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Research paper



Competency-based learning (CBL) and animation-based learning: a comparative study on students' academic achievement, interest and retention in auto mechanics

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Abstract

A quasi experimental research design was adopted to compare competency-based learning and computer animation to determine their effect on academic achievement, retention and interest of students in auto mechanics. The pretest, posttest nonequivalent design was used. Six research questions were answered and four hypotheses were tested at 0.05 level of significance. Two technical colleges were used for the study. Population for the study was 115. Simple random sampling was used to assign school to treatment groups. No sampling was conducted in selection of students because intact classes were used. Auto mechanics Achievement Test (AMAT) and Auto mechanics Interest Inventory (AMII) were the instruments used for data collection. The data collected from the administration of the pretest and posttest was analyzed using Mean to answer the research questions while the hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). The finding of the study revealed among others that students taught auto mechanics using competency-based Learning technique had higher retention and interest and a higher score in the achievement test than students taught using computer animation technique. The hypotheses tested showed that $p < 0.05$ implying a significant difference in the effect of a competency-based learning technique on the achievement score, retention score and interest of students taught auto mechanics. Based on the findings of the study, it was recommended that competency-based learning should be adopted for teaching of auto mechanics in the Technical Colleges since the course is project based.

Keywords: *Auto Mechanics; Competency– Based Learning; Computer Animation; Technical Colleges.*

1. Introduction

Many students in auto mechanics are changing their pattern of learning from technology-based teaching to pattern utilizing competencies. This is because the competency-based approach to learning is viewed as an alternative to some of the recent technology-based teaching approaches, [1]. Using a competency-based approach to learning allows students to develop self mastery of knowledge, and abilities to demonstrate learning competencies, [2] [3]. In other words, it is assumed that students learns more from their own behavior and not necessarily from the behavior of the instructor or any instructional media since the majority of the responsibility for learning a high technical subject like auto mechanics is placed upon the students, [4] [5].

A competency-based approach to learning according to scholars is that type of open approach where more emphases is placed on pedagogical process instead of result so that the students gain more insight and experience rather than, for example seeing a film or hearing a lecture about something, [4] [6]. The tasks of repairing a vehicle clearly is a project-based task that serves as a precursor to the CBL approach because it was largely focused on the actual practitioners' experiences by measuring knowledge, skills or abilities needed by students to successfully practice in an automobile industry, [7] [8]. It outlines a systematic open approach to improving individual students' performance, [9], hence students are no longer adjudged by merely stating what they have learnt or passing an exam as a measure of outcome; rather outcomes are measured through using what they have learnt to create change and advance solutions through projects that demonstrates student's knowledge and skills, [10]. This open approach, within constraints, requires different activities on the part of both students and instructors. For example the student become proficient and active within class, [1], and the instructor becomes the manager of students learning by wanting to perform, do something, say something, use technology or show a film, [4].

However, in trying to show a film, instructors don't only need just more than knowledge of auto mechanics but a more functional knowledge on the use of technology as a pedagogical skill for effective teaching, [11]. This is because new generations of learners emerged from the early 2000 referred to as digital natives, [12]. This is a generation of learners who were born or brought up during the age of digital technology. They are so familiar with computers and the internet from an early age. The use of computer for teaching this generation of learners is referred to as Computer Assisted Instructions (CAI), [13].

Computer-Assisted Instruction (CAI) is that instruction or learning that involves the use of a computer system, including any of the hardware, software, network and telecommunication efforts, for the primary purpose of learning, [14]. The CAI software after development must be tested by the quality assurance team to en-

