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The Outcome of 3d Computer Animation and Computer Tutorial Teaching Techniques on Students' Retention in Motor Vehicle Mechanics Work in Technical Colleges

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Abstract

Computeranimation involves producing the appearance of movement on a screen. The study was guided by two research questions, and two null hypotheses were tested at the 0.05 level of significance. Is there substantial variance in retention scores between students using 3D computer animation and those using computer tutorials? No substantial variance existedbetween the retention scores of male and female students using 3D computer animation. The population included 157 students from four technical colleges. The design was quasi experimental, and students who were taught with 3D computer animation software outperformed students who used computer tutorials; recommendations were made based on the observations.

Introduction

The aptitude to remember things is what is referred to as retention; it can also mean holding or retaining something in one's mind [13]. This is the capacity to retrieve or retain knowledge learned in the past or to retain information for an extended amount of time. High academic achievement obliges students to possess a variety of abilities [23], including intelligence, interest, and discipline. [27] stated that a learner's capacity to connect newly learned knowledge to prior knowledge may be connected to his or her poor performance in science learning and retention. Retention is among the urgent problems that worldwide institutions of higher learning are currently experiencing, as a learning process [7]. [8] found that students need only engaging, activity-based teaching methods to remember the knowledge they have learned when given the likelihood of visualizing what the teacher has tutored them via a mental image known as "imagery"; students are better able to remember and maintain the knowledge they have gained [4]. Imagery is the aptitude to recall mental images or experiences. As a theory, imagination can be tactical, visual, or auditory. Additionally, he said that imagery plays a substantial role in learning materials retrieval and retention. Teachers present educational material in ways that many students find appealing [4].

Retaining learned materials is one thing; although accessing or retrieving such information is quite another [26], it is important to remember that learners who do not fully comprehend the concepts, factors, and rules of the learned materials tend to memorize information or use a cramming technique [25]. It was discovered that if instructional strategies support students in connecting previously learned material to new information, meaningful learning and retention are ensured.

A study conducted in Nigeria examined the impact of a cognitive constructivism instruction approach on students' retention in introductory technology. Regarding the retention and academic performance of students in introductory technology, the findings indicated that both the constructivism learning approach and the conventional method are equally effective. Moreover, [24] mentioned the outcomes of abolishing credulous beliefs stratagem on knowledge and achievement. Retention in genetic concepts also improves students' understanding of retention. Because it resonates with manifold senses, the animation instructional technique has a potent visual component. Students may benefit from making

connections between the new idea and preceding knowledge. Retention can be improved by slowing the learning rate. [32] stated that among the topics that have received the greatest attention in higher education is student retention in the classroom. After conducting historical and current research on student retention, he was able to pinpoint three areas that warrant further investigation to further enhance student retention: institutional maneuvering, programme implementation, and the ongoing challenge of advancing the academic achievement of low-income students.

The schematic diagram below illustrates the two teaching techniques and shows that when the techniques are deployed consistently, retention increases as students' academic performance and interest gradually change.

Theoretical Framework

This study is anchored on the cognitive load theory.

(CLT) developed by [37]. The theory explains that learning depends on how much mental effort is required to understand new information. It argues that human working memory has limited capacity. When too much information is presented at once, learners become overloaded, which negatively affects their understanding and retention. This principle is directly relevant to motor vehicle mechanics work, which involves complex systems, technical terms, and step-by-step mechanical processes.

Cognitive load theory identifies three types of mental load involved in learning. The first is the intrinsic load, which refers to the natural difficulty of the subject matter. Motor vehicle mechanics work contains topics such as engine operations, transmission systems, and electrical components, which are naturally demanding. The second is extraneous load, which comes from poor presentation of information. If instruction is unclear or disorganized, students may struggle unnecessarily. The third is germane load, which is the mental effort that supports meaningful learning and understanding.

According to the findings of this study, 3D computer animation and computer tutorial teaching techniques are expected to reduce unnecessary mental strain. Animation can clearly show how engine parts move and interact, making abstract ideas easier to understand. Computer tutorials can present information in small, organized steps, allowing students to learn at a manageable pace. When instruction reduces unnecessary confusion and presents content clearly, students can focus more on understanding the core concepts.

