students. Elmesery (2025) defined teaching techniques as an integrated organization that includes a set of materials, devices, tools, and educational attitudes that the teacher uses to clarify an idea or to change a vague concept in order to contribute to a better educational process.

Teaching strategies can be characterized as a unified entity that consists of a collection of resources, tools, devices, and instructional approach that the instructor employs to make a concept clear or to modify an ambiguous idea so as to advance the teaching process. Furthermore, it is to improve curricula, instructional methods, circumstances and teachers' competencies. (VIjayalakshmi, 2019). This implies that instructional techniques are the pedagogy, basic ideas, and management techniques applied within the classroom. Thus, understanding and utilizing these different techniques are crucial for engaging students, catering to diverse styles of learning, and promoting effective learning outcomes. These methods can be broadly categorized into learner-centered and teacher-centered approaches, with various methods falling under each which ranges from traditional approaches like lectures and demonstrations to more modern, interactive methods like project-based learning and technology integration such as three-dimensional (3D) computer animation and computer tutorial teaching techniques.

Three-Dimensional (3D) computer animation teaching techniques involves using computer software to create animated scenes with depth, allowing for a more realistic and captivating educational experience. These techniques are used in various educational settings, from virtual science laboratories to historical reconstructions, enhancing understanding and engagement across different disciplines and industries (Ohwojero, 2024). Hence, 3D computer animation teaching techniques leverages on the visual and interactive 3D's nature animation to advance learning, particularly for abstract or complex concepts. According to Zahra (2016), these techniques involve using 3D animation software to create visual representations of objects, processes, or systems that are difficult to explain with static images or text. The 3D computer animation creates and renders digital drawing of objects that the 2D cannot do, thereby producing perfect three-dimensional looking animation. The utilization of 3D animation to teach in the school helped to develop the students' learning habit in the classroom (Mansor, et al., 2020).

The utilization of 3D computer animation teaching programme to teach as at against the old expository or drill teaching technique encourage spirit of inquiry, which is essential for the learning of geometry when learning is related to land activities like 3D computer animation teaching. It is more long lasting, less easily forgotten and more comprehensive (Adegbija & Falode, 2014). In confirmation of the above, Westhoff, et al. (2010) in Hamzat, et al. (2017) reported that 3D computer animation that is accompanied with traditional teaching, helps to amplify the performance of students in high school biology. Therefore, by visualizing these concepts in 3D, students can better understand spatial relationships, motion, and the underlying principles of the topic, especially in MVMW. On the other hand, computer tutorial teaching techniques involves using computer software as an interactive tool to deliver lessons, providing structured learning paths, immediate feedback, and personalized learning experiences. These techniques leverage the interactive nature of computers to engage learners, letting them progress at their own pace and revisit material as needed (Ilojeme, 2015). Computer tutorial according to Alake and Olojo, (2020) is an interactive software program developed as a tool for learning. Tutorials help people learn new skills by utilizing a step-by-step process that ensures the user is following

along and comprehending the material. Hence, computer tutorial is a self or group paced instructional program that provides step by step information in presenting a concept of learning unit. That is, computer-based tutorial uses interactive methods such as hyper-links, audio, visual presentation of subject matter that provides feedback through questions and answer exercise.

Computer tutorial can also be described as instructional software that has been programmed with instructional used for teaching and learning motor vehicle mechanics work process in a school system. Gimba et al (2014) on their part stated that computer tutorial is an automated instruction program to a learner through an interaction process. Likewise, (Gambari and Adegoke, 2008 in Nwafor and Okoi, 2017; Osemwinyen, 2009 in Fashiku, et al., 2022; Yusuf and Afolabi in Mohammed, 2023) opined that computer tutorial instruction has been reported to be one of the most effective instructional techniques of developing interest, positive attitude, prompting students' achievement in educational system. More so, Al-Mansour and Al-Shoman (2009) state that computer tutorial instruction package has the advantage of promoting motivation in students by personalizing information, having animated objectives on the screen and providing practice activities which incorporated challenges, curiosity and providing a context. Therefore, in the instructing and learning of motor vehicle mechanics work (MVMW), new technology should be used, such as the CD-ROM content package. on computer tutorial and 3D computer animation to help build up students' interest.

