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EFFECT OF COMPUTER SIMULATION ASSISTED INSTRUCTION ON SENIOR SECONDARY SCHOOL II PHYSICS STUDENTS' RETENTION IN OHAFIA EDUCATION ZONE ABIA STATE

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Abstract
This study focused on the effect of Computer Simulation Assisted Instruction strategy on retention of students in Physics. Two Research Questions and two Hypotheses guided the study. The study adopted post-test delayed posttest quasi-experimental research design involving 93 Senior Secondary School II (SSS2) Physics students from four intact classes purposively selected and divided into experimental group exposed to CSAI and the control group exposed to TLTM. The study adopted multi-stage sampling techniques. The population of the study was 3480 (SSS2) Physics students from all the 225 coeducational public secondary schools in Abia State. A single instrument Physics Achievement Test (PAT) containing 50 multiple choice test questions; subjected to test of reliability using Kudar-Richardsons'(KR – 20) formular and a reliability coefficient of 0.82 was obtained. The data collected was statistically analyzed using mean and standard deviation to answer the research questions and analyses of covariance (ANCOVA) at (0.05) level of significance was used to analyze the Hypotheses. The findings of the study showed that there was significant difference between the mean retention of students taught Physics with CSAI and TLTM in favour of the students' with CSAI. Furthermore, the study revealed there was no significant interaction effect between teaching strategies (CSAI & TLTM) and gender on students' retention in Physics when taught with CSAI and TLTM. In conclusion, the study revealed that CSAI when used in learning enhanced students retention and gender parity on the learning of Physics and recommends that teachers should adapt CSAI in the teaching and learning of Physics which was expository in nature with synergic positive effect. Also, curriculum planners should include computer simulation into the secondary school Physics curriculum to ensure schools administrators support in-cooperating computer simulation technology into their teaching pedagogies in Physics.

Keywords: Computer simulation, Retention, Physics, Motivation and Gender

INTRODUCTION

Dynamic Educational Technologies such as Computer Simulation in science and engineering has increased dramatically in the last decades. Most of the textbooks used in college courses now come with DVDs and URL to a website. This can be attributed to the fact that computer simulation creates common visualization between the students and the teacher and facilitates communication in teaching (Scalis etal; 2011). However, Saadeddin etal; (2012) stressed that computer simulation in education must be part of instructional design which entails well designed curriculum. In Physics education, well design curriculum plays a role in building students' cognitive, psychomotor and effective domain in learning which in turn enhances students' retention and remembering ability.

In education, Retention is vital in ascertaining the level performance of a learner in a learning event. High retention ability with good understanding will likely correspond to high performance of a learner. According to Parhi(2013), Retention is the ability of a learner to reproduce repeatedly facts which the learner had internalized. Also, Singh, Sharma & Brijesh, 2008) described Retention as the capability of an individual to sustain acquired knowledge of facts, theory and laws in a particular field of endeavor over a considerable period of time. Retention depends on the nature and memory capacity and ability of an individual which partly depends on individuals' biological and hereditary gene. Retention ability and memory capability of individual in education are malleable and could be enhanced through many means such as the use of repetition, effective teaching method and by creating motivation in the learner as well as the use of effective instructional technology. According to Parhi (2013), Retention can be measured through Method of Recall, Method of Recognition and Method of Relearning. Method of recall involves the students being able to reproduce what was learnt when required. The recognition method is the discrimination between seen and unseen, capacity to recognize or express knowledge of a thing that has been seen earlier and requires students to identify the correct response from among a number of options in examinations with multiple-choice items.