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sure best quality, [15]. There are now several CAI packages on auto mechanics which could be used with power points, intelligent tutors, computer simulation, computer animation etc., [16] [17]. In this study, computer animations are the CAI tool to be considered.
Animations are dynamic visual material created using computers to present pictures as though they have motion, [18] [19]. They are constructed by running together thousands of separate photographed images to convey an impression of movement. Traditionally, each image is hand drawn or modeled. The models are placed in a set and moved, and each movement is photographed. Sound effects, including speech, may also be incorporated into the final film. Nowadays, animations are often produced much more quickly using specialist computer software packages where images of models or drawings can be scanned into a computer and manipulated, or the images can be computer-generated. The capable features of animation can enliven the learning experience, [20]. Animation can attract learners' attention and increase their motivation to learn. Animation that combines visual and verbal knowledge also helps students to store information into long-term memory thereby facilitating encoding and retrieval process, [21].
Although animation seems to attract learners' attention and increase their motivation to learn, whether or not instructions using animation can facilitate students learning achievement, retention or interest in auto mechanics better than a Competency-based learning technique still remains a question. This is because while proponents of computer-based instructional applications suggest that animation teaching is the best effective alternative to traditional teaching [22], critics argue that the use of it is a destructive innovation, [23]. However, the task before the technical colleges in producing skilled labour especially in this technology driven society calls for a reappraisal of how auto mechanics learning content is delivered. Given these optimistic assessments, it becomes critical that empirical studies spurns the divide between the theory and praxis of a competency-based learning and computer animation learning technique with a view to determining their effects on academic achievement, interest and retention of students learning Auto mechanics.
To achieve this, two groups of technical colleges will be randomly selected and assigned treatment and control group respectively. One group will be taught using computer animation while the other will be taught by a competency based learning technique. It is expected that the result will be of immense benefit to the National Board for Technical Education (NBTE), Examination Bodies, Curriculum Planners, Technical Colleges, Researchers, and policy makers especially in selecting appropriate teaching strategies.

1.1. Purpose of the study

The general purpose of this study is to make a comparison of computer animation learning and a competency-based learning technique on academic achievement, interest and retention of students in auto mechanics. The study specifically sought to:

- Examine the effect of computer animation based learning when compared with competency-based learning techniques on students' academic achievement in auto mechanics.
- Find out the effect of a computer animation based learning on student's retention in auto mechanics when compared with competency-based learning technique.
- Find out the effect of computer animation based learning on students' interest in Auto mechanics when compared to competency-based learning technique.

1.2. Research hypotheses

$H0_1$: There is no significant difference between the mean scores of students taught auto mechanics using computer animation techniques and those that learnt using competency-based technique in an achievement test.
$H0_2$: There is no significant difference between the mean scores of students taught Auto mechanics with computer animation technique and those that learnt using competency-based technique in a retention test.
$H0_3$: There is no significant different between the mean interest rating of students taught Auto mechanics with computer animation technique and those taught using competency-based learning technique on students' interest in auto mechanics.

2. Method

2.1. Design of the study

A quasi-experimental design was used for the study because intact classes (non-randomized groups) would be assigned to experimental and control group, [24]. Specifically, the pretest, posttest, non-equivalent control group design was adopted for the study.

2.2. Area of the study

The study was conducted in technical colleges offering auto mechanics in Enugu State Nigeria. There are three Government Technical Colleges in Enugu State. Two of these technical colleges; Government Technical College Nsukka, and Government Technical College, Ndeabor was randomly selected for this study because the two technical colleges in the state have had much intervention of the government in terms of provision of ICT facilities and an elaborate auto mechanic laboratory which was found helpful in implementing this study.

2.3. Population for the study

The population for this study was 115 students comprising of 58 students in GTC Nsukka and 57 students in GTC Ndeabor.

2.4. Sample and sampling technique

The sample size for this study was hundred and Fifteen (115) students. No sampling was conducted in selection of the students because intact classes were used in the two schools for the study. The two schools sampled were assigned to be taught using computer animation and competency-based learning techniques respectively.