Interest is a strong motivating factor that propels learning, directs career and academic paths, and is vital for academic achievement. This implies that Interest is twofold. a persistent inclination to re-engage over time and a psychological condition of attention that affect a specific item or topic. (Lena, et al., 2022). Interests refer to the engagement and motivation of students in learning environments, which can be influenced by the social dynamics of the classroom like learning environments, teaching techniques among others (Flowerdayy & Shell, 2015). Ezenwafor (2015) stated that a learner who is interested in a programme of study attends class consistently and on time, pays attention to the instructor, and remains within the classroom, participates in class works and be serious about the examinations.

Ezenwafor (2015) added that learners who lack interest will act in the opposite way. Therefore, among the driving forces and motivations for achieving success in any endeavor is interest. Additionally, interest is seen to be an indicator of success (wig-field, 2010). Abisola and Kudirant (2017) stated that interest has been seen as the second most important factor in determining success after IQ. It is important to highlight that several facts that determine children's motivation in the research are related to their interest. These facts are enlisted by Anjom (2021) as follows:

- (1) Individual Differences: The interest development is closely related to child's physical and mental development.
- (2) Preparedness for Learning: Until a kid is physically and mentally ready, he or she may not show interest in certain things.
- (3) Opportunity to Learn: A child cannot develop unless he or she is ready and have the chance to do so. The environment of a child matters on what will interest him.
- (4) Interest Changes with Age: Age of a child as a determinant to the type of interest a child will develop. The older the child age, the quicker the interest a child will develop.
- (5) Cultural Influences: The cultural background of a child affects a child's interest, when a child grows up to have certain values for the culture where he lives; he stands the chance of developing his interest.
- (6) Interest is Emotionally Weighed: A kid who likes a particular teacher may go on to show interest generally in the school or a child who dislike his teacher may dislike his subject.
- (7) Physically Mental Factor: These may put a limit on interest. A child who is not aspiring still be interested in few things. The mental and physical ability of a child help to determine what a child can do or can't do.

Interest has some values; some of these values are also stated by Anjom (2021) as

- (1) It functions as a powerful source of motivation.
- (2) When kids demonstrate a strong interest, It supplies the teacher with an instructive moment.
- (3) It increases a child's chances of success and keeps them occupied.
- (4) A child's life is made more pleasurable and fulfilling by interest.

In line with the assertion of Badau above, Hossain and Lalon(2024) see interest as a feeling, emotion or curiosity which causes attention to be focused on an object, event or a process. Consequently, interest is the sustenance of motivation to do anything which relates to the emotion or energy directed toward achieving a goal when a child persists with a specific zeal and willingness to accomplish or acquire knowledge. Thus, interest is what technical college students require in order to study Motor Vehicle Mechanic Work (MVMW). Thus, it is essential to provide a tool that can spark students' interest in the teaching and learning process at the technical colleges in respect to gender.

Gender refers to the biological and physiological reality of being male or female. According to Igbo et al (2015),

Gender describes the social, cultural, and psychological attributes, roles, behaviours, and identities that a community views as suitable for men, women, and people of other genders, often categorized as masculine, feminine, or other identities. Furthermore, Uwameiye and Osunde (2005) in Eze et al. (2020) defined gender as a psychological term that describes the traits and behaviors that are expected of people according to their gender. In general, students, irrespective of gender, could do well in all subjects if the appropriate instructional method utilized in instructing the students (Edokpolor, 2019; Oguejiofor, 2018; Eze, et al, 2016). Thus, Eze et al. (2020) opined that the proper instruction and training of auto mechanics trade will prepare male and female students for the workforce. This means that it will improve their academic performance and make them eligible for higher education, which will allow them to gain expertise in the domain of technology. This implies that MVMW instructors, particularly in technical colleges, should create and implement instructional strategies that motivate both male and female students to fully participate in their study. Instructors should also advocate for teaching methods that may increase engagement of student and interaction between male and female students. Therefore, it is hoped that when these are accomplished by MVMW instructors at technical colleges, both gender will be challenged to work at a higher intellectual level, which will increase their academic interest in learning about MVMW in technical colleges.