Within the conceptual framework of the study, 3D computer animation and computer tutorial teaching techniques served as the independent variables, while student retention in MVM was the dependent variable. According to cognitive load theory, when instructional methods reduce unnecessary mental burdens and support clear understanding, information is more likely to be stored in long-term memory. As a result, students taught with well-structured multimedia techniques are expected to demonstrate better retention than are those taught with less structured methods.

Teaching/Learning Techniques of Motor-Vehicle-Mechanics-Work in Technical Colleges

In technical colleges, motor-vehicle-mechanics-work (MVMW) involves a trade-off among vocational training skill programs that are primarily run in a casual setting using apprenticeship-style instruction. Its goal is to generate skilled auto men for the advancement of industry and technology in society[21]. As a vocational training program, motor vehicle mechanics are tutored in technical colleges and special skill-acquisition centers located in motor vehicle workshops throughout Nigeria. After training, individuals who have learned motor-vehicle-mechanics-work (MVMW) abilities are expected to either work for themselves or find rewarding employment. Motor-vehicle-mechanics-work is tutored in technical colleges in workshops. [15] stated that a workshop is a location, space, room, or building where mechanics, tools, hand tools, workbench, and materials are deployed in the production or repair of various vehicles. As people in motor vehicle mechanics who are talented, individuals who have received training in various aspects of auto-repairment, such as electrical work, physical activity and mechanical work, automobile body building (panel beating), and automobile merchandizing, have the ability to trade [28]. A trainee who has gained technical ability in a casual setting at a designated Motor-Vehicle-Mechanics-Workshop within a set time frame is known as an apprentice.

For both private and public transport, a motor vehicle is a self-propelled land vehicle with an internal combustion engine and typically four wheels. Its styles, number of doors, and intended uses are all of a deserted brand. [1] described a motor vehicle as a device that has several systems, including a cooling system and an ignition system. A skilled apprentice's comprehension of the principles governing the operations of these systems is essential for the efficient and effective repair and maintenance of motor vehicles. Technical abilities are hard abilities that involve the application of tools and equipment that interact with work properly and efficiently plus all technical matters. These abilities are learned via thoughtful, methodical, and workable effort to carry out multipart activities as job functions involving ideas, including cognitive abilities, technical abilities, and interpersonal abilities [7]. According to established standards and the manufacturer's instructions, the ability to expertly and competently repair, service, and maintain engine components is referred to in this study as mechanical and technical ability. The National Business and Technical Examination (NABTEB) (2007) stated that to establish a profitable standard motor vehicle mechanics enterprise, motor vehicle mechanics must possess the work abilities necessary to maintain the balance and alignment of wheels and tires. To maintain and service today's automobiles, motor vehicle mechanics need to possess this set of abilities.

Computer Tutorial in Motor-Vehicle-Mechanics-Work

A computer tutorial is a self-paced or group-paced educational program that offers detailed instructions for introducing a concept or unit of study. A computer-based tutorial can also be defined as instructional software programmed with instructional materials deployed to teach and learn the work process of motor vehicle mechanics in a school system. It employs communication techniques such as hyperlinks, audio, and visual presentations of the subject matter that offer feedback via queries and answer exercises. [6] defined computer tutorials as automated programs that teach students via a

communication process. [30] also defined a computer tutorial as an automated program that uses software to teach students via a communication process. Using appropriate programming to motivate and persuade students' interest through the learning procedure, a computer tutorial package was designed and presented to capture and hold the learner's attention throughout the entire lesson [10]. To boost this claim, a tutored IC was designed using tablet PCs loaded with communicating software, and countless examples of how technology can encourage students' active engagement were provided [9]. As student retention improved when computers were deployed for data assessment. Among the multimedia teaching methods that have been scientifically shown to improve student performance, spark students' interest, and lessen the tedious and abstract nature of learning mathematics and other vocational subjects is computer tutorial instruction [2], [9]. [14] stated that computer tutorials help students spend more time studying, which improves their comprehension and helps them pinpoint their areas of strength and weakness.