2.5. Instruments for data collection

The instruments used for data collection are Auto mechanics Achievement Test (AMAT) and Auto mechanics Interest Inventory (AMII). The AMAT used for this study was developed by the researcher based on the NBTE curriculum content for Auto mechanics. The items in the AMAT covered the content area in auto mechanics for GTC. The AMAT is a multiple choice objective test consisting of 30 items with four options (A-D) which was used to test students' achievement. The multiple-choice form of objective test was adopted because it can measure a variety of more complex outcomes in knowledge, comprehension and application which together provides a framework to measure students' achievement, [25].
Each item has four alternative options. Every correct answer has one point and an incorrect answer was awarded 0 point. The Table of Specification was developed based on the topics outlined in the course content. Auto mechanics Interest Inventory (AMII) is a 20-item inventory designed to elicit students' likes and dislikes that could arouse their curiosity and desire to learn as the teacher teaches. Basically, the AMII is students' self report inventory to measure their interest in Auto mechanics.
To determine if the students are answering the questions or merely checking responses at random, the same question was re-worded in different ways. The Auto mechanics Interest Inventory (AMII) was made up of 20 items using a five-point Likert scale as follows;
Strongly Agree- 5

Agree - 4
Undecided - 3
Disagree - 2
Strongly disagree - 1
The researcher developed five lesson plans for each of the treatment groups. One of the groups was taught using computer animation technique while the other was taught using competency-based approach. The lesson plans were developed based on the areas of fuel system and petrol engines so as to assess the effects of computer animation technique and a competency based learning on students' achievement, interest and retention. Each of the lesson plans contained the outcome expected on the achievement, interest and retention so that the teachers could aim at them. The researcher and the auto mechanics teachers in these technical colleges carefully planned and designed the lesson, using appropriate verbs to address the six levels of cognitive domain in bloom's taxonomy of educational objectives (knowledge, comprehension, application, analysis, synthesis and evaluation). A table of specification was drawn based on the outlined topics of the study content.

2.6. Validation of the instrument

The AMAT and the AMII were face validated by three experts. One of the validates were drawn from the Vocational and Technical Education (VTE), unit, University of Nigeria, Nsukka and one from Enugu State Technical Education Board. Each of the validates was given a copy of the instruments and lesson plan for validation. They were requested to assess the clarity and appropriateness of the instruments. The instruments were restructured based on their inputs. They suggested that computer animation be compared with a package that is non computer based, that is competency-based learning.

2.7. Reliability of the instrument

The instruments used for this study, Auto mechanics Achievement Test (AMAT) and Auto mechanics Interest Inventory (AMII) were trial tested on 20 students of Government Technical College, Enugu. The test-retest reliability method was used in two separate administrations (X and Y) within an interval of two weeks. The test retest reliability was determined using Kuder Richardson-20 and a reliability co-efficient of 0.75 was obtained. Cronbach alpha reliability method was used to establish the reliability of the interest inventory and reliability co-efficient of 0.79 was obtained.

2.8. Control of extraneous variables

2.8.1. Experimental Bias:

To reduce experimental bias (Hawthorne effect) that might influence the outcome of the study, the regular teachers teaching Auto mechanics in the colleges were used to teach their own students. Hence, the researcher was not directly involved in administering the research instruments and the treatments.

2.8.2. Lesson plan development

To control invalidity that could be caused by teacher variability in the development of the lesson plans and to ensure uniform standard in the conduct of the research, the researcher and teachers teaching currently prepared the teaching instruments (the lesson plans) for the experimental group and the control group. Five lesson plans each were developed. Training manual was prepared by the researcher to explain the concepts in the lesson plan.

2.8.3. Training of teachers for the treatment groups

A two-week intensive training programme was organized for the teachers in all the sampled schools on the use of the AMAT and AMII. The teachers that taught the treatment group assigned to computer animation were given training and detailed explanations on how to use the package. The researcher gave demonstration lessons and requested the teachers to ask questions which were answered in detail so as to strengthen their learning.
In order to ensure that the teachers adhered to instructional principles and procedures required in using the computer animation, the teachers did demonstration lessons using the lesson plan developed by the researcher while the researcher and other participating lecturers did the assessment. The exercise was repeated until teachers were adjudged as capable of using the simulation.

2.9. Other experimental conditions controlled

The students were not informed that they are being involved in any research process. The same lesson contents were taught to all the treatment groups. The experimental group was taught using the computer animation and the control group used competency based learning technique.