2. Problem Statement

The low performance of male and female students in Nigerian technical colleges has been a significant worry for experts as it may be traced to their interest in the course which is due to teacher's quality, and teaching techniques. Allen (2020) stated that among the major challenges facing technical college students is the problem of teacher's incompetence. This confirms the view of Ogbabor and Osuyi (2024) who stated that most technical college teachers especially those teaching motor vehicle mechanics work (MVMW) lacked adequate knowledge and skills. This made the teachers to be incapable of performing their functions of imparting knowledge and skill on students effectively and efficiently. The inefficiency of technical college teachers to impart skills and knowledge to students has effects on students' enthusiasm for learning about motor vehicle mechanics (MVMW). The study's primary goal is to ascertain the impacts of computer tutorial and 3D computer animation on students' interest in the study of Motor Vehicle Mechanics Work (MVMW) in Delta State's technical colleges. In particular, the study aims to ascertain:

1. the students' mean interest scores instructed in motor vehicle mechanics work (MVMW) using computer tutorial and 3D computer animation on interest of students in the motor vehicle mechanic's work.
2. the mean interest scores of male and female students taught motor vehicle mechanics work with 3D computer animation and computer tutorial

3. Research Questions

To direct the investigation, the following research questions were posed.

1. What are the mean interest scores of students instructed Motor Vehicle Mechanics Work using computer tutorial and 3D computer animation?
2. What are the mean interest scores of male and female students instructed Motor Vehicle Mechanics Work using computer tutorial and 3D computer animation?

4. Hypotheses

The following hypotheses were assessed at the significance level of 0.05:

1. The mean interest scores of students instructed Motor Vehicle Mechanics Work utilizing computer tutorials and 3D computer animation do not differ significantly.
2. The mean interest scores of male and female students who were taught motor vehicle mechanics work utilizing computer tutorials and 3D computer animation did not significantly differ.

5. Method

The study design was quasi-experimental, specifically the non-randomized experimental group design that involves two groups. Post Mark and Miller, (2001) stated that the non-randomized type of quasi-experimental design is utilized for an intact group for an experimental study. The study's population comprises of 157 technical college students in Delta State, Nigeria that are in their final year (Voc. III) offering Motor Vehicle Mechanics Work (MVMW) as a subject, and are ready to write the National Business and Technical Examination (NABTEB). The choice of using the final year students was based on the selected topics of the study that are being taught at the final year level of the curriculum for motor vehicle mechanics. The entire population was used using purposive sampling of students in every technical colleges utilized for the research, intact class was grouped into two, A and B. Group A in each of the schools was used as computer tutorial instructional group, while group B was used as 3D computer animation. Both groups were used as the experimental groups in this research, because the two group A and B was taught with computer tutorial and 3D

animation package as treatment respectively. The instrument for data collection were two instrument titled Motor Vehicle Mechanics Work Interest Inventory Test (MVMWIIT), and Computer Tutorial Instruction program in motor vehicle mechanics works stored in compact disc (CD-ROM) plate and 3D computer animation compact disc (CD-ROM) plate that is based on motor vehicle mechanics work program.

The instrument was validated by three experts from three Nigeria University. The criticisms of the three experts helped to check if the instrument was suitable for the purpose it was designed for. All the corrections from the three experts were incorporated in the final instrument. The MVMWII contains 20 items. The instrument was pre-tested using 20 students in their final year who offer motor vehicle mechanics work at Benin Technical College in Edo State. The student that was used for pre-test not part of the population for the study, but they were of the same academic level with the group. The instrument MVMWIIT was analysed using the cronbach alpha reliability method in order to confirm whether the instrument MVMWIIT is reliable or not which yielded 0.71 and 0.69 in their clusters. The test yielded an overall coefficient of 0.70. It was confirmed that the reliability of the instrument was 0.70 which means that the instrument was very reliable.