3D computer animation techniques in motor vehicle mechanics

In computer graphics, animation is the process of giving any inanimate object life and making it appear to be alive. Even the utmost lifeless objects can be given vitality and emotion via computer animation. [22] explained computer animation as a type of pictorial presentation that includes computer-generated motion pictures that depict relationships between drawn figures, motion pictures, and simulations that interact with concepts, videos, and illustrations. Computer animation is a method for producing the appearance of movement on a screen or for recording a sequence of discrete states of a dynamic scene [3]. The fundamental concept underlying animation is to replay captured images quickly enough for the human eye to mistake them for continuous motion. Computer animation is a powerful tool that can bring a series of lifeless images to life and is deployed in a variety of contexts, including entertainment, computer-aided design, scientific visualization, and educational art. Researchers in the field of chemistry education have shown that learners' comprehension of chemistry concepts is improved by animated graphics [29]. Computer animation is widely regarded as among the most effective methods for elucidating models and processes in natural science education, and its impact has been observed in various domains, such as tourism, industry, medicine, and education. Computer animation has been the most prominent aspect of technology-based learning environments for the past twenty years [31]. Since it is often said that a picture speaks a thousand words, many educators use animated cartoons as a supplement or alternative to traditional teaching methods [5]. An increasing number of science teachers have begun using animated cartoons in their lessons, making science classes easier for students to understand, especially in physics and other science-interacting subjects [11]. [16] and [34] provided evidence to support this claim, stating that students are actively involved in their economic studies by using animated cartoons to explain fundamental economic and microeconomic concepts in the social sciences. Animation gives students access to dynamic information that static graphics either do not provide or cannot provide. Research has demonstrated that computer animations enhance memory for illustrated material and understanding of the scenario outlined in textbooks [6, 17]. In recent years, animation has been deployed as a means of illustration in schools to help students visualize concepts that might otherwise be difficult to do [18]. [12] offered an analogous visualization via the application of

graphics that helped to facilitate the construction of mental models. The ability of computer animation to increase students' comprehension levels is contingent upon their individual interests and affects their memory and cognitive load in the classroom.

Statement of the Problem

At both the elementary and high school levels, student retention has become a major concern for educational institutions, and retention issues are present in all schools worldwide [19]. To enhance classroom learning, student retention has emerged as a critical issue that needs to be addressed [20]. Since the 1970s, student retention has been a substantial problem; however, despite substantial investment in these programs, five factors that best encourage retention in the educational system have been identified [32], [35]. They have high standards for students, clearly outline the requirements of the institutions, and offer wise counsel regarding academic decisions. Many students lack clarity about their plans and require assistance in creating a roadmap. Academic, social, and personal support are especially important before and during the first year. Students who actively participate in their education are more likely to stay in social learning, which involves group learning and is especially beneficial and can help students form friendships; this is another factor that influences average student persistence in learning[33]. Determining the impact of computer tutorials and 3D computer animation on students' retention in Motor Vehicle Mechanic Work (MVMW) at Technical College is the main challenge of this study.

Purpose of the Study

This study aimed to ascertain the outcomes of computer tutorials and 3D computer animations on student retention in technical college courses that teach motor vehicle mechanics work (MVMW). More precisely, the study will ascertain the following outcomes:

1. Communicating computer tutorials and three-dimensional computer animations improve students' retention of knowledge that interacts with auto-regression.

2. Students who received tutored motor vehicle mechanics via computer tutorials and 3D computer animation were retained regardless of their sex.

Research Queries

To direct the investigation, two research questions were posed.

1. What impact do computer tutorials and 3D computer examinations have on students' retention in automotive mechanics?
2. What impact does gender have on students' retention of knowledge in regard to computer tutorials for motor vehicle mechanics and 3D computer examinations?

Hypotheses

Two null hypotheses were formulated and tested at the 0.05 level of significance.

1. When teaching motor vehicle mechanics works via computer tutorials versus using 3D computer animation, there was no discernible variance in the retention scores of the two groups of students.

2. When teaching motor vehicle mechanics works using computer tutorials versus 3D computer animation, there was no discernible variance in the retention scores of male and female students.

Methodology

Design of the Study

This research employed a quasi-experimental design—more precisely, a nonrandomized experimental group design with two groups and intact class groups.

Area of Study

The study was conducted in the South—South geopolitical zone, specifically in the Delta State. It is among the Federal Republic of Nigeria's thirty-six states. It shares borders with the states of Edo, Bayelsa, and Anambra. The study was conducted at four of the state's technical colleges. The Technical College in Sapele, Ogor, Asaba, and Agbor are the technical colleges. The four technical colleges were chosen for the study because they offer motor-vehicle-mechanics-work (MVMW) and have ICT resources that improve student instruction.