The present study involving the use of computer simulation as an aid to instruction adopted recognition method of measuring retention using Physics Achievement Test PAT involving multiple choice objective questions from which students selected the best options as the answer to a given question item after a delayed period of time. To appreciate the role educational technology plays in terms of the knowledge of the concepts, principles, and laws of Physics to the learners in the development of science and technology, Idah (2013) was of the view that students who are exposed to functional equipment necessary to help them acquire the basic skills required to enhance understanding of Physics tend to gain more knowledge, effectively apply what they acquired after a period of time in an academic setting and most times gain high retention. Also, Wambugu (2011) is of the view that presentation of interesting materials and mastering of a concept by a learner can enhance retention. Parhi (2013) is of the view that students retain and remember more what they see, and practice. In view of these, the use of audio visuals like computer simulation assisted instruction strategy expectantly could enhance students' ability to gain in-depth knowledge of Physics concepts, develop interest and motivation, improve on Retention and also develop the required skills and ability to apply the knowledge gained in real life situation.

The ability of students to retain and remember facts acquired in learning plays a role in the performance of student in the learning of Physics which is described as the branch of science which studies natural phenomena such as land and sea breezes, electromagnetism, thunder and lightning and rainbow formation at their fundamental levels (Young and Freedman, 2012). Physics is central in the scientific and technological advancement of any nation especially the developing countries like Nigeria. Without the knowledge and application of Physics, it wouldn't have been possible for man to explore other planets of the universe, design enhanced semiconductors which had advanced the field of information and computer technology ICT.

Today, through satellite technologies, man can view events taking place in distant countries; travel through far distances in a short time using Airplane and speed trains. Through solid state Physics, man had fabricated materials with high tensile engineering strengths and conductivity in electricity; such as superconductors that conduct electricity with zero electrical resistances.

As an effort to improve on the learning and teaching of Physics, research study had being conducted with computer simulation; a deviation from the conventional method of teaching and learning. In accordance, computer simulation is revealed to have potential effect in teaching-learning processes, speeds up teachers' educational potentials, allowing students to learn by discovery methods and apply learned concepts of Physics to scientific phenomena in everyday life (Mirriam, 2015; Smetana and Bell,2012). According to Musasia, Abacha and Biyoyo (2012) when computer simulation is used in practical investigation; helps female students as well as the male to developed better attitude towards practical based instructions in Physics. The promotion of conceptual understanding In Physics is important towards its application in an examination condition and real life situations and requires a well and carefully designed instruction, time and effort (Adidan, Trundle and Lafing 2010). According to Vosnidou etal; (2011) the traditional practice of science instruction in teaching emphasized memorizing a lot of science concept and literal understanding of concepts. According to Konicek etal; (2015), students with this types of concept understanding would explain any page in a text book, reproduce graph or pictures at a moment notice in replica but may not have acquired the basic concepts' knowledge that provides explanatory evidence of the ideas about the concepts or phenomena and can hardly effect knowledge transfer in subsequent relevant situations.

For instant, in Physics, students can rely on their memorization of the term electric field but lack the conceptual understanding about the construct 'electric field' to explain what it implies in the real world to aid them explain other similar natural phenomena. Contrary to this trend, Adidan etal; (2010) opined that learning in science requires content understanding and knowledge to be constructed by the learner rather than memorization of facts merely transferred from the teacher to the learner as found in traditional teaching method. Furthermore, Taskin and Kandemire (2010) opined that the potential of computer simulation to portray phenomenon in most cases arouse students' interest with the dynamic models of a system creates unarguably unique way of helping learners conceptualize facts in Physics.