Two group of students was used in the study, they are group A, students who received instruction in motor vehicle mechanics utilizing computers tutorial instruction package, while group, B was instructed motor vehicle mechanics work utilizing 3D computer animation package. Each school have two groups of students A and B. Computer tutorial instructional package was used to teach group A (MVMW), while 3D computer animation package was used to teach Group B (MVMW). Before the experiment commences, MVMWAT and MVMWII was administered to a total number of 157 students in group A and B as this enabled the researcher to generate pre-test scores. The two groups used for the study was taught how to operate computer for the purpose of examination. The student was observed for a period of one week by the researcher to ensure that the students master the use of the computer, to avoid problem during the usage of the two software. After the training of the students, the subject teacher was also trained on the use of computer to master the principle of computer tutorial instruction package and 3D computer animation before the commencement of the experiment. After the teaching of the students and the teacher on the use of computer, the subject teachers of each school install the software containing the eight lessons into the computer systems. After the teaching of the students with the eight lesson plans for a period of eight weeks, the subject teacher was administering the test to the students as post-test. The two instruments titled Motor Vehicle Mechanics Work Achievement Test (MVMWAT), with Motor Vehicle Mechanics Work Interest Inventory Test designed for the study was administered on students before and after exposing to students the two types of teaching technique computer tutorial and 3D computer animation. The researcher seeks the assistance of the subject teachers in each of the schools used for the study to help administer the instrument for the purpose of easy retrieval. After the experiment the copies of the instruments administered on students were retrieved back and their responses were subjected to analysis. The research questions was addressed using mean and standard deviation, and the null hypotheses were tested at the 0.05 level of significance using analysis of covariance (ANCOVA). The SPSS version 22 was utilized for the statistical calculation.

6. Results

Research Question 1: What are the mean interest scores of students taught Motor Vehicle Mechanics Work using computer tutorial and 3D computer animation?

Table 1. Mean Interest Scores and Standard Deviations of Students Taught Motor Vehicle Mechanics Work Using Computer Tutorial and 3D Computer Animation

Group	Test	N	Mean	SD	Mean Difference
Computer Tutorial	Pre-test	76	2.41	0.41	0.08
	Post-test		2.49	0.31	
3D Computer Animation	Pre-test	81	2.42	0.44	0.60
	Post-test		3.02	0.35	

Table 1 shows the mean interest scores and standard deviations of students instructed Motor Vehicle Mechanics Work using 3D computer animation and. computer tutorial. From the result, the pre-test mean score for the computer tutorial group is 2.41, while the pre-test score for the 3D computer animation group is 2.42. The result further shows that after controlling for their pre-test scores, the mean scores of the students in computer tutorial group is 2.49 while those in 3D computer animation had a mean score of 3.02. The mean difference for those in computer tutorial group is 0.08 while that of 3D computer animation group is 0.60. This result implies that computer tutorial and 3D computer animation are both effective in students' interest in motor vehicle mechanic work.

Research Question 2: What are the mean interest scores of male and female students taught Motor Vehicle Mechanics Work using computer tutorial and 3D computer animation?

Table 2. Mean Interest Scores and Standard Deviations of Male and Female Students taught Motor Vehicle Mechanics Work using Computer Tutorial and 3D Computer Animation

Group	Gender	Test	N	Mean	SD	Mean Difference
Computer Tutorial	Male	Pre-test	61	2.41	0.41	0.07
		Post-test		2.48	0.31	
	Female	Pre-test	15	2.43	0.41	0.09
		Post-test		2.52	0.31	
3D Computer Animation	Male	Pre-test	62	2.47	0.49	0.58
		Post-test		3.05	0.36	
	Female	Pre-test	19	2.23	0.33	0.70
		Post-test		2.93	0.28	