2.9.1. Experimental procedure

The experiment commenced with the administration of pretest to all the groups (experimental and control group) by the regular teachers teaching auto mechanics in the participating institutions. This is to provide data on students' achievement and interest before any treatment was administered. After the pretest, the teachers in the experimental group showed the students the animation using projector. The experimental group received instruction by watching the animations, while the control group had their lessons through conventional method. The classroom in the experimental group was conducted in a team based, cooperative learning manner where students and teachers actively interact with one another on the content already provided by the animation software.
The treatment for this research lasted for 5 weeks while each lesson has duration of 80 minutes. At the end of the treatment, a post test was administered on both groups using the AMAT and AMII test items by the teachers and their assistants. The exercise provided a post test data for the two dependent variables (Achievement and Interest) after the treatment. The AMAT was re-administered two weeks after administering the achievement test to collect data on the students' retention.

3. Method of data collection

The auto mechanics teachers and their workshop assistants administered the pre-test to the treatment groups in their respective schools. In the pre-test, the AMAT and AMII were administered on the students. Answer scripts were provided for the students to fill in the correct answer for AMAT. The students were required to check a response most appropriate to them in the AMII. The answer scripts for the AMAT was marked by the researcher to obtain students' achievement score and re-administered two weeks after so as to collect data on students' retention.

3.1. Methods of data analysis

The data collected from research questions were analyzed using mean and standard deviation. Meanwhile, Hypotheses formulated for the study were tested at .05 level of significance using Analysis of Covariance (ANCOVA). The null hypothesis was rejected if p-value is less than 0.05 while null hypothesis was accepted if p-value is greater than 0.05. The choice of ANCOVA statistics is because it is a statistical technique which removes the initial differences between groups, so that the selected or pre-tested groups can be correctly considered as equated or equivalent by removing score difference in the pre-test performance across groups and reducing the between-group source variation, [24].

4. Result

This section presents the results and discussions of the data analyses for the study. Presentations were organized according to the research questions and null hypotheses that guided the study.

Research question 1:

What is the effect of computer animations based teaching technique on students' academic achievement in Auto mechanics when compared to competency-based learning method?

Table 1: Mean Score of Students Academic Achievement in Auto Mechanics

Technique	N	Pretest $\bar{x}$	Std. Dev	Posttest $\bar{x}$	Std. Dev	Mean Gain $\bar{x}$
CBL	57	21.99	12.21	81.58	10.86	59.59
Animation	58	21.78	11.54	66.00	18.04	44.22

Table 1 showed the scores of the students taught Auto mechanics using computer animation and those that learnt using competency-based method. The students that learnt by competency-based had a mean score of 21.99 in the pretest and 81.58 in the post test, making a pretest, posttest mean gain of 59.59. The group taught auto mechanics using computer Animation method had a mean score of 21.78 in the pretest and 66.00 in the posttest making a pretest, posttest mean gain of 44.22.

From the result presented on the table, the group that learnt auto mechanics using competency-based Learning approach gained more in the achievement test than those taught using computer animation.

Hypothesis One

$H0_1$: There is no significant difference between the mean scores of students taught auto mechanics using computer animation techniques and those that learnt using competency-based method in an achievement test.

Table 2: Analysis of Covariance (ANCOVA) Of Students' Achievement Scores in Auto Mechanics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	6687.930[a]	2	3343.965	16.273	.000
Intercept	140225.170	1	140225.170	682.394	.000
Pretest	584.162	1	584.162	2.843	.095
Technique	6136.741	1	6136.741	29.864	.000
Error	20343.519	99	205.490		
Total	596288.778	102			
Corrected Total	27031.449	101			

a. R Squared = .247 (Adjusted R Squared = .232)

Table 2 shows the F-calculated values for effect of computer animation and competency-based learning method on students' achievement scores in auto mechanics. The F-calculated value for treatment is 29.864 with a significance of F at 0.00 which is lesser than .05 level of significance. Hence, the null-hypothesis is rejected.