Study population

The population of students included 157 technical college students who were in their final year (Tech III), enrolled in Motor-Vehicle-Mechanics-Work (MVMW) as a subject and were prepared to complete the National Business and Technical Examination (NABTEB). The study's chosen topics informed the decision to use the final-year students.

Sample and Sampling Techniques

Students in year III (the final year) at the four technical colleges offering motor vehicle mechanics work (MVMW) were purposefully sampled. The articles were selected based on the study's chosen topics, which were tutored at the MVMW curriculum's year III (final year) level. The entire classes were divided into A and B groups in each of the technical colleges that were deployed for the study. In each school, group A received instruction via computer tutorials, while group B received instruction in 3D-computer-animation. Both groups served as experimental groups for the study since they received instructions using computer tutorials and 3D animation packages, respectively.

Instrument for Data Collection

The Motor Vehicle Mechanics Work Achievement Test (MVMWAT) and the Motor Vehicle Mechanics Work Interest Inventory Test (MVMWIIT) were the instruments used in this study. Students at a different school that offers the subject were given these tests. An instrument to collect data for a reliability and validation test was given to the students.

Validation of the instrument

Face and content validity were assessed for the two instruments, the Motor Vehicle Mechanics Work Achievement Test and the Motor Vehicle Mechanics Work Interest Inventory Test. The two instruments were validated by five experts. Three instructors from the Delta State University Department of Industrial Technical Education and two instructors from the Department of Measurement and Evaluation Unit at Delta State University, Abraka, are included in the five validations for criticism. The instrument validation criticisms aided in determining whether the device was appropriate for the application for which it was intended. The final instrument was updated with validation corrections.

Instrument reliability

The researcher was able to determine whether the two instruments were reliable based on the computation of the student response, following the pretesting procedure. The two instruments were calculated to be 0.73 and 0.79, indicating that the instrument was reliable.

Experimental Procedure

In this study, two groups of students were grouped: group A received instruction in motor vehicle mechanics using a computer tutorial package, and group B received instruction in motor vehicle mechanics work using the 3D computer animation package. Every school had two student groups, A and B. Group A was tutored on MVMW using the computer tutorial instructional package, and Group B was tutored on MVMW using the 3D computer animation package. A total of 157 students in groups A and B were given the MVMWAT and MVMWII before the start of the experiment to allow the researcher to complete the pretest. To facilitate the examination, both groups received computer instruction. The researcher watched the students for a week to ensure that they understood how to use the computer and to ensure that there were no issues when using the two pieces of software. Prior to the start of the experiment, the subject teacher received additional computer training ensuring that the students fully understood the concepts of computer tutorial instruction packages and 3D computer animation. By providing computer instruction for both students and teachers, each school's subject teachers install eight lessons that are worthy of software on computers. After eight weeks of instruction were provided through the eight lesson plans, the subject teacher gave the students a posttest. Six weeks later, the same instrument was used for the retention test.

Method of Data Collection

After the students completed the two instruments, the Motor Vehicle Mechanics Work Achievement Test (MVMWAT) and the Motor Vehicle Mechanics Work Interest Inventory Test, which were specifically

designed for the study, the data were collected. Three weeks later, the two groups were tested again, and the data were collected again to compare the two scores and determine the degree of retention.

Methods of Data Analysis

While the null hypotheses were tested at the 0.05 level of significance using analysis of covariance (ANCOVA), the researcher employed the mean and standard deviation to address the research question. The data were statistically analyzed using SPSS version 22, which is a statistical package for social sciences. The calculated p value was used to make the analysis decision; if the calculated value was greater than the p value, the hypothesis was rejected; and if it was less than the p value, the hypothesis was accepted.

Presentation and analysis of the data

The substantive analysis's findings are based on the interacted research queries and hypotheses.

Research Question I: What impact do computer tutorials and 3D computer animations have on students' retention of automotive mechanics?

Table 1:

Group	Test	N	Mean	SD	Mean Variance
Computer	Posttest	76	1.96	0.53	0.40
Tutorial	Rest-test		2.36	0.38	
3D Computer	Posttest	81	1.96	0.42	0.83
Animation	Ret-test		2.77	0.55	

Table I shows the comparison of the outcomes of computer tutorials and 3D computer animations on students' learning aptitude when working as automotive mechanics. The average posttest score for the computer tutorial group was 1.96, while the posttest score for the 3D computer-animation group was 1.96. The results further showed that after considering their posttest scores, the average score of the students in the computer exercise group was 2.36, while that of the students in the 3D computer examination group was 2.77. The mean variance for those in the computer tutorial group was 0.40, while the mean variance in the 3D computer animation group was 0.83. This result implies that both computer tutorials and 3D computer animations are effective at helping students retain their knowledge of working as automobile mechanics.