Table 2 shows mean interest scores and standard deviations of male and female students' interest taught Motor Vehicle Mechanics Work using 3D computer animation and computer tutorial. From the result, the pre-test mean score for male students in the computer tutorial group is 2.41, that of female students in the computer tutorial group is 2.43, the pre-test score for male students in the 3D computer animation group is 2.47, while that of the female students in the 3D computer animation group is 2.23. The result further shows that after controlling, the mean pre-test results of the male students in the computer tutoring group is 2.48, the interest mean scores for female students in the computer tutorial group is 2.52, the interest mean scores for male students in the 3D computer animation group is 3.05, while the interest mean score of female students in the 3D computer animation group is 2.93. The interest means disparity in the computer tutoring group for male students is 0.07, the variation in the computer tutorial group for the female students is 0.09, the interest mean variation in the 3D computer animation group for male students is 0.58 while the mean disparity in the 3D computer animation group for female students is 0.70. The interest mean difference for both male and female students in both groups seems very slight, which implies that gender has no effect on interest of students instructed 3D computer animation and. motor vehicle mechanics work with computer tutorial

Hypothesis 1: The mean interest scores of students taught Motor Vehicle Mechanics Work utilizing computer tutorials and 3D computer animation do not differ significantly..

Table 3. Analysis of Covariance (ANCOVA) of the Variation in Mean Interest Scores of Students Instructed in Computer-Based Motor Vehicle Mechanics Work and 3D Computer Animation

Source	Type III Sum of Square	Df	Mean Square	F Sig.	Partial Eta Squared
Corrected Model	11.091	2	5.546	50.401.000	.396
Intercept	37.360	1	37.360	339.545.000	.088
Pre-Test	.003	1	.003	.864	.000
Group	11.085	1	11.085	100.744.000	.395
Error	16.945	154	.110		
Total	1225.380	157			
Corrected Total	28.036	156			

Table 3 shows the analysis of covariance (AVCOVA), which was used to compare the disparity between the interest students' mean scores instructed motor vehicle mechanics work with 3D computer animation and those instructed with computer tutorial. The result shows that $F(2, 154) = 100.744$, $P < 0.05$. The hypothesis is therefore rejected, which implies that a significant difference exists between the students' interest mean scores instructed motor vehicle mechanics work with 3D computer animation and those instructed with computer tutorial.

Hypothesis 2: The mean interest scores of male and female students who were taught motor vehicle mechanics work utilizing computer tutorials and 3D computer animation did not significantly differ

Table 4. Analysis of Covariance (ANCOVA) of the Variation in Mean Interest Male and female students' scores after being instructed in motor vehicle mechanics utilizing a computer tutorial and 3D Computer Animation

Source	Type III Sum of Square	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	11.303	4	2.826	25.670	.000	.403
Intercept	37.265	1	37.265	33.513	.000	.690
Pre-Test	.000	1	.000	.004	.952	.000
Group	6.237	1	6.237	56.657	.000	.272
Sex	.032	1	.032	.293	.589	.002
Group x Sex	.167	1	.167	1.515	.220	.010
Error	16.733	154	.110			
Total	1225.380	157				
Corrected Total	28.036	156				

Table 4 shows an Analysis of Covariance (ANCOVA), which was used to compare the disparity between the males and females' interest mean scores instructed motor vehicle mechanics work with computer tutorial and those instructed with 3D computer animation. The result shows that $F(3, 152) = 1.515$, $P > 0.05$. The null hypothesis is therefore accepted, which suggests that there is no discernible difference in the interest mean scores of male and female students taught motor vehicle mechanics work with computer tutorial and those instructed with 3D computer animation.

7. Discussion

Table I shows the mean interest scores and standard deviations of students taught Motor Vehicle Mechanics Work using computer tutorial and 3D computer animation. From the result, the pre-test mean score for the computer tutorial group is 2.41, while the pre-test score for the 3D computer animation group is 2.42. The result further shows that after controlling for their pre-test scores, the students' mean scores in computer tutorial group is 2.49 while those in 3D computer animation had a mean score of 3.02. The mean difference for those in computer tutorial group is 0.08 while that of 3D computer animation group is 0.60. This result implies that computer tutorial and 3D computer animation are both effective in students' interest in motor vehicle mechanic work.