The finding presented in table 2 implies that there is a significant difference between the mean scores of students taught auto mechanics using computer animation techniques and those taught using competency-based method in an achievement test.

Research Question Two:

What is the effect of computer animations based teaching technique on students' retention in Auto mechanics when compared to competency-based learning method?

Table 3: Mean Score of Students Retention in Auto Mechanics

Technique	N	Post test $\bar{x}$	Std. Dev	Retention $\bar{x}$	Std. Dev	Mean Gain $\bar{x}$
CBL	57	81.58	10.86	90.99	6.87	9.42
Animation	45	66.00	18.04	72.30	14.21	6.30

Table 3 showed the scores of the students taught Auto mechanics using computer animation and those that learnt using competency-based approach. The students that learnt by competency-based had a mean score of 81.58 in the posttest and 90.99 in the retention test, making a retention mean gain of 9.42. The group taught auto mechanics using computer animation method had a mean score of 66.00 in the posttest and 72.30 in the retention test making a retention mean gain of 6.30.

From the result presented on the table, the group taught auto mechanics using competency-based retained more in auto mechanics than those taught using computer animation method.

Hypothesis two

$H0_2$: There is no significant difference between the mean scores of students taught Auto mechanics with computer animation technique and those that learnt using competency-based approach.

Table 4: Analysis of Covariance (ANCOVA) of Students' Retention in Auto Mechanics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	8845.795[a]	2	4422.897	38.158	.000
Intercept	27000.798	1	27000.798	232.947	.000
Posttest	54.220	1	54.220	.468	.496
Method	7396.003	1	7396.003	63.808	.000
Error	11475.035	99	115.909		
Total	718691.112	102			
Corrected Total	20320.829	101			

a. R Squared = .435 (Adjusted R Squared = .424)

Table 4 shows the F-calculated values for effect of computer animation and competency-based method on students' retention in auto mechanics. The F-calculated value for treatment is 63.808 with a significance of F at 0.00 which is lesser than .05 level of significance. Hence, the null-hypothesis is rejected.

The finding presented in table 4 implies that there is a significant difference between the mean scores of students taught Auto mechanics with computer animation technique and those taught using competency-based method in retention test.

Research questions three:

What is the effect of computer animations based teaching technique on students' interest in Auto mechanics when compared to competency-based learning method?

Table 5: Mean Interest Rating of Students Taught Auto Mechanics

SN	Question item	Computer Animation X	Computer Animation SD	CBL X	CBL SD
1	It will be lovely if auto mechanics is taught every day	3.98	0.92	4.11	1.03
2	auto mechanics task is not boring	1.49	0.73	1.69	1
3	I am always eager to be in the auto mechanics class	4.42	0.57	4.2	0.73
4	Lectures in auto mechanics is so exciting	4.47	0.54	4.42	0.66
5	I feel so free to interact with my peers in auto mechanics class	4.3	0.71	4.44	0.66
6	I would like to start up an engine repair shop and auto mechanics is important to me	3.96	0.8	4.27	0.75
7	I like my auto mechanics lecturer because of the way he delivers his lectures	4.28	0.8	4.24	0.71
8	I am always at ease in auto mechanics class	2.46	1.13	2.38	1.27
9	My lectures in auto mechanics has made me love tuning to automobile channels for latest in engine design and construction	4.49	0.71	3.21	0.67
10	My passion from the auto mechanics class leads me to go online to search for more information in engine servicing and repairs	4.35	0.67	3.02	0.74
11	Auto mechanics assignments are interesting	2.04	1.02	2.29	1.18
12	The technique used by my teacher has made me positive	4.04	0.91	3.12	0.72