Hypothesis I: When teaching motor vehicle mechanics via computer tutorials versus using 3D computer animation, there is no discernible variance in the retention scores of the two groups of students.

Table I1 shows the analysis of covariance (ANCOVA) comparing the retention scores of students who received tutored 3D-computer-animation versus those who were tutored Motor-Vehicle-Mechanics Work using a computer tutorial.

Table 2:

Source	Type III Sum of Square	Df	Mean Square	F Sig.	Partial Eta Squared
Corrected Model	10.261[a]	2	5.131	24.504 .000	.241
Intercept	85.682	1	85.682	409.237.000	.727
Pre-Test	2.850	1	2.850	13.611 .000	.081
Group	7.417	1	7.417	35.423 .000	.187
Error	32.243	154	.209		
Total	1089.874	157			
Corrected Total	42.504	156			

Q.R squared = .241 (adjusted R squared = .232)

Table 2: Table 2 shows the analysis of covariance (AVCOVA) used to compare the variance between the retention scores of students who were trained to work as automobile mechanics using computer tutorials and those who were tutored using 3D computer animations. The results showed that P (2, 154) = 35.423 and P < 0.05. Therefore, the null hypothesis is rejected, which implies that there is a substantial variance between the retention scores of students who tutored automotive mechanics using computer tutorials and those who tutored using 3D computer animations.

Research Question 2: What impact does gender have on students' retention of knowledge in regard to computer tutorials for motor vehicle mechanics and 3D computer animations?

Table 3: Comparison of the Outcomes of Gender on Students' Retention of Learning Tutored Motor-Vehicle-Mechanics-Work with Computer Tutorial and 3D-computer-animation.

Table III

Group	Gender	Test	N	Mean	SD	Mean Variance
Computer	Male	Pretest	61	1.98	0.56	0.37
Tutorial		Posttest		2.35	0.39	
		Ret-test		1.86	0.41	
	Female	Posttest	15	2.39	0.39	0.53
		Ret-test		1.97	0.43	
3D	Male	Posttest	62	2.81	0.54	0.84
Computer		Pretest		1.92	0.42	
Animation	Female	Rent-test	19	2.74	0.59	0.82

The impact of gender on students' retention in the Motor Vehicle Mechanics Work computer tutorial and 3D computer animation lessons is contrasted in Table 3. Male students in the computer tutorial group had a mean score of 1.98 on the posttest, while female students in the same group had a mean score of 1. 86. Male students in the 3D computer animation group had a pretest score of 1. 97, while female students did the same, with a mean score of 1. 92. The fallouts also indicated that after adjusting for posttest scores, boys in the computer tutorial group scored an average of 2 points, girls in the computer tutorial group scored an average of 2 points, and boys in the 3D computer animation group scored an average of 2 points. Eighty-one girls in the 3D computer animation group had an average score of 2. 74. For male participants in the computer tutorial group, the mean variance was 0.37; for female participants in the computer tutorial group, the mean variance was 0.53; and for male participants in the 3D computer animation group, the mean variance was 0.84. Similarly, for female participants in the 3D computer animation group, the mean variance was 0.82. The fact that the mean variance between the male and female students in both groups appears to be very small suggests that gender has no bearing on how well students retain the knowledge they are tutored about motor vehicle mechanics work using computer tutorials and 3D computer animation.

Hypothesis 2: When teaching motor vehicle mechanics using a computer tutorial versus a 3D computer animation, there is no discernible variance in the retention scores of male and female students.

Table 4: Analysis of covariance (ANCOVA) of the variance between retention scores of male and female students who utilized motor vehicle mechanics work with computer tutorials and those who utilized 3D computer animation.

