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Impact of computer simulations model and problem solving software on students' achievement, interest and retention in electrical installation and maintenance works in technical colleges in Edo State, Nigeria.

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Abstract

Academic achievement and knowledge retention of students for concepts taught in school has been of major of concern to researchers in education, particularly as it is likely to have corresponding influence on school results. It could also facilitate the capability of educational institutions to retain students in schools. These phenomena which constitute socio-economic problems in the worldwide could also apply to students and educational situations especially in Edo State, Nigeria. Thus the researchers set out to explore if using computer simulations model and problem solving software could improve students' overall achievement / performance in Electrical Installation and Maintenance Works in technical colleges. In this study three research questions were answered and three null hypotheses were tested at 0.05 level of significance. Quasi-experimental design was used for the study. Population of the study was 126 National Technical Certificate (NTC) year 11 Electrical Installation and Maintenance Works students in state owned technical colleges. The sample of the study was made up of 101 students. Purposive sampling technique was used to draw four technical colleges approved by National and Business and Technical Examination Board, (NABTEB). Instruments for data collection were Electrical Installation and Maintenance Works Achievement Test (EIMWAT) and Electrical Installation and Maintenance Works Interest Inventory (EIMWII). Test–retest method was used to establish its reliability of EIMWAT and was calculated using Pearson Product Moment Correlation which yielded a correlation coefficient value of 0.81 and Cronbach alpha reliability coefficient method was used for EIMWII and 0.85 obtained. Treatment (teaching) procedure of computer simulations model, problem solving software and Lecture-demonstration teaching method for the study was carried out. The EIMWAT and EIMWII were used for all the tests, the contents were reshuffled, and the colour of the paper changed. The data were collected and analyzed using the mean and standard deviation. The Analysis of Covariance (ANCOVA) was used to test the null hypotheses. The findings of the study revealed that students in the experimental group obtained higher mean scores in their post-test than those in control group. Also, there was a significant difference between the mean scores of experimental group and control group in the cognitive achievement, interest and retention ability of students in EIMW in technical colleges. In view of the positive impact of computer simulations model and problem solving software it was recommended among others, that the methods should be adopted for teaching especially in EIMW in the technical colleges in order to enhance students' overall achievement. Also, government should provide technical colleges with computers, software packages and internet facilities to enable students maximize the benefits of computers simulations-based and problem solving software for teaching and learning especially in EIMW in technical colleges.

Keywords: Computer Simulations Model, Problem Solving Software, Achievement, Interest and Retention, Electrical Installation and Maintenance Works and Technical Colleges.

Introduction

Education is an experience that develop the mind, character, physical ability and behaviour of an individual to live well and contributes meaningfully to the welfare of his society (Sirswal, 2011) and (LaShaw, Sago & Lambert, 2013). Nigeria's philosophy of education entails that education is an instrument for national development, the interaction of persons and ideas are all aspects of education. According to the National Policy on Education, Federal Republic of Nigeria, FRN, (2004) stated that education fosters the worth and development of the' individual; for each individual's sake, and for the general development of the society. Additional, (FRN, 2016) listed five main national aims and objectives which have been proven to be the necessary foundation for the building the country's future social economic development and sustainability. They are as follows:

- A free and democratic society;
- A just and egalitarian society;
- A united, strong and self-reliant nation;
- A great and dynamic economy and
- A land full of bright opportunities for all citizens.

Technical education is that level of education obtain at technical colleges designed to prepare individual to acquire practical skills, basic scientific knowledge and attitude require as craftsmen and technicians at sub professional level. Also technical education is the acquisition and utilization of knowledge and practical skills. Specifically, the objectives of technical college institutions are enumerated below:

- To produce graduates with vocational and technical skills leading to the production of artisans and craftsmen who will be self-reliance;
- Gainfully employed as lower level sub-professionals;
- Work as self-reliance individuals and
- Having potentials for further studies National Policy on Education, Federal Republic of Nigeria (FRN, 2016.)

Technical trades represents; automobile engineering craft practice, fabrication and welding craft practice, air-conditioning and refrigeration mechanics works, mechanical engineering craft practice, radio/television and electrical works. Also, the construction trades embodies: block laying,/bricklaying and concrete works, painting and decoration, plumbing and pipe fittings, carpentry and joinery, furniture making and upholstery and electrical installation and maintenance works (FRN, 2004).

Electrical Installation and Maintenance Works (EIMW) Programme is one of the Technical and Vocational Education (TVE) programme which, according to the curriculum of the programme National Board for Technical Education, NBTE, (2003) provides training that leads to the production of skilled personnel like craftsmen and technicians who could either secure employment at the end of their training, set up their own businesses or further their studies in Polytechnics, Colleges of Education (Technical) and Universities. In the course of the programme, students are expected to acquire entry level knowledge and manipulative skills for employment in electrical industry in Nigeria. Similarly the students are likely to use a variety of tools/equipment and machines, which was specified in the following behavioural objectives:

- Demonstrate various practical works involving resistors, capacitors and inductors (Series/parallel connection);
- Undertake both domestic and industrial installation;
- Install electrical equipment/machines;
- Prepare and join electrical cables;
- Install/connect batteries for charging systems;
- Use tools to dismantle, recoil and recouple an electrical machine (generator or motor) and
- Undertake test on installations and machines using appropriate tools (NBTE, 2003).