	about practicing professionally in the automobile industry				
13	I don't have to cram my notes because learning in the auto mechanics class is interesting to me	4.04	0.98	4.36	0.71
14	Identifying components of an engine is simplified because of the teaching approach of my teacher	4.14	0.72	4.2	0.89
15	I love asking and answering questions in the auto mechanics class	4.16	0.75	3.24	0.88
16	I advise my friends in the lower class to specialize in automobile technology because of the method by which auto mechanics is taught in the classroom	4.04	0.8	3.02	0.88
17	Method adopted by my teacher has made Auto mechanics very easy for me to learn	4.28	0.88	2.38	0.83
18	The method of teaching makes me at ease in the class	4.14	0.79	2.28	0.71
19	I don't feel sleepy because of the method used in teaching auto mechanics	4.02	0.94	4.13	0.84
20	The automechanic class is very interactive	2.02	1.04	2.95	1.49
	Total	3.76	0.82	3.4	0.87

Table 5 shows the mean interest rating of students taught auto mechanics using computer animation and those taught through competency-based method. From the table, the student taught using computer animation have a higher mean interest rating of 3.76 while those taught using competency-based technique had a mean interest of 3.40.

Hypothesis Three

$H0_3$: There is no significant different between the mean interest rating of students taught Auto mechanics with computer animation technique and those taught using competency-based method.

Table 6: Analysis of Covariance (ANCOVA) of Students' Interest in Auto Mechanics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	.953[a]	1	.953	13.372	.000
Intercept	1356.610	1	1356.610	19032.329	.000
Method	.953	1	.953	13.372	.000
Error	7.128	100	.071		
Total	1375.164	102			
Corrected Total	8.081	101			

a. R Squared = .118 (Adjusted R Squared = .109)

Table 6 shows the F-calculated values for effect of computer animation and competency-based method on students' interest in auto mechanics. The F-calculated value for treatment is 13.372 with a significance of F at 0.00 which is lesser than .05 level of significance. Hence, the null-hypothesis is rejected. The finding presented in table 6 implies that there is a significant difference between the mean interest rating of students taught Auto mechanics with computer animation technique and those taught using competency-based approach.

5. Findings of the study

The following findings emerged from the study based on the research questions and hypothesis tested.

Findings from research question 1 showed that students taught auto mechanics using competency-based technique had a notably higher score in the achievement test than students taught using computer animation teaching techniques. Hypothesis 1 also showed that there is a significant difference in the mean scores of students taught auto mechanics using computer animation techniques and those taught using competency-based technique in an achievement test

Findings from research question 2 showed that students taught auto mechanics using a competency-based approach retained more than students taught using computer animation teaching approach. Hypothesis 2, showed that there is a significant difference in the mean scores of students taught auto mechanics using computer animation techniques and those taught using competency-based learning technique in retention test

Findings from research question 3 showed that students taught auto mechanics using computer animation have a higher mean interest rating than students taught using competency-based learning method. Hypothesis 3, also showed that there is a significant difference between the mean interest rating of students taught Auto mechanics with computer animation technique and those taught by competency-based approach.

6. Discussion of the Findings

Findings from research question 1 showed that students taught auto mechanics using competency-based approach had a notably higher score in the achievement test than students taught using computer animation method. Finding from hypothesis 1, showed that the difference in the effect of computer animation and competency-based method on students' achievement score is significant.

This finding agrees with that of Jennifer et al who carried out a case-study on competency-based education to illustrate the effect of competency-based education on student's achievement in psychology as against other pedagogical techniques, [10]. They found that competency-based education is more effective in improving students' achievement in psychology.

This significant effect of competency-based learning as best in improving students' achievement can be attributed to the fact that competency-based learning allows students to master competencies and advance upon mastery of learning targets not as a result of time-based requirements but students receive customised supports both in school and out of school to ensure they stay on track. In other words, animation teaching could make students lack good reasoning skills for drawing logical inferences from observations.

Findings from research question 2 showed that students taught auto mechanics using competency based approach retained more than students taught using computer animation method. The hypothesis tested also showed that there is a significant difference in the mean scores of students taught auto mechanics using computer animation techniques and those taught using competency based method in retention test.