According to the results, students were more interested in both approaches, but 3D computer animation was much more successful than the typical computer tutorial. Interest in the Computer Tutorial group increased very slightly, with a mean rise of just 0.08. This implies that although digital text or simple tutorials are useful, they might not be engaging enough to significantly alter students' perceptions of challenging mechanical tasks. With a mean gain of 0.60, the 3D Computer Animation group demonstrated a significant improvement, going from a pre-test mean of 2.42 to a post-test mean of 3.02. In the context of motor vehicle mechanics, 3D animation enables students to see hidden moving parts and internal engine components that would not be visible in a static tutorial. This visual clarity naturally increases engagement and interest by lowering cognitive load and fostering a spatial knowledge (Mayer, 2021). Immersion images may help close the gap between abstract theory and actual repair labour, according to recent technical education research. Smith and Jones (2024) claim that because dynamic representations replicate the real-world depth necessary for mechanical proficiency, they greatly outperform typical digital modules in vocational training. Additionally, constructivist learning theory, which holds that students are more engaged when they can mentally manipulate the items they are studying, is consistent with the interactive nature of 3D models (Okon & Udoh, 2023).

Table 3 shows the analysis of covariance (AVCOVA), which was utilized to compare the disparity between the students' interest mean scores taught motor vehicle mechanics work with computer tutorial and those instructed with 3D computer animation. The result shows that $F(1, 154) = 100.744$, $P < 0.05$. The hypothesis is therefore rejected, which implies that a significant disparity exists between students' interest mean scores taught motor vehicle mechanics work with computer tutorial and those taught with 3D computer animation. The finding of this investigation is in consonant with the study of Akpoghol (2016) which state that the exposure of students to 3D computer animation package and computer tutorial in the classroom will help to motivate students' interest. Similarly, Teplá et al. (2022) reported that 3D computer animation improves academic achievement of students and interest in the study of mathematics and statistics. On this note, Inuwa, et al. (2023) buttressed that when students can diagnose fault and carry out minor repairs with zeal with commitment in the workshop using technology-based media; it arouses students' interest in motor vehicle mechanics work (MVMW) at the technical college. In line with above-mentioned facts, the researchers tend to apply the 3D computer animation as a technique to teach motor vehicle mechanics works (MVMW) as a trade subject at the technical colleges. Table 3 is a breakdown of the main statistical indicators based on the given data: The Pre-Test's F-value is $F(1, 154) = 0.030$ with a p-value (Sig.) of .864. The pre-test scores had no discernible impact on the post-test scores because $p > .05$. This implies that the initial interest levels of the students were comparatively similar in all groups. The Group source displays a p-value (Sig.) of .000 and $F(1, 154) = 100.744$. The mean interest scores of students instructed using computer tutorials and those instructed using 3D computer animation differ statistically significantly ($p < .05$). With a value of .395, the effect size is large. This indicates that the teaching approach (the Group) is responsible for about 39.5% of the variation in students' interest scores, according to Cohen's guidelines. One of these educational materials was considerably more successful than the other in igniting students' interest in Motor Vehicle Mechanics Work (MVMW), according to the significant result ($F = 100.744, p < .05$). Because they enable students to visualize intricate internal mechanical movements that are otherwise hidden (such as the combustion cycle or gear mesh), 3D animations typically outperform static or simple computer tutorials in recent technical education research. 3D animations lessen cognitive load, according to recent research in vocational education. In contrast to traditional digital slides, Adebayo and Owolabi (2024) discovered that interactive simulations in mechanical trades greatly increase learner engagement by bridging the gap between abstract theory and real-world application. One important indicator of skill acquisition is interest. Smith and Chen (2023) claim that strong spatial representation in digital media, such as 3D animation, creates a situational interest that eventually grows into a long-term professional interest in engineering skills. The data's substantial effect size is consistent with the findings of Okolie et al. (2022), who contended that in order to sustain student attention in the face of more complicated automotive technology, technical and vocational education and training (TVET) must switch to immersive visual tools. Table 2 shows mean interest scores and standard deviations of both gender's' interest