Source	Type III Sum of Square	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	10.359[a]	4	2.590	12.246	.000	.244
Intercept	84.440	1	84.440	399.281	.000	.724
Pre-Test	2.861	1	2.861	13.530	.000	.082
Group	4.471	1	4.471	21.142	.000	.122
Sex	040	1	.040	.191	.663	.001
Group Sex	.048	1	.048	.228	.633	.002
Error	32.145	152	.211			
Total	1089.874	157				
Corrected Total	42.504	156				

Q.R. Squared = .244 (adjusted R squared = .224)

The retention scores of male and female students who received tutored Motor Vehicle Mechanics Work using computer tutorials and those who were tutored using 3D computer animation were compared using analysis of covariance (ANCOVA), as shown in Table 4. F (3, 152) = 0.228, P > 0.05, as per the results. Therefore, the null hypothesis is accepted, suggesting that retention scores for male and female students who received tutored motor vehicle mechanics using computer tutorials and those who were tutored using 3D computer animation do not differ significantly.

Discussion of Findings

The study revealed a significant difference between students taught using computer tutorials and those taught using 3D computer animation, indicating that both methods are effective at teaching MVM. However, students exposed to 3D animation demonstrated superior comprehension, retention, and engagement. This finding suggested that while computer tutorials provide structured guidance, 3D animation offers dynamic visualization that makes complex mechanical processes easier to understand. International research supports this finding; for example, [33] found that animation improved students' academic achievement more than traditional methods did, while [8] noted that animations help learners organize knowledge and recognize cognitive schemas. Similarly, [36] observed that new software and hardware techniques in animation can enhance learning, and [38] concluded that animations are especially beneficial when the learning process involves motion or visualization.

These findings also showed that both multimedia instructional techniques increase students' interest in learning about motor vehicle mechanics and that gender does not significantly affect outcomes or

engagement. This demonstrates that well-designed technology-based instruction can support equitable learning opportunities and foster motivation across diverse groups of learners. In a global context, this aligns with discussions in vocational education and educational technology, which emphasize the importance of interactive and visual tools in teaching practical skills that are otherwise abstract or difficult to observe.

Overall, the study contributes to broader debates in TVET and educational technology by demonstrating that 3D animation not only enhances learning and retention but also encourages learner engagement and provides an inclusive approach to technical instruction. These insights suggest that integrating multimedia tools into vocational programs can improve skill acquisition, cognitive processing, and motivation, offering lessons that are applicable beyond the local context to technical education worldwide.

What distinguishes this study is not merely its comparison of instructional techniques but also its effort to connect instructional design with cognitive functioning in a trade-based learning environment. Rather than treating technology as an end in itself, the study examines how carefully structured 3D animation and computer-guided tutorials can shape the way learners process complex mechanical information and retain it over time. In doing so, the discussion in TVET research has shifted from issues of equipment availability or general teaching effectiveness to the deeper question of how instructional presentation influences memory and understanding in practical subjects. This perspective has implications beyond the immediate context, as many vocational systems worldwide face similar challenges in teaching abstract mechanical processes to learners with varying academic backgrounds. By demonstrating that retention improves when instructional methods reduce mental overload and present content in manageable, logically sequenced forms, this study contributes to broader debates on how digital tools should be designed and integrated within technical and vocational education for meaningful learning outcomes.

The following are the findings:

1. Students who received instruction using 3D computer animation software outperformed those who received computer tutorial instruction.
2. Students who received computer tutorial instruction and those who received instruction using 3D computer animation demonstrated greater interest in learning about the work of motor vehicle mechanics.
3. Students who received instruction using 3D computer animation comprehended and retained the material better than did those who received computer tutorial instruction.
4. The study of motor vehicle mechanics using 3D computer animation and computer tutorials was not significantly impacted by sex (male or female).
5. The impact of gender and teaching methods on students' interest in working as motor vehicle mechanics was not statistically significant.

Recommendation

On the basis of this study, the following recommendations were made:

(1) The subject teacher should be encouraged to use computer tutorials and 3D computer animation more when teaching the subject because these tools improve students' retention in Motor Vehicle Mechanics Work. Students' interest in the subject will improve.

(2) The National Business and Technical Examination Board (NABTEB) and other professional organizations should host conferences, seminars, and workshops for technical teachers on the application of 3D computer instruction.

(3) Technical colleges should incorporate ICT into their curricula and influence how teachers teach computer animation and tutorials.

(6) Motor vehicle mechanics work teachers should pay attention to the issue of gender differences in the classroom. They should strive at all cost to eliminate content, instructional techniques and materials that introduce gender differences in the classroom.

(7) The handling of innovations such as computer tutorials and 3D animation obliges highly skilled personnel, which is why staff training is essential.

(8) State and federal governments should mandate computer literacy for students enrolled in technical colleges across the country.