According to Andural and Ikyumen (2006) added that today a lot of emphasis is being placed on practical teaching which prepares recipients for various occupations. Similarly, Gubta (2013) listed the following as types of electrical installations and maintenance works: bare conductor wiring, conduct wiring, rubber sheathed wiring, polyvinyl chloride (PVC) wiring used in sheathed wiring of earthed concentric installations, mineral insulated installations and electrical machine installations.

To make the teaching and learning of EIMW concepts more concrete, interesting in this present technological age. It may be necessary to apply Digital Natives' theory in the classroom learning environments. According to Prensky (2001) described todays' students are no longer the people our educational system was designed to teach. Prensky terms Digital Natives were now spending their lives surrounded by digital media and spending less time on reading or outdoor activities, and their attention spans were shorter than in previous generations. Also, since their early childhood the Digital generations are connected with and socialized by digital media and information and communication technologies such as TV, video games, IPad, the internet and mobile communication. The digital generation has a different learning approach from former generations, e.g. non-linear learning or multi-switching and multi-tasking. In contrast, Prensky (2001) explained that the Digital Immigrants, are developing digital skills that will always be like learning a second-language rather than being innate. The generations who have not grown up with and are not used to digital technologies but take on recent technology applications like email, instant messenger or social networks in both their everyday and working world, are called digital immigrants. Presently, the Digital Natives' are being taught by Immigrants who are, in effect, not of the same language. It becomes obvious for EIMW teachers to radically re-structure the classroom learning environment in a way to incorporate computer-aided instruction.

One of the recommended teaching method by the Federal Republic of Nigeria, (FRN, 2007), is the application of computer-aided instruction; a part of ICT. Computer aided instruction (CAI) refers to the use of computer as a tool in teaching and training. It involves computer learning activities in the computer lesson with reinforced instructional materials introduced and taught by teachers. The students receive feedback from the computer and maintain some degree of control (Eze & Onwusa, 2020). Some of the computer-aided instruction include instructional programming, drill and practice, computer tutorial model, problem solving software and computer simulations model.

Computer simulation model is a computer based instructional strategy that mirrors, anticipates and amplifies real life system, situations or phenomenon with guided experiences in a fully interactive way. Computer simulations are computer programmes that creates animated, interactive, game-like environments, which focus on connecting real-life phenomena to the underlying science. Within this processes, it makes the visual and conceptual models of experts and scientists simple, so that they can be understood by learners. Paul, (2010) considered simulations as a discipline of designing models of actual or theoretical physical systems, executing the models on a digital computer and analyzing the execution output. Simulations therefore, represent the principle of learning by doing. This implies that, learning about a system first requires building a model of some sort and then operating the model. In simulation software, data is input and with the help of data input and diagrams, one can get appropriate results. The use of simulations are activity-based learning that are as natural as a child who employ role plays method. Thus learners could understand the world around them by interactions with other people and objects.

Kanneras cited in Silvia (2013), simulations give students the chance to apply theory, develop critical thinking skills, and provide a welcome relief from the everyday tasks of reading and preparing for classes. Also, simulations could make excellent use of computer capabilities such as ability to control multiples variables, dynamism of presentation, time control and effect of randomness. According to Jimoyiannis and Komis, (2001) computer simulations provide students with an open learning environment, which provide them an opportunity to:

- Develop an understanding of physical phenomena and laws by developing hypotheses and testing ideas.
- Develop an understanding of the relations between physical concepts, variables and phenomena by isolating and manipulating parameters.
- Utilize a variety of representations, including pictures, animations, graphs, vectors and numerical data displays, which help them understand the underlying concepts, relationships and processes.
- Demonstrate their portrayal and mental models of the physical world.
- Employ an investigative approach about phenomena that are difficult to experience in a classroom or lab environments, due to their complexity, technical difficulty, money or time consumption, or because they occur too fast to be understood by just observing them in real-life settings.

Despite the outlined advantages of computer simulations model there are some shortcomings, for instances: it costs more money to design simulations model than making the product. The data we get after performing simulations model may be difficult to understand the concepts. The simulations data could only be understood by technical people in the field. It takes a long time to set up and test a simulation model. This is because simulations model may takes a lot of data to be input and making the environment also counts. From the foregoing, it is worth investigating to see if computer simulations model could influence students' achievement, interest and retention in EIMW with visual, auditory, or kinesthetic learning styles as well as application of problem solving software in classroom real world situations.

The problem solving software consist of rules that allows computer users to solve problems using computers. Software's are the series of instruction that enable the computer to perform a task or collection of tasks. Thus series of programme in the computer linked together make up software. The problem solving software methodology provided by the designers of the original computer; could formulate the problem solving techniques; may develop a solution algorithm; encode the algorithm and data into a programme and decode the result as well as extract the solution. Thus, problem solving approach could offers computer programming as a one-size-fits-all pattern for computer users as a problem solving tool and independent of the problem domain. However, in problem-solving the learner is assigned to solve a specific problem and then to discuss the result with the computer in a conversational style (Selwyn, 2011). This approach of using computer as problem solving tools could result from the requirement to encode the algorithm into a programme, which implies knowledge of computer architecture and functionality. There are actually lots of different types of educational software including the followings: interactive software for students who are not ready to use a mouse or keyboard and educational software for teaching academic skills, programmes that may possibly teach students basic keyboarding skills. Also, software that teaches students how to think logically, solve problems and artistic software that a learner may perhaps use to create colour pictures. Furthermore, the use of problem solving software approach have some advantages in teaching and learning processes in the classroom situations, which include the followings:

- Students may likely control their own learning experience, pace at which they learn and how to face such challenges.
- Computers could help students' to make adequate use of their senses to extract information.
- Learners learn through creating and utilizing hands-on knowledge and skills.