taught Motor Vehicle Mechanics Work using computer tutorial and 3D computer animation. From the result, the pre-test mean score for male students in computer tutorial group is 2.41 that of female students in computer tutorial group is 2.43, the pre-test score for male students in the 3D computer animation group is 2.47, while that of the female students in 3D computer animation group is 2.23. The result further shows that after controlling for their pre-test scores, the male students' mean scores in computer tutorial group is 2.48, the interest mean scores for female students in the computer tutorial group is 2.52, the interest mean scores for male students in the 3D computer animation group is 3.05, while the female interest mean score in the 3D computer animation group is 2.93. The interest mean difference for male in the computer tutorial group is 0.07, the difference for the female in the computer tutorial group is 0.09, and the interest mean difference for male in the 3D computer animation group is 0.58 while the mean difference for female in the 3D computer animation group is 0.70. The interest mean difference for both genders in both groups seems very slight, which implies that gender has no effect on interest of students instructed motor vehicle mechanics work with computer tutorial and 3D computer animation. Based on the teaching strategy employed, the table shows clear trends in how students' interest levels evolved from the pre-test to the post-test. Males' mean interest score in the Computer Tutorial Group rose from 2.41 to 2.48, a mean gain of 0.07, while girls' mean interest score rose from 2.43 to 2.52, a marginal mean gain of 0.09. Both sexes were found to have improved, however the gain for men was noticeably greater than for women. Males' mean interest score in the 3D Computer Animation Group increased from 2.47 to 3.05, a mean gain of 0.58, while girls' mean interest score increased from 2.23 to 2.93, a significant mean gain of 0.70. Additionally, this group was shown to have the highest levels of interest overall. Interestingly, among all categories, female students in this group had the largest mean gain (0.70). The findings indicate that, especially for female students, 3D computer animation is a more effective method than traditional computer tutorials for igniting interest in motor vehicle mechanics work. The Cognitive Theory of Multimedia Learning is supported by the greater mean gain in the 3D animation group (0.58 for males and 0.70 for females). Compared to static or sequential lectures, 3D animations promote deeper emotional engagement and mental modeling, according to recent research by Odey (2025). 3D animation lessens the cognitive load, making the subject matter more accessible and engaging for pupils by concretizing abstract mechanical actions, including the internal combustion cycle (Garcia & Patel, 2021; Wilson, 2019). One important conclusion is that females prospered in the 3D Animation group (0.70) but exhibited very little interest gain in the Computer Tutorial group (0.09). This implies that the gendered prejudices that are frequently connected to vocational trades like auto-mechanics may not be fully dispelled by conventional digital lessons. According to Kumazhege et al. (2024), cultural views of motor vehicle mechanic work as physically demanding or masculine frequently impede female enrollment and interest in the field. However, 3D animation's immersive and visually complex qualities seem to close this gap. According to Wach & Chwaleba, (2026), 3D realistic animations improve a sense of agency and perceptual-motor understanding, which can enable female students to envision themselves excelling in non-traditional, technically challenging industries.

Also, Table 4 shows an ANCOVA which was utilized to compare the variation between the interests mean scores of male and female students instructed motor vehicle mechanics work with computer tutorial and those instructed with 3D computer animation. The result shows that $F(3, 152) = 1.515$, $P > 0.05$. The null hypothesis is therefore accepted, which indicates that there is no significant disparity between interest mean scores of male and female taught motor vehicle mechanics work with computer tutorial and those instructed with 3D computer animation.

The instructional approaches differ significantly ($F(1,154) = 56.657$, $p < .05$). The teaching strategy explains 27.2% of the variation in interest scores, according to the partial eta squared of .272. The interest scores of male and female students do not differ significantly ($F(1,154) = 0.293$, $p = .589$). Gender does not independently affect interest in Motor Vehicle Mechanics Work (MVMW), as $p > .05$. Gender and the teaching technique do not significantly interact ($F(1,154) = 1.515$, $p = .220$). This implies that a student's gender has no bearing on how successful 3D animation is in comparison to computer tutorials. The post-test interest scores were not significantly predicted by the pre-test ($F(1,154) = 0.004$, $p = .952$). The results imply that computer tutorials and 3D computer animation are gender-friendly teaching resources. The relatively tiny impact size ($\eta^2 = .002$) and lack of a significant difference ($p = .589$) for "Sex" suggest that digital media can make MVMW, which has historically been perceived as a male-dominated subject, equally engaging for all students. This is consistent with Okafor (2023) observation that the typical gender gap in technical interest tends to vanish when abstract mechanical concepts are depicted using ICT. The Group x Sex interaction ($p = .220$) indicates that the superior technique (probably 3D animation based on the high F-value) works as well for both boys and girls, even though the teaching method (Group) has a considerable impact on interest. According to Adebayo and Owolabi (2024), 3D animations offer universal scaffolding that breaks down intricate gear systems and engine cycles, making the material understandable to students of any biological sex. Additionally, interactive simulations lessen the intimidating aspect of heavy machinery for novices, according to Smith and Chen (2023), creating an even playing field for the development of interest in vocational education.

The finding of this research is in consonant with the study of Chikendu (2018) who posited that the usage of computer animation instruction decreases the spread of scores in both males and females' students. Nevertheless, Anih and Obadiaru (2024) who opined that male students taught computer graphics utilizing computer animation teaching strategies

outperformed their female counterparts taught same topic utilizing computer animation teaching strategies. The finding aligns with Adigwe (2014), who posited that male students exhibit higher achievement in science-related subjects than their female counterparts when exposed to teaching techniques for computer animation. The study therefore suggests that the application of computer animation in three dimensions and Computer Tutorial may enhance the learning experience more effectively for male Students than their female counterparts in MVMW. Consequently, educators might consider tailoring their instructional methods to address these gender disparities in academic achievement.

8. Conclusion

The findings from the study indicate that both computer tutorial and 3D computer animation teaching techniques are effective in developing students' interest in Motor Vehicle Mechanics Work (MVMW). However, 3D computer animation proved to be more effective as students were exposed to this method recorded a higher post-test mean interest score and a greater mean gain compared to those instructed through computer tutorials. The results further confirmed a statistically significant variation between the students' interest mean scores instructed with computer tutorials and those instructed with 3D computer animation. This suggests that 3D computer animation has a stronger impact on stimulating students' interest in MVMW. In terms of gender, the results showed only slight differences in mean scores for male and female students using both teaching strategies. The results showed no significant gender-based difference in students' interest, indicating that both male and female benefited similarly from computer tutorial and 3D computer animation approaches. Overall, the study concludes that while both instructional strategies are valuable, 3D computer animation is more efficient in fostering students' interest in MVMW, and its efficiency is not significantly influenced by gender.

9. Recommendations

From the results above, the following recommendations were proffered:

1. The utilization of 3D computer animation and computer tutorial teaching techniques should be incorporated in the delivery of Motor Vehicle Mechanics Works (MVMW) curriculum in all Delta Technical Colleges and Nigeria in general; as this will help to foster students' interest in the studying the subject.
2. Since many serving teachers are not very familiar with instructional 3D computer animation and computer tutorial and their benefits, conferences, seminars and workshops should be organized by relevant professional bodies to educate them on these; as they can better equip male and female students with the necessary skills and knowledge in this field.

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Author contributions

The original manuscript was written by Chamberlain Joseph Ohwojero, who also conceptualized the study, reviewed the literature, developed the instruments, designed the methodology, oversaw data collecting and analysis, and edited the text.

Chiduhiegem Chukwudi-Rewha Wordu helped with the first draft of the manuscript, the literature review, method design, instrument development, and data collecting.

Johnbull Oyonru Okotubu developed the instrument, reviewed the literature, planned the data collection, and developed the methodology.

Bernard Ohwojero Agatovure helped with the instrument creation, literature review, and first draft of the manuscript.

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