Declarations

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Consent to Participate Declaration

Informed consent was obtained from all participants, and participation was voluntary. Confidentiality and anonymity were assured.

Approval Committee

Ethical approval for this study was obtained from the Research and Ethics Committee of the Faculty of Education, Delta State University, Abraka, Nigeria.

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Figures

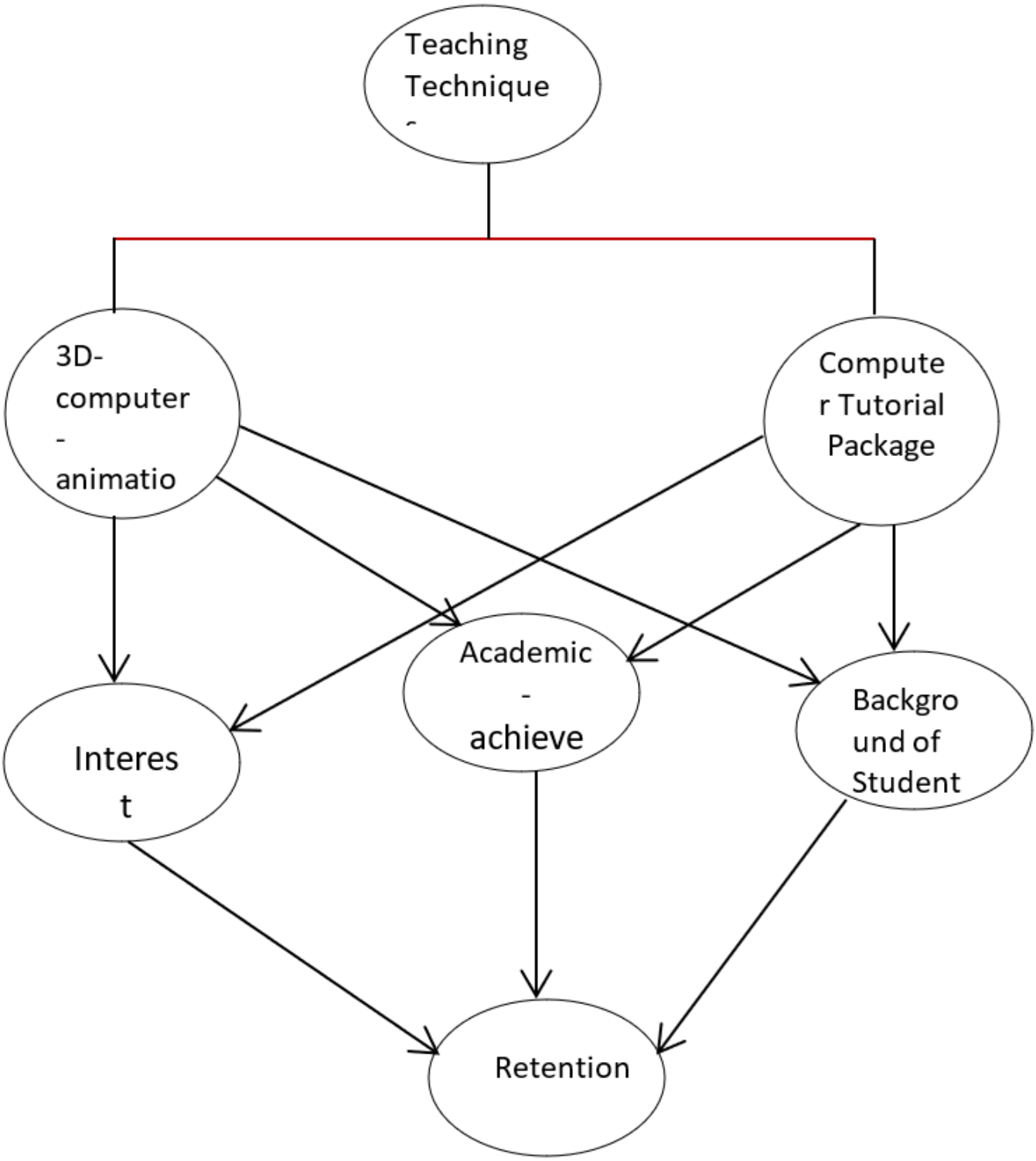


Figure 1

A schematic diagram showing the effect of computer tutorial packaging and 3D-computer-animation teaching techniques [32].