- Computers perhaps help students' develop positive attitudes toward technology.
- Computers are really beneficial in developing students' fundamental skills (i.e. cause and effect, problem solving, procedural thinking and creativity).
- Computers could be helpful to students' who have speech, audio or motor limitations because they act as a patient tutor allowing the student to learn at his own pace.
- Computers may likely also teach self-confidence and self-esteem.
- Computers also impart social skills.

Nevertheless the delineated advantages, there are also several disadvantages of problem solving software in teaching and learning. Some of these shortcomings are: software needs to be carefully chosen in order to ensure that what might holds your learner attention could also educating them at the same time, it is rare to find a school that have enough computer for every student, thus scheduling could become problematic in approach and it may be difficult to get students' attention whenever they are on the computer.. However, the complexity of the problem domains when computers are used as a problem solving tool could tremendously help to enhance students' overall cognitive performance/ achievement.

Cognitive achievement represents the outcome that indicates the extent to which a person has accomplished specific goals that focus on activities in instructional environments, specifically in schools. They could be seen as the outcome of students' effort in examinations. Eze, Ezenwafor and Molokwu (2015) posited that achievement is used to measure student's success in educational institutions or how well students meet standard set out by examining bodies or the institution. Cognitive achievement is a major issue to teachers, students, parents and guardians as well as other stakeholder in the education industry. This concern cuts across all school subjects all levels of the education system including primary, secondary and tertiary. A high cognitive achievement for any class of students is an indication of teaching and learning effectiveness while poor achievement, on the other hand, is an indications that the teaching and learning process is ineffective. In the context of this study, cognitive achievement refers to intellectual and skills attained by a student in a particular subject, measured by a score obtained in a test. Cognitive achievement is dependent on several factors such as, learning environment, instructional methods and teaching strategy, teachers' attitude and enthusiasm, as well as students' interest.

Interest is a persisting tendency to pay attention and enjoy some activities. Musa, (2009) defined interest as a zeal or willingness of participating in activity from which one derives some pleasure. Musa further stated that interest is a tendency to become absorbed in an experience and to continue in it. Ogwo and Oranu (2011) laid emphasis on the need for teachers to stimulate students' interest in learning without which students' achievement will be minimal. It is what one perceives in these engagements that shape ones' interest. Interest most often is directly tied to the content or instruction, it also directs and enhances learning. In this context of study, interest simply represent what an individual likes or dislikes and that they are usually associated with the activities. In the educational environment, students' interest, especially in EIMW could play a significant role in facilitating their knowledge retention.

Retention is viewed as the ability to remember or recall practical skills what is taught at the time it is needed. Psychomotor according to Salihu (2014) is a degree of skill demonstrated by an operator in the completion of a task. Psychomotor task in a college subject is represented by scores or marks obtained in a performance test. Retention according to (Safo, Ezenwa and Wushishi, 2013) is the ability to keep or retain the knowledge of what is learnt and to be able to recall it when it is required. The ability to remember and apply concept learnt on the later day is referred to as retention, (Eze, Ezenwafor and Obidile, 2016). For instance, if a group of students are exposed to classroom instruction on a particular subject after which a test is given, such test only reveals the extent of the content of that subject learnt by the students. If another test is given (say two weeks or more) after the instruction, one can infer from the result of the test how much of the content of the instruction the students retained (Mustafa, Ashhan, & Turgay, 2011). Eze, Ezenwafor and Onwusa, (2020) concluded that the application of appropriate teaching method could benefit students the opportunity to learn more from what they were taught and to acquire knowledge with practical skill orientation for lifelong utilization. This is essential in the educative process, because such high academic retention ability scores in acquired knowledge or skill could be successfully transferred to the work place, and could eventually result in high labour productivity. The predominant teaching method mostly used in technical colleges is conventional method such as lecture - demonstration teaching methods.

Lecture-demonstration teaching method (L-DTM) is known as the traditional talk-chalk method of teaching. Here the teacher does the talking while students serve as receiver only by listening and taking down notes. Eze and Osuyi (2018) described L-BTM as the type of teaching method in which the teacher is the principal actor while the learners watch with the intention to act later. In the same vein, Odundo and Gunga (2013) outlined the advantages some L-DTM to include; teachers covering a lot of grounds in a single class period, dissemination of large quantity of information to students in a short period of time, and non-use of any equipment and laboratory. In addition, the method enable provision of quality learning materials by the teacher, encourages self-discovery learning and develops, students listening and communication skills. Despite the outlined benefits of L-DTM, it has several shortcomings, it shows no regard for individual differences among learners and does not provide opportunity for adequate classroom participation in the teaching and learning process. As a result, students learn comparatively little of what has been taught as they only hear and see the teacher. In most cases, the students are passive and boredom is easily associated

with the method. It causes dissatisfaction, inadequate knowledge development, low interest and high dependency of students on teachers. The consequence of this is that the students may not be able to retain their learning and to apply it to new situations.

Teaching and learning have significant roles to play in the production of competent manpower in electrical industries. It is expected that EIMW graduates should possess requisite skills which would enable them to perform well in their areas of discipline. By observation, the skilled job opportunities in industries are not filled up, yet technical college products roam about in the streets. Technical colleges' graduates in EIMW could not take up the available skilled jobs in electrical industries simply because of lack of requisite skills in computer operational competencies. Majority of imported machines in electrical installation are computerized and traditional skills are not adequate to survive in this present technological era. The standard of performance of Nigerian technicians, in general, is at the moment very low and weak in the practice of their trades, thereby retarding the overall productivity of the Nigeria economy. Unfortunately, it is very sad that the EIMW graduates could not possess adequate and relevant skills required by industries. The lack of adequate and appropriate work skills, therefore, makes the graduates unproductive. It is essential that EIMW teachers devise alternative method of teaching by which knowledge and skills could be taught to learners taking the advantages of computer simulations model and problem solving software. Therefore, there is need to curb the perceived poor performance of students' in public examination among EIMW students. This assumption prompted the present study, the impact of computer simulations model and problem solving software on students' cognitive achievement, interest and retention in EIMW in technical colleges in Edo State.

Statement of the Problem

The rapid changes and complexity of today's world present new challenges and put new demands on the educational system. As a result of increasing industrialization in modern time, knowledge and skills in technical education become increasingly essential in everyday life. These needs for knowledge and skills necessitated a change to improve the preparation of technical students for functioning in the continually changing and highly demanding environment. Today's world of technology depends mainly on high skilled manpower for productivity. Increased attention on the application of computer-based technology in the classroom and the existing skills demand lifelong learning and self-reliance in the workplace. The use of computer-aided instruction has become integral to the educational system worldwide. This could enables most educational programmes to modify the curriculum to create room for implementation and utilization of information and communication technology that stimulate practical instruction.

Thus, one of the reason for demonstrated persistent poor performance of technical colleges' students in the final NABTEB examination could be attributed to inappropriate instructional method arising from the use of conventional teaching methods such as lecture/demonstration to implement the curriculum (Owoso, 2012; Oranu, 2003). Thus the integration of information and communication technology into teaching and learning in classroom have resulted into big gap between teaching at schools and the ways students get information in the 21st century. Currently, visual materials are used in all human endeavour, and students are under the effect of technological tools such as television, computers, iPad, Android phones, modem and flash drive. Therefore, when teaching and learning at schools are supported through various sounds, visuals and animations, more permanent and productive learning are likely to takes place (Ercan, Bilen & Bulut, 2014).

Hence, there is urgent need to bridge the existing gap in knowledge because form observation, there is still persistent low performance of students in technical colleges in EIMW in public examination. This prompted the researchers' curiosity to determine the impact of computer simulations model and problem solving software on students' cognitive achievement, interest and knowledge retention in EIMW in technical colleges.

Purpose of the Study

The purpose of study therefore was to determine if using computer simulations model and problem solving software to teach EIMW students in technical colleges would improve their cognitive achievement, sustain their interest and address the problem of poor knowledge retention in the subject better than teaching them using L-DTM. Specifically, the study sought to determine the:

1. Mean cognitive achievement score of students taught EIMW with computer simulations model and problem solving software with those taught with L-DTM.
2. Mean psychomotor retention score of students taught EIMW with computer simulations model and problem solving software with those taught with L-DTM.
3. Interaction effect of teaching methods on ability level on technical college students' interest in EIMW.

Research Questions

The following research questions guided the study:

1. What are the mean cognitive achievement scores of students taught EIMW using computer simulations model and problem solving software with those taught using L-DTM?
2. What are the mean psychomotor retention scores of students taught EIMW using computer simulations model and problem solving software with those taught using L-DTM?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

1. There is no significant difference between the mean cognitive achievement scores of technical colleges students taught EIMW with computer simulations model and problem solving software with those taught using L-DTM.
2. There is no significant difference between the mean psychomotor retention scores of technical colleges students taught using computer simulations model and problem solving software with those taught EIMW with L-DTM.
3. There is no interaction effects of teaching methods on ability level on technical college's students' interest in EIMW.

Method

Quasi-experimental design was adopted for the study. Specifically, the pretest, posttest non-randomized control group design was adopted for the study. The design was adopted because it was not possible for the researchers to randomly sample the subject and assign them to groups without disrupting the academic programme and the timetable of the technical colleges involved in the study. The study was conducted in technical colleges in Edo State which is located in the south-south zone of Nigeria. The population of the study was 126 National Technical Certificate (NTC) year 11 students. The sample of the study was made up of 101 National Technical Certificate (NTC) year 11 students. Purposive sampling technique was based on availability of professionally qualified staff, computer facilities for teaching, regular electricity supply and willingness of regular teachers to participate as research assistants. One intact class was used in each of the four schools giving a total of four intact classes. Simple random sampling was used to assign two intact classes to experimental groups and the other two intact classes to control groups.

The instruments were developed by researchers and used for the data collection in this study. Electrical Installation and Maintenance Works Achievement Test (EIMWAT) and Electrical Installation and Maintenance Works Interest Inventory (EIMWII). The 50 multiple choice test items were used as pre-test and after the treatment, the instruments were reshuffled and the colour of the paper changed before administering it as post–test and retention test (delayed post- test). Table of specifications was used to allocate questions on the EIMWAT to content areas. Items in the EIMWAT were constructed with strict adherence to the application of levels of revised edition of Anderson and Krathwohl (2001) Bloom's taxonomy of educational objectives as follows: remember, understand, apply, analyze, evaluate and create.

The Electrical Installation and Maintenance Works Interest Inventory EIMWII consisted of two sections A and B. Section A sought to elicit bio-data of the students while section B contained 45 items of the instrument. The EIMWII was developed by the researchers. The interest areas are academic, leisure, vocational and general. Likewise, EIMWII was based on five point Likert type scales are listed below: Strongly Agree (SA) =5, Agree (A) =4, Undecided (U) =3, Disagree (D) =2 and Strongly Disagree (SD) =1.

The instruments EIMWAT and EIMWII were used for data collection was face and content validated by three experts. A panel of three experts from Department of Technology and Vocational Education and Computer Science Department - all in Nnamdi Azikiwe University, Akwa. They considered the clarity, simplicity of the computer simulations model and problem solving software as well as its suitability for the level of the subject. They verified the extent to which the items of each unit were effective for teaching considered for testing the concepts they were meant to test and check the possible errors and suggested answers. Base on the observations, corrections and advice of the panel of experts, the original package of computer simulations model and problem solving software were edited by the researchers for the final draft of the instruments. The package (computer simulations model and problem solving software), thus validated were used for conducting the study.

The reliability of the EIMWAT instrument for this study was established using test-retest method. Copies of the EIMWAT were administered to 25 NTC 11 EIMW students drawn from Utagba-Ogbe technical college in Delta State who were not part of the population. After a period of one week, the instruments, EIMWAT were re-administered as retest. Reliability estimate of the EIMWAT was calculated using Pearson Product Moment Correlation between the two sets of scores. This yielded a correlation coefficient of 0.83. The EIMWII was administered together with the EIMWAT to 25 NTC 11 EIMW students and was calculated using Cronbach alpha reliability coefficient method was used for EIMWII and 0.87 obtained, which the researchers considered adequate for the study.

Experimental Procedure

The researchers sought and obtained permission from the authorities concerned for the involvement and participation of their students and teachers in the study. The study lasted for eight weeks (one week for pre-test and briefing of teachers involved, five weeks for treatment and one week extra for the retention test or delayed posttest). The EIMW lesson plans and lesson notes that were used were developed by the researchers. An orientation programme was organized for the four participating EIMW teachers in the first week. Separate sessions were organized for the two groups of teachers. Experimental group was trained using computer simulations model and problem solving software in teaching EIMW and L-DTM was employed using charts, real objects, illustrations and demonstration during the training session.

In the first week, the instruments EIMWAT and EIMWII were administered to experimental and control groups

through the help of the regular classroom teachers (research assistants). The administration of the pre-test lasted for one hour for each school. The teachers collected the scripts and hand over to the researchers for marking and the scores were recorded accordingly.

The actual teaching of the topics for both (control and experimental groups) commenced in the second week of the experiment followed normal school time-table schedule covering five working days. The subject teachers in both technical colleges assisted the researchers in teaching the lessons to prevent bias that may be introduced by teacher effect. Treatment (teaching) for the experimental group was designed specifically to employ computer simulations model (animation, graphics, data input and diagrams and problem solving software (programmes are developed in the form of collection of instructions that control the functionality of the computer to achieve a single purpose in learning related to the area of interest) in EIMW classroom/workshop. The control group employed lecture/demonstration teaching method only in normal classroom situations. The primary focus of the teaching process was concentrated on battery system, battery charging, domestic installation, cable jointing, and winding of electrical machines as contained in the NBTE 2001 curriculum.

EIMWAT and EIMWII items which were used during the pre-test stage were also used for the post test. However the EIMWAT items was reshuffled or re-arranged differently from that of pretest in order to make the test look different to students. The treatment lasted for a period of five weeks. The post-test was administered at the end of the fifth week by the class teachers (research assistants). The experimental group wrote the examination using the computers. The scoring of the examination, storing in the database and displaying of results was done instantly by the computer when a student click submit after the examination. The control group wrote the examination conventionally and the research assistants supervised the examination. The researchers marked the scripts, recorded the marks and made the scores available to the students.

Furthermore, the EIMWII was equally re-administered as posttest to ascertain the extent of students' interest. The experimental group used the computer to fill the EIMWII and was sent to the researchers e-mail while the control group were given pen and paper to tick the items. The research assistants printed the complete copies of EIMWII for experimental group and complete copies of control group and were handed over to the researchers. Retention test (delayed post-test) was also administered to ascertain students' level of knowledge retention. The same questions from EIMW items were used for the post-test for the experimental and control groups, but the questions were also reshuffled. The scripts were also collected, marked and recorded by the researchers. Thus the scores were collated and used for data analysis for the study.

Method of Data Collection and Method of Data Analysis

The academic exercise provided post-test data for each of the dependent variables. Data collected were analyzed using mean scores and standard deviation. The Analysis of Covariance (ANCOVA) was employed to test the hypotheses at 0.05 level of significance. In testing the hypotheses, if p-value was less than the level of significance (0.05), the null hypothesis was rejected but if the p-value was greater than or equal to the level of significance at (0.05), the null hypothesis was accepted. Data analysis was done using Statistical Package for the Social Sciences (SPSS) version 20.

Results

Research Question 1: What are the cognitive achievement scores of students taught EIMW using computer simulations model and problem solving software with those taught using L-DTM?

Table 1: Mean and Standard Deviation for pre-test and post-test cognitive achievement scores of student's

Cognitive achievement

Groups		Pre-test		Post test		
	No	Mean	SD.	Mean	SD.	Mean Gain
Experimental	51	1.879	1.289	27.121	5.533	25.24
Control	51	2.051	1.403	22.872	5,716	19.82

Table 1 shows the mean and standard deviation of achievement scores of students in experimental and the control groups. The mean scores indicates that the experimental group had higher mean scores in the posttest. The mean gain for experimental group is 25.24, the control group is 19.82. The difference in mean gain is 5.42 which shows that the experimental group performed better than the control group in the classroom activities.

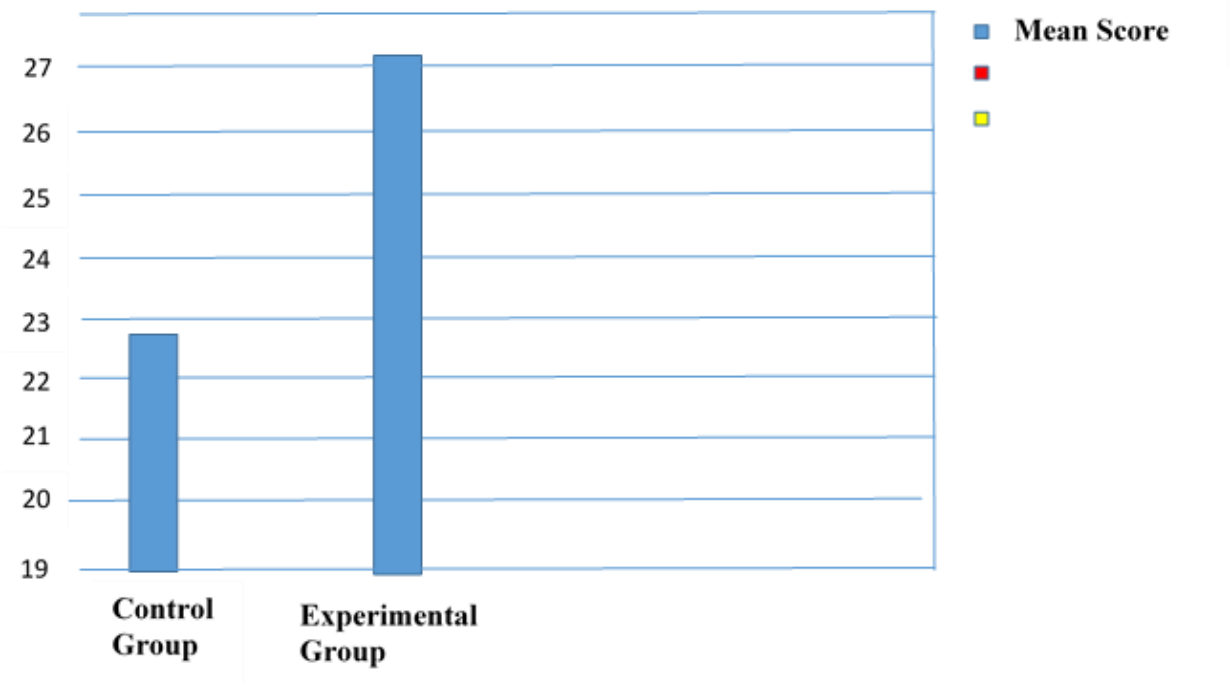

Figure 1: Bar chart showing the differences between the control group and experimental group in cognitive achievement post-test

Research Question 2: What are the mean psychomotor retention scores of students taught EIMW using computer simulations model and problem solving software with those taught using L-DTM?

Table 2: Mean and Standard Deviation for pre-test and post-test psychomotor retention scores of students

Retention

Groups		**Retention test**		
	No	**Mean**	**SD_1**	**Mean Gain**
Experimental	51	30.05	11.901	12.90
Control	50	23.05	7.507	

Table 1 shows the mean and standard deviation of retention scores of students in experimental and the control groups respectively. The mean scores showed that the experimental group had better knowledge retention. The mean gain 12.90. The table shows that the experimental group retain more than the control group in the academic exercise.

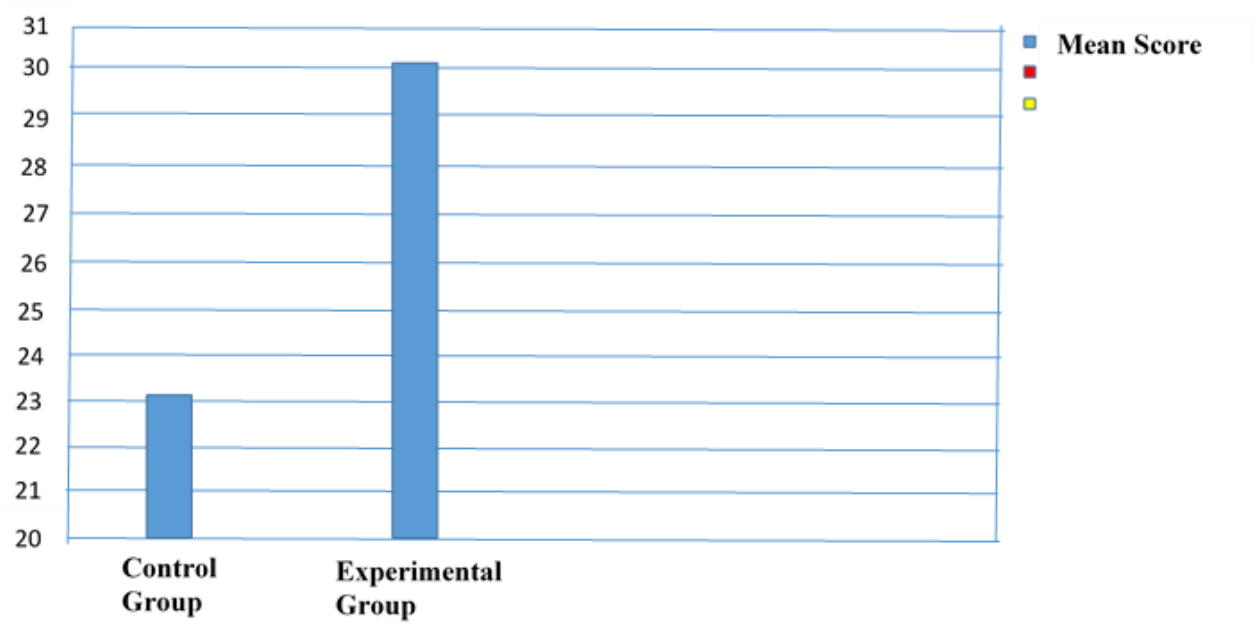

Figure 2: Bar Chart showing the differences between the control group and experimental group of psychomotor retention scores

Hypothesis 1: There is no significant difference between the mean scores of experimental group and control group in the cognitive achievement of students in EIMW in technical colleges

Table 3: Summary of Analysis of Covariance (ANCOVA) for differences in cognitive achievement of students

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	591.605a	2	295.802	9.5610	.000
Intercept	3649.742	1	3649.742	117.9630	.000
Pretest	743.232	1	74.232	2.3990	.126
Group	539.381	1	539.381	17.4330	.000
Error	2134.840	99	309160		
Total	45164.00	101			
Corrected Total	2726.44	100			
Significance at sig of F less 0.05					

Table 3 shows that there is significant main effect of treatment in the post test achievement of students in the experimental and control groups $F(1, 113) = 17.4330$, $p< 0.05$. This means that there was significant difference in the mean achievement scores of students in the experimental group and the control group. Thus the hypothesis that there is no significant mean difference in the achievement of students taught with computer simulations model and L-DTM is therefore rejected. Thus, students who were taught with computer simulations model and problem solving software have higher academic achievement than those taught with the L-DTM. Therefore, it means that teaching with computer simulations model and problem solving software indeed boosted student's academic achievement.

Hypothesis 2: There is no significance between the mean scores of experimental and control group in the psychomotor retention of students in EIMW in technical colleges

Table 4: Summary of Analysis of Covariance (ANCOVA) for differences in psychomotor retention of students in EIMW

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	5758.827	2	2879.414	512050.	. 000
Intercept	559.949	1	5590.949	99425.	. 000
Pretest	2789.729	1	2789.729	49611.	. 000
Group	2568.292	1	2560.292	455300	. .000
Error	3880.049	99	56.233		
Total	70017.000	101			
Corrected Total	9679.875	100			
Significance at value of F less 0.05					

Table 4 shows that there is significant main effect of treatment in the post test retention mean score of students in the experimental group and the control groups F(1. 113) = 455300, p< 0.05. This means that there was significant difference in the mean retention scores of students in the experimental and control groups. Therefore, the hypothesis that there is no significant difference in the retention mean scores of students in experimental and control group is therefore rejected. Hence, students who were taught with computer simulations model and problem solving software have higher academic retention ability than those taught with the L-DTM. It can therefore be construed that teaching with computer simulations model and problem solving software indeed improved student's academic retention ability.

Hypothesis 2: There is no interaction effect of teaching methods on ability level of technical college students' interests toward EIMW

Table 5: Interaction of teaching methods on ability level of technical college student's interest in EIMW

Source	Type III Sum of Squares	Df	Mean Square	F	P-value.
Corrected Model	30516.195[a]	3	10172.065	65.186	.000
Intercept	1231324.695	1	1231324.695	7890.689	.000
method* Achievers	30516.195	3	10172.065	65.186	000
Error	15136.636	97	156.048		
Total	1663525.000	101			
Corrected Total	45652.832	100			
a. R Squared = .668 (Adjusted R Squared = .658)					

Table 5 shows that the F-calculated value for posttest effect is 65.186 with a significant probability value of 0.000 which is less than 0.05 alpha level. This implies that there was significant interaction effect on teaching method and ability level of students' interest on technical college. The hypotheses was therefore rejected. This, in turn, implies that it is not just the teaching method that caused the improvement of students' interest, since students who were higher achievers had developed better interest in the treatment. The nature of interaction is shown graphically below. Figure 3 below is a clear demonstration of this.

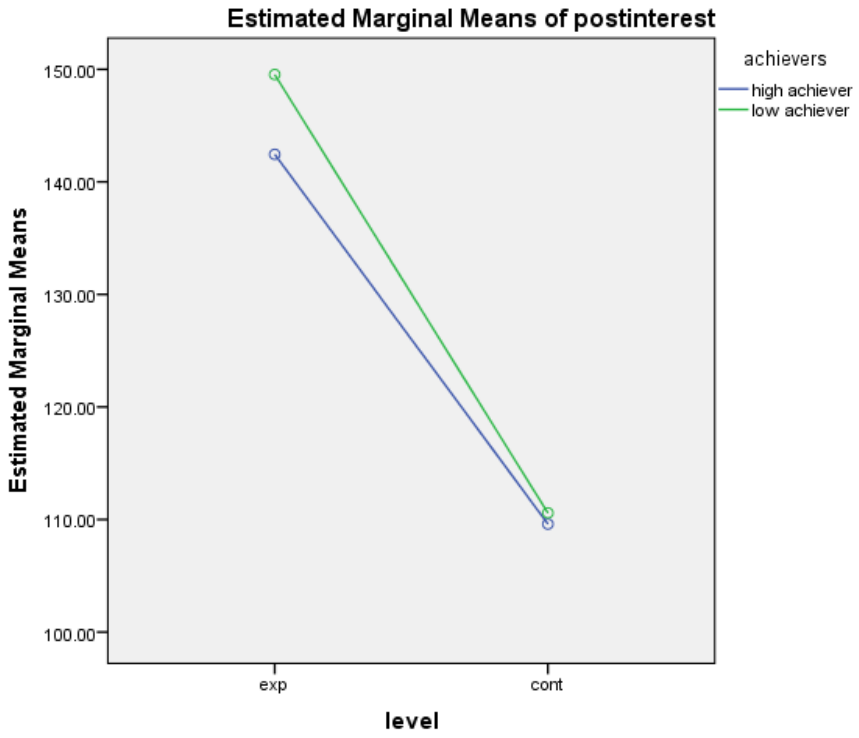

Figure 3: Interaction effects of teaching methods on ability level of technical college students' interest in EIMW in experimental and group

Discussion of Results

The finding revealed that the effect of computer simulations model and problem solving software on students' cognitive achievement is higher than those taught with lecture-demonstration teaching method. This result is in line with the findings of Adedoja and Fakokunde (2015); Eze, Ezenwafor and Onwusa (2020) which reported that computer assisted instruction had significant effect on the post-test achievement scores of students. This could be as a result of series of serious academic activities that was incorporated in computer simulations model and problem solving software which may have strengthened the cognitive ability of the students.

Also, the study revealed that the students taught using computer simulations model and problem solving software instructional retained concepts taught better than those taught with L-DTM. This findings is in line with Akcy, Durmaz, Tuysuz and Feyzioglu (2006) who found that, students taught using computer simulations model and problem solving software retained the concepts than those students taught using L-DTM. This could be as a result of sequence of activities and experiences involved in computer simulations model and problem solving software which made the students to develop and construct their own knowledge meaningfully and retained the concepts taught for longer period of time in the classroom activities. This means that computer simulations model and problem solving software used in treatment significant improved students' knowledge retention.

Findings from the study revealed that there was significant interaction effect of teaching methods and ability level on technical college students' interest taught using computer simulations model and problem solving software in EIMW. This indicates that there was significant interaction effect in the teaching method used had interaction effect on interest of students in EIMW. It suggests that it is not just the teaching method that could boost students' interest but the students' academic ability. The findings agrees with that of Oyenuga, (2008); Eze and Onwusa, (2020) which reported that there was significant interaction effect of teaching methods and ability level of students' interest taught computer based instruction and conventional teaching method. The fact that students' in experimental group performed better than the control group does not really implies they had higher interest but could be as a result of different academic ability level of students. This is because, it is believe that students with sound academic ability may likely performed better than those with low or medium academic ability in the classroom teaching exercise.

Conclusion

Based on the findings of the study, it was concluded that computer simulations model and problem solving software instructional delivery is more innovative, more compelling and more effective method for improving students' overall achievement/performance. The application of computer simulations model and problem solving software actually inspired students' interest and indeed improved knowledge retention in EIMW in technical colleges.

Recommendations

Based on the findings of the study, the researchers recommends the following:

1) EIMW teachers should adopt computer simulations model and problem solving software instructional strategy to improve achievement, interest and knowledge retention among students' in technical colleges.
2) Production of software packages should be integrated as part of course content of study in the EIMW in technical colleges
3) EIMW teachers and students should shift from the traditional/conventional method (lecture and demonstration of teaching method) and ensure the instruction in technical colleges become students' and self-assisted learning oriented.
4) EIMW teachers in technical colleges should be equipped with ICT facilities for teaching and learning processes to enable the students develop computer literacy and skills from elementary schools which will eventually assist them in a better usage of ICT facilities in technical colleges.
5) Workshops and seminars should be organized by Ministries of Education and related Government agencies to enlighten EIMW teachers to improve their knowledge and skills on the use of computer simulations model, problem solving software as well as ICT facilities.

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