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Effects of Computer Simulation Demonstration Instruction Strategy and Gender Challenges on Male and Female Students' Achievement in Physics in Ohafia Education Zone Abia State

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Abstract

Pretest-posttest quasi-experimental research design was adopted to investigate the effect of Computer Simulation Demonstration Instruction Strategy CSDIS on male and female Students' achievement in Physics in Abia State; involving 93 senior secondary school I (SSS1) Students of intact classes purposively selected from the population of 86 coeducational secondary schools in Ohafia Education of the state. Three research questions and three corresponding hypotheses guided the study. The instrument for data collection was adapted Physics Achievement Test (PAT) containing 50 multiple choice test questions which was face and content validated by three experts in the field of education and subjected to test of reliability using Kudar-Richardson's (K-R 20) formulae and a reliability coefficient of (0.82) was obtained. The data collected was analyzed statistically using Mean and Standard Deviations to answer the research questions while t-test analysis and analysis of covariance (ANCOVA) was used to test the hypotheses at (0.05) level of significance. The findings of the study showed that although there was no significant difference between the mean achievement scores of male and female students taught Physics using Computer Simulation Demonstration Instruction Strategy (CSDIS); that CSDIS enhanced students' achievement in Physics across gender. Furthermore, the findings showed that there was a significant-difference between the mean achievement scores of male and female students taught physics using TLDTS. In addition, the observed mean difference showed that CSDIS enhanced male and female students' mean achievement scores in Physics more than the TLDTS. Furthermore, the findings of the study revealed there was no significant interaction effect of teaching strategies (CSDIS & TLDTS) and gender on students' mean achievement scores in Physics. Based on the findings of the study, it was recommended among others that curriculum planners should re-plan the Physics national curriculum to accommodate computer simulation Demonstration instruction Strategy CSDIS to enhance teaching and learning of Physics in senior secondary schools in Abia state, government should organize seminars and workshops to train and retrain in-service Physics teachers in Abia state to integrate the use of CSDIS strategy in the teaching and learning of Physics in the classroom. Also, school administrators should increase the time allocated to the learning of Physics in secondary schools' time table to accommodate the use of CSDIS in the class room for the learning and teaching of Physics in senior secondary schools in Abia state.

Keywords: *Physics, Achievement, Computer Simulation, Gender, Learning*

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Background to the Study

The factors that affect students learning in Physics as a science subject include nature of subject matter, Physical limit and cognitive ability of the learner, lack of interest and motivation, difficulty and abstract nature of Physics concepts, lack of balance, unsuitable teaching method, misconceptions in Physics and gender limitations (Adegoke & Chukwunenye, 2013; *Logar & Savec, 2011).* However, misconceptions in Physics, teaching methods and gender play important roles in career selections, and academic achievement of students in learning of science in general (Parhi, 2013). Gender is a term that psychologically and sociologically differentiates humans based on sex. According to Parhi (2013), gender psychologically differentiates humans with same skeletal structure but different sex organs: Gender shows that humans have gonads in the form of testis in male with X chromosones and ovaries in female with and Y chromosomes. Sociologically, Parhi (2013) further opined that gender differentiates the sitting posture, cultural dressing and dancing of male and female citizens a society. In addition, Singh *et al* (2008) opined that gender differentiates male as humans with masculine physical outlook while female has feminine nature. Physically, the performance of male and female students in education could be relative. It was observed that the male could perform better than the female in Physical task such as mechanical work and inclined to areas of study such as Physics , Mathematics, Engineering, and Medicine while the female tend to perform better than the male in linguistics and emotional management and tends towards areas of study such as arts, secretarial studies, nursing, Teaching and Linguistic studies which was not unconnected with the female notion that fields of study such as Mathematics, Physics, Medicine and Engineering were for males that are masculine rather than the female with feminine body (Pharhi, 2013; Singh *e tal;* 2008). In line with the forgoing, Aina (2013) opined that when given equal opportunities, male students performed better than the females in sciences especially Physics and Mathematics.

The concept of learning plays important role in the education of male and female students in secondary schools. According to Singh, *etal* (2008), learning is defined as a process through which old behavior is weakened or new behaviour is formed which depends on experience devoid of factors such as native response tendencies, temporary state of the learner such as drug effect and emotional current. According to Parhi(2013), learning is that event which brings about relative permanent change which is enduring and modifiable by experience through training and practice in a formal or informal educational activities devoid of factors such as fatigue, illness, drugs and maturation which also causes permanent changes in behavior of an individual and opined that learning involves motive, attractive goal and barrier to the attainment of such goal. On one hand, Motive is a dynamic force which energizes and compels a learner to act towards forming and modifying a behaviour. Motive and needs of a learner demand satisfaction and the actions taken by a learner towards satisfying such needs depend on the strength of the need which manifests in the form of the strive to attain the goal. Another factor in the process of learning is the barrier to learning which keeps the learner from attaining the goals set in learning. Barrier in learning is an essential ingredient of a learning process without which the needed motive for changes in behavior to attain a goal of learning will not occur.

The three stages of a learning process which are motive, set goal and barrier to goal attainment produce essential readiness and interest in a learner to learn which are preceded by a learning situation. The quality, speed and the effectiveness of a learning process is dependent on the kind of learning situation and learning environment available for learning. According to Parhi (2013), Warm and favourable environment brings about satisfactory results