The implication of this finding is that competency-based learning is more effective than computer simulation teaching method in enhancing students' retention of auto mechanics with a little margin. This is in line with the findings of the survey conducted by U.S. Department of Education in 2012, [16]. They found that student's retention rate for Competency Based Learning programs are mixed; sometimes higher than the comparison group - (68% to 83%) and roughly on par with those of the students in Computer-animation based Learning groups.

They attributed this to an overwhelming interest and enthusiasm of the student in competency-based learning brought about by students having a range of practical learning experiences at school, and in the community. In a related development, studies have shown that there is accelerated learning competence and increase in retention when students are taught using competency-based teaching method, [26]. However, although animation is also effective in helping students retain knowledge, [27], competency-based learning is found to be more effective in this study.

Findings from research question 3 showed that students taught auto mechanics using computer animation have a higher mean interest rating than students taught using competency-based approach. Hypothesis 3 further confirmed that there is a significant difference between the mean interest rating of students taught

Auto mechanics with computer animation technique and those taught using competency based approach. This finding agrees with the result of a study carried out by, [28] where they found students taught with computer animation to have showed more interest in learning. Motivation and interest of the students play an important role in the teaching learning process. In comparison of computer animation with the competency-based teaching method, [29] found that the lesson becomes more interesting with the use of computer programming to motivate the students and arouse their interest in teaching learning process.

A study carried out by [30] on the effects of animation and conventional method on students' motivation found that students taught with animation were more motivated than those taught using conventional method. The high interest rating when animation was used could be attributed to the fact that computer animation is a more interactive teaching method where the students are passive learners watching animated objects.

7. Implication of the findings

The primary aim of this study was to compare the effect of computer animation and competency-based teaching method on students' achievement, interest and retention of technical college students in auto mechanics. In view of this, the findings of the study showed that student taught using computer animation had higher interest than students taught using competency-based technique. On the other hand, there is a discovery that students taught auto mechanics using competency-based method had higher achievement score and high retention when compared with students taught using computer animation.

However, these findings have great implications for students, teachers, government, curriculum planners and the society. For example, students studying auto mechanics will learn better; record much achievement and retain their learning better when competency-base teaching technique is used. The findings will also influence the decision of teachers in adopting competency-based teaching for classroom instruction. The study implies that government must do more in investing in the development of competency-based programmes for other vocational trade subjects outside of auto mechanic trade. Curriculum planners must also ensure that computer based technologies are integrated in to instructional delivery on our Technical Colleges.

8. Conclusion

Application of competency-based education to all aspects of human endeavor coupled with the need to create student-centred classroom to engage learners in their leaning tasks, improve learners' interest and consequently achievement in the school subjects has necessitated educators to work collaboratively with community partners and students to develop flexible learning environments, grouping strategies and extended opportunities to support a unique learning plan for every student. Again as many tools of the digital age such as video tutorials, animations and so on are finding their way into the classroom, these results have shown that computer animation helps motivate student more in auto mechanics than competency-based teaching method by creating a more interactive and engaging learning environment for teachers and learners.

But on the contrary, competency-based teaching has also shown to be a more powerful pedagogical method to use in other to achieve student's proficiency, greater achievements and mastery of auto-mechanics and every other vocational subjects.

9. Recommendations

Based on the findings of this study, the researcher recommends the following;

- Computer animation and competency-based teaching should be adopted for teaching of auto mechanics in the Technical Colleges
- The curriculum specification for the Technical Colleges should include the use of animation and competency-based approach for teaching of other skill based modules aside from auto mechanics.
- The government should support and encourage the development of competency-based education and computer based animation for teaching other vocational subjects.

10. Limitation and suggestion for further studies

The number of Technical Colleges covered limited the generalization of the findings. From the findings of this study the following further researches are suggested:

- Hierarchical study of the effect of selected digital tools on students' achievement, retention and interest in vocational skill subjects.
- Development of an immersive animation package for teaching automobile diagnosis and repairs
- Investigating the extent to which computer animation tutors can be a replacement for human tutors in the teaching and learning of vocational trade.

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