Instructional materials also play a vital role in education towards enhancing teaching and learning. According to Azar and sengellec (2011), instructional material is described as didactic materials which are locally made (improvized) or machined which make teaching and learning easy and could enhance lesson impact; if intelligently used. In his own view, Isola (2010) referred instructional materials as objects or devices which help the teacher to make a lesson much easier to the learner. According to online source (makingtuno.wordpress.com), instructional material can either engage or demotivate students when the instructor (teacher) employs first rated resources that inspire a learner, increase their capacity to learn and retain information. Implicatively, equipping the classroom with a wide range of top quality instructional materials like computer simulation, curriculum foundation can be developed with ease. Instructional materials can be classified as audio instructional materials which appeal to the sense of hearing, visual instructional materials which appeal to the sense of vision and audio visuals which appeal to both the sense of hearing and vision. Audio visuals have advantage over the audio and visual instructional materials as it takes into advantage both the auditory and vision sense of the learners which are imperative in the learning of Physics and science in general. According to Parhi(2013), audio visuals affect outcome of learning and opined that based on Dale Cone of Learning, learners remember 10 % of what they read, 20% of what they heard, 30% of what they see and hear, 70% of what they say and write and 90% of what they say and do. In effect, Parhi (2013) opined that exposing students to audio visual instructional materials and making them interactive helps students to be active participant in a learning situation and enhanced their ability to retain and remember facts acquired in learning. Information and communication technology (ICT) in the form of

computer simulation in learning incorporates audio and visual aspect of instructional materials; making computer simulation instructional materials a tool in learning which has the potential to increase students motivation, understanding and remembering of concepts acquired in learning towards enhancing students' performance in areas such as academic achievement, retention, attitude and interest.

Although, instructional materials like computer simulation have relative positive effect in learning, its use has inherent limitations. According to Trundle and Bell (2010) , some of the factors affecting computer simulation use as an instructional material is time factor; as the time allotted to Physics in secondary schools' time table (40m- 45m) is not sufficient as to accommodate the use of computer simulation. Tolgar (2011) opined that the teaching strategy is a significant factor, stressing that teaching strategies determines the effect of computer simulation on students' learning and understanding of concepts in Physics. Candida, Cravino and Soares (2014); revealed that effective use of computer simulation in learning as an instructional material depends to a large extent on teachers' role factor.

According to Kahiru (2014), computer simulation is defined as a design of the model of a system which aid understanding of the system's behaviour. Also, Mengistu and Kahsay (2015) described computer simulation as the computer representational model of a dynamic system, object or event in a real or abstract world. According to Romero and Martins (2012), among other consideration opined that computer simulation is divided into instructive computer simulation which is the type used for information dissemination, and Reinforcement in learning and constructive computer simulation which is the type that provides learners with a contextual environment where they are part of unfolding events. Candida, Cravino and Soares (2014) opined that computer simulation plays a vital role such as provision of problem solving skills in learning when its application is planned. Computer simulation is an alternative tool in learning where real equipment is either not available or impractical to set up, creates interaction and individualized attention making the learner active participant in learning processes (Logar &Savec, 2011; Trundle and Bell, 2010). According to Umoke and Nwafor (2014), computer simulation aid teaching and learning event especially when the teacher introduces a new topic, tries to build concept knowledge , reinforce ideas and provide final review and reflection to visualize science concepts and further stressed that computer simulation supports development of insight to form gestalt into complex phenomena , afford the learner opportunity to practice laboratory techniques before engaging in actual laboratory experience with real apparatus. According to Akpan (2010), computer simulation provides a combination of animation and visualization in science concepts and supports development of insight when presented during concept demonstration. This agrees with the Gestalts theory of learning by insight (1887-1967); which opined that individuals learn by seeing a problem situation as a whole, form a gestalt (pattern) of the problem and provide solution out of the understanding of the whole by insight. In accordance, Singh etal (2008) opined that a learner learn by facing a problem situation with open mind, by using survey with reasoning, experience, trial and error with meaningful understanding and with ability to see relationship between one aspect of the problem and the other arrive at a possible solution by insight.

According to Parhi(2013), Gestalt theory of learning advocates that the a teacher should present concepts for study as a whole and later explain the concept unit by unit incorporating the principles of proximity, similarity, closure, continuity and contrast; accounting for the cognitive level of the learner which emphasized the role of motivation in learning; stressing that the teacher should focus on ensuring the learner is motivated to learn with desire and purpose. Computer simulation as an innovative audio visual instructional material in learning is observed with potential to present Physics concepts as a whole to the students to observe and form a gestalt (pattern) of the concepts as the teacher presents the concepts unit by unit using the maxims of learning for the learner to understand the whole. Computer simulation helps a learner to form close similarity of events and concepts taught in class to effect transfer of learning in education towards enhancing remembering and retention of students in Physics.

Motivation on one hand plays important role in the learning of Physics. According to Iderima (2014), Motivation is the force that accounts for the arousal, selection, direction and continuation of behaviour in learning. Psychologically, motivation plays the role of energizing and sustaining bahaviour and help in capturing attention in learning situations through an internal process initiated by some needs which lead to the activities that will satisfy those needs . This implies that motivation is an internal process which is prompted by some need and some activities which in turn satisfies the need or want of the learnert. Motivation arouses interest, provide the needed driving force to learn and perform certain activities towards the attainment of the goals set by the teacher. When learner is well motivated, performance in learning could be enhanced towards students' achievement, interest and retention in Physics.

Gender is another factor that plays a role in determining the interest of a learner in the learning of science subjects especially Physics in senior secondary schools. According to Parhi(2013), gender is a factor that psychologically describes humans based on sex; with same skeletal structure but with different hormone components, and physical appearances. Genetically, the Male in terms of hormones has X and Y chromosomes while the Female has only X chromosomes. Sociologically, gender describes roles of human beings with reference to sex; such as the nature of dressing of human beings, sitting posture and nature of dance for male and female in a given society. In addition, gender differentiates the masculinity and feminity of an individual. A male individual is predominantly masculine while a female possesses a feminine nature. This physical outlook to a large extent predicts perhaps that male can perform better than female in some physical task in the society and education in general. According to Parhi(2013), it is perceived that most sciences like Physics are more of masculine subjects and opined that females are directed towards areas of study such as arts, secretarial studies, Nursing and teaching that are viewed as feminine courses which to a large extent influences some female folks to believe that field of Physics, Mathematics, Engineering, and Medicine are for the male gender. Furthermore, Parhi(2013) revealed that male gender performs better in certain areas like mechanical work than their female counterpart while females does better in certain areas like linguistics and emotion management more than the male gender. These showed that performance of the female and male genders in specific areas of human endeavours are probably relative. However, Abungu, Okereke and Wachanga (2014), emphasized that if given equal opportunities, students will perform well irrespective of their gender in learning. Parhi(2013) opined that students internalize concepts learned with every available material, equipment, facilities and gadgets exposed to them irrespective of their genders.

In the same vein, Izzet and Ozkan (2008) is of the view that computer assisted instruction enhances gender parity in teaching and learning. On the contrary, Moor, Combs, and Aina (2013), opined that when given equal opportunity, male students performed higher than the female in sciences especially Physics and Mathematics. In effect, Khan (2013), revealed that Gender parity in science learning could be enhanced and opined that challenges of gender differences can be overcome when supportive policies are made to ascertain positive expectations for academic achievement and retention. In relation to the forgoing, this study integrally seeks to investigate effect of Computer simulation assisted instruction use in the learning of Physics on the retention of students in Physics and to ascertain if gender interaction affects retention of students and gender parity in Physics when they are giving equal opportunity in learning.

Computer Simulation Assisted Instruction

Computer simulation assisted instruction can be described as the use of programed instructions keyed into the computer as software or videos of dynamic models of a system in learning to solve a specific problem by the teacher and makes learning easy and simple to the learner (Khan, 2011). According to Aina (2013) Computer simulation assisted instruction is the use of computer simulation in teaching situation to complement teaching. Yusuf and Afolabi (2010) opined that computer simulation aid learning processes towards enhancing students' performance and development than traditional teaching method. According to Nwanne (2017). Computer simulation assisted instruction encourages learning at one's pace, provides drills and practice mode with immediate feedback when necessary, creating room for discovery allowing for

repetition of mode of instruction for emphasis. Agomouh(2016) opined that teachers should incorporate the use of computer simulation in teaching as innovation in education had gone beyond traditional lecture method of instruction and opined that use of ICT devices like computer simulation can greatly facilitate the acquisition and retention of knowledge and academic achievement in Physics.

Traditional Lecture Teaching Method

Traditional lecture teaching method according to Ezenwa (2011), is a method teaching which involves the teacher formally presenting a subject matter to a learner in order to attain stated instructional objectives with the teacher doing the talking while the learners listens, take note and are occasionally given chance to ask questions; stressing that learners are not actively involved in the learning situation and are not given all the opportunities needed to ask questions to express their opinions in the learning situation. Logar and Savec (2011), described traditional lecture teaching method as that teaching method in which the teacher transmits information about a subject matter and contents verbally to the learner and involves most times writing on the chalk board with some traditional instructional materials while students take note of facts considered important. Gupta and Pasirija (2012) opined that teacher centered teaching method leads to poor performance in science subjects especially in the learning of Physics and stressed that Traditional lecture teaching method does not encourage discovery learning and brain storming in Physics stressing that misconceptions in Physics are not effectively corrected. In this study, computer simulation assisted instruction unlike Traditional lecture teaching method is seen to have the potential of using modeling to scaffold learning of hidden nature of abstract system in Physics, making the student view the audio visuals of such system simulation and get the gestalt of the concept taught by the teacher. This could in turn encourage discovering learning, effective correction of misconceptions and enhancement of retention in Physics.

EMPERICAL STUDIES

Tolgar(2011) conducted a study on the use of computer simulation as instructional material in the learning of Physics in Turkey and found that there was significant difference between the achievement of students exposed to Physics concept learning with computer simulation PCLCS and traditional Physics learning TPL in favour of the students in PCLCS and opined that using computer simulation in Physics learning builds students interest to learn Physics, student felt challenged and motivated to do their work using computer simulation over traditional instructional materials and had improved understanding of basic principles of Physics and encouraged Physics teachers to adopt computer simulation as an innovative instructional materials in the teaching of Physics. Yacin and Bayrakceken (2010), investigated the effect of computer simulation with 5E learning circle on students' understanding of static electricity concept in Physics and found that computer simulation as an instructional material is effective in making students acquire new knowledge , remember to explain the observed and help students to improve on their misconceptions in Physics. According to Zacharia (2012), computer simulation can be used as alternative form of instructional strategy from their study of volume-displacement and opined that students exposed to computer simulation performed well as those who had hands on experiment in the laboratory and revealed that there was no significant difference between male and female students' performance in the learning of volume-displacement and opined that computer simulation scaffolds gender differences in learning.

STATEMENT OF PROBLEM

Despite the importance of Physics as a science subject and in nations development in areas of information and computer technology, medicine and engineering, its learning at the upper secondary school levels had being continually faced with difficulties (Haagen-Schetsenheafer,2012). This

difficulties can be traced to some factors such as misconceptions in Physics, Phobia, nature of students, mathematical and abstract nature of most Physics concepts , teacher factor, lack of good foundation knowledge in Physics , poor psychomotor skills, poor and low cognitive abilities, instructional and teaching strategies used by the teacher; among which teachers' factor and instructional techniques are considered important factors (Haagen etal; 2012, WAEC Chief Examiner's Report ,2021). Another factor according to Isola (2012) is that students perceive Physics as a difficult science subject in secondary schools curriculum. In ohafia education zone, teacher affirmed that students lacks the interest and motivation to learn science subject and attributed the development to the rise in intervening factors such as advancement in social media usage which acts as source of distractions to the students. This had impacted negatively to enrolment and performance of students in Physics in both internal examination and external West African Senior School Certificate Examination (WASSCE). Based on WAEC Chief Examiners Report (2021) on students' performance in Physics, students had low average performance score of 24% in practical out of 50% and 26% out of 60% in Essay part. This poor performance according to WAEC Chief Examiner's Report (2021) had impacted negatively in students' enrolment into higher institution for science and engineering related courses. Hence, this study investigated the effect of computer simulation assisted instruction as audio visual instructional material on senior secondary school students' Retention in Physics.

RESEARCH QUESTIONS

1. What are the post-test and mean retention scores of students taught Physics using CSAI and TLTM.
2. What are the effects of teaching strategies (CSAI and TLTM) on male and female students' mean retentions scores in Physics.

RESEARCH HYPOTHESES

1. **H_{01}:** There is no significant difference between the mean retention scores of students taught Physics using CSAI and TLTM.

2. **H_{02}:** There is no significant interaction effect between strategies and gender on students' mean retention scores in Physics when taught using CSAI and TLTM.

RESEARCH METHOD

This study adopted pretest posttest and delayed post quasi-experimental research design involving non randomized intact classes divided into experimental group and control group respectively. The dependent variable is the retention of students in Physics while the dependent variables are the CSAI and TLTM. The intervening variable is the gender of the students. The study was conducted in Abia state; a state in the south east of Nigeria divided into 3-educational zones. The study was delimited to Ohafia education zone of the state which accordinfg to SEMB (2017) is comprised of four sub-zones with 86 public coeducational secondary schools distributed thus across the four zones: Ohafia LGA (28), Bende LGA (25), Arochukwu LGA , (17) Isukwuato LGA (16). The target population comprised of 3480 Senior Secondary School two (SSS2) Physics students in Abia state. Multistage Sampling Techniques was adopted for the study. Simple random sample technique was used to select Ohafia education zone out of the three education zones in Abia state and the two LGAs in Ohafia education used for the study. Purposive sampling technique was used to select the four schools from each of the two LGAs used for the experimental group and control group. The selection of the schools was motivated by the decision to select schools with qualified Physics teachers, with equipped Physics laboratories and ICT facilities and ready to assist the researcher in conducting the treatments with reliable power supply. Also, purposeful sampling was used to assign the schools to the EG and CG based on availability of ICT facilities required for the study as differentiating factor. The sample size was 93 (SSS2) Physics students. The control group has 46 students comprised of 18 male and 28 female.

The Experimental Group has 47 students comprised of 20 male and 27 female. One research instrument Physics Achievement Test PAT adapted from WAEC past question papers was used for data collection. The PAT was tested for reliability using Kudar-Rechardson-20 (KR-20) formula and a reliability coefficient of 0.82 was obtained. The PAT was face and content validated by three experts in the field of science education.

METHOD DATA COLLECTION

The computer simulation assisted instruction package used for the study contains static electricity concepts simulation adopted from Physics Education Technology PhET designed by Physics Education Research PER group of the university of Colorado and copied into a flash and extracted from the flash using laptop computer with high battery capacity and used to give the assisting teachers brief orientation before the actual treatment commenced. The CSAI was presented to the students using a projector on a white screen by the teacher during the normal teaching sessions intermittently at different stages of the class using maxims of learning. During the learning sessions, only relevant sections of the lesson that require computer simulation was presented to aid explanation and students' understanding. Initial class scores of the students was used to ascertain their level of foundation in Physics before treatment. After treatment, the posttest and delayed posttest was administered and the data collected at the spot in all cases by the assisting Physics teachers in each of the schools used. The data collected were analyzed using mean and standard deviation to answer the research questions and ANCOVA at (0.05) level of significance used to analyze the research hypotheses.

RESULT AND DISCUSSION

This section was used to present results of data analyzed.

Research question 1: What are the post-test and mean retention scores of students taught Physics using Computer Simulation Assisted Instruction CSAI and Traditional Lecture Teaching Method TLTM.

Table (4.3): Posttest and Mean Retention Scores of Students Taught Physics with CSAI and TLTM.

Groups Method	N	Post-test		Delayed Post-test		Mean gain
		Mean	SD	Mean	SD	
TTM	46	55.50	7.99	57.52	7.44	2.02
CSAI	47	58.40	8.10	62.12	7.32	3.72
Mean Difference		2.90		4.60		
TOTAL	93					

That the mean gain of the EG in Table (4.4) is 3.72 and that of CG is 2.02 showed that both students of CSAI and TLTM had enhanced mean retention scores in Physics when exposed to CSAI and TLTM with students of the EG exposed to CSAI having more retention scores of 52.12 than the student in CG with TLTM who scored 57.52 mean retention.

H_{01}: There is no significant difference between the mean retention scores of students taught Physics using Computer Simulation Assisted Instruction CSAI and Traditional Lecture Teaching Method TLTM.

Table (4.4): Analysis Of Covariance (ANCOVA) For The Mean Retention Score Of Students Taught Physics With CSAI And TLTM.

Source of Variation	Sum of Squares	Df	Mean Square	F	p-value	Decision
Corrected Model	1383.504[a]	2	691.752	15.330	.000	
Intercept	2520.669	1	2520.669	55.862	.000	
Post-test	268.206	1	268.206	5.944	.017	Sig.
Retention	894.870	1	894.870	19.832	.000	
Error	4061.076	90	45.123			
Total	338447.000	93				
Corrected Total	5444.581	92				

a. R Squared = .254 (Adjusted R Squared = .238), S= Significant

Table (4.4) showed that the probability value associated with the calculated F_{cal} (19.832) for the mean retention scores of the student in EG and CG is (0.000). This is lower than the (0.05) level of significance. Hence, H_{01} was rejected. This implies that there was significant difference in the mean retention scores of student taught Physics using CSAI and TLTM in favour of the student in EG exposed to CSAI.

Research question 2: What are the interaction effects of teaching strategies (CSAI and TLTM) on male and female students' mean retentions scores in Physics.

Table 4.7: Interaction Effect Of The Teaching Strategies (CSAI & TLTM) On Mean Retention Scores Of Students In Physics.

METHOD INTERACTION	MALE AND FEMALE GENDER	Mean	Std. Deviation	N
	FEMALE	57.29	6.62	28
TTM retention	MALE	57.89	8.76	18
	Total	57.52	7.44	46
	FEMALE	61.56	7.00	27
CSAI retention	MALE	63.35	7.84	20
	Total	62.32	7.34	47
	FEMALE	59.38	7.08	55
Interaction effects	MALE	60.76	8.63	38
	Total	59.95	7.74	93

Table (4.7) showed that male and female students in the EG with CSAI had mean retention scores of 63.35 male and 61.56 female, the male and female students of the CG with TLTM had mean retention scores of 57.89 male and 57.29 female. This showed that teaching strategies CSAI and TLTM had positive effect on male and female students retention in Physics with male and female students in the EG having higher mean retention scores than the male and female student in the CG. However, the interaction effect of teaching strategies and gender on students' retention when exposed to CSAI and TLTM strategies favoured male and female in both groups as indicated by the pooled mean of 60.76 male and 59.38 female but comparatively in favour of male and female students in EG with CSAI.

Ho_2: There is no significant mean interaction effect between strategies and gender on students mean retention scores in physics when taught using CSAI and TLTM.

Table (4.8): Analysis of Covariance on Mean Interaction Effect of Teaching Strategies (CSAI & TLTM) and Gender on Mean Retention Scores of Students in Physics.

Source	Type III Sum of Squares	Df	Mean Square	F	P. value
Corrected Model	2148.482[a]	4	537.121	14.075	.000
Intercept	912.746	1	912.746	23.918	.000
Post test	1572.460	1	1572.460	41.205	.000
Group	99.904	1	99.904	2.618	.109
Gender	3.823	1	3.823	.100	.752
Strategies(*)Gender	.525	1	.525	.014	.907
Error	3358.249	88	38.162		
Total	339707.000	93			
Corrected Total	5506.731	92			

R Squared = .390 (Adjusted R Squared = .362)

Table(4.8) showed that the probability value associated with the calculated F_{cal} (0.014) is 0.907. The P(0.907) is greater than the (0.05) level of significance. Hence, the H_{04} was accepted. This implies that there was no significant interaction effect between teaching strategies (CSAI & TLTM) and gender on students' mean retention scores in Physics when exposed to CSAI and TLTM. This indicates that gender of the students did not actually combine with the teaching strategies CSAI and TLTM to enhance students' retention in Physics. Rather, the Positive effect observed is due to the teaching strategies used in favour of the EG with CSAI.

SUMMARY OF FINDINGS

1. The teaching strategies CSAI and TLTM enhanced students' achievement in Physics equivalently. But comparatively; CSAI enhanced students achievement in Physics more than TLTM. However, there was no interaction effect between mean achievement scores of students in Physics when exposed to CSAI and TLTM.
2. There was significant difference between the mean retention scores of students in Physics when exposed to CSAI and TLTM in favour of the students in EG with CSAI. This indicates that CSAI enhanced positively students' retention in Physics more than the TLTM.
3. There was no significant interaction effect of teaching strategies and gender on students mean retention scores in Physics when exposed to CSAI and TLTM. This indicates that gender of the students did not actually combine with teaching strategies to affect the retention of the students in Physics. Rather, the observed positive effect was due to the teaching strategies used in favour of the student in EG with CSAI.

Discussion of findings

Table (4.3) showed that students exposed to CSAI had higher retention in Physics than students exposed to TLTM. Table (4.8) showed there was no interaction effect between teaching strategies and gender on retention of students in Physics when exposed to CSAI and TLTM. This indicates that the positive effect on students retention in Physics was caused by teaching strategies in favour of EG students with CSAI strategy This might be due to the potential of computer nsimulationto present dynamic models of Physics systems to the students which created motivation and positive mental readiness to learn enabling them to form gestalt of the concepts presented for study. Table(4.7) however showed that teaching strategies CSAI and TLTM

had positive effect on male and female students in Physics but the male and female students with CSAI had higher retention than the male and female students exposed to TLTM. The findings of the study corroborated with the findings of Yalcin and Bayrakceken (2010) who affirmed that computer simulation enhanced students' ability to retain and remember observed events. It also agrees with the findings of Mariam(2018) who affirmed that computer simulation in learning enhanced retention and comprehension of Physics concept. This is also line with the findings of Izzet and Ozkan (2008) who oponed that Computer simulation enhances gender parity in learning and Parhi(2013) who revealed that when learning events are made real to the learners it enhances learning outcome such as retention and remembering

Conclusion of the study:

This study revealed that computer simulation instruction CSAI strategy enhanced students' retention in Physics more than the traditional lecture teaching method TLTM strategy. Furthermore, the study showed that gender did not combine with the teaching strategies CSAI and TLTM to enhance male and female students retention in Physics. Rather, the positive effect observed was attributed to the teaching strategies used in favour of the CSAI strategy. This revealed that CSAI enhances gender parity in the learning of Physics in senior secondary schools in Abia state.

Recommendation:

Based on the findings of this study, the following recommendations were made.

1. Since computer simulation was found to have synergic effect on students' retention in Physics, it is therefore necessary for teachers to adopt it as instructional strategy in the teaching and learning of Physics.
2. The curriculum planners should incorporate computer simulation instructional strategy into the secondary school Physics curriculum to ensure that schools will embrace the integration of computer simulation as an ICT technology into the teaching of Physics.
3. Computer simulation design should be included as a course of study in Physics curriculum for students in science education programs of the colleges of education and universities to enable them design computer simulation of Physics concepts based on their students cognitive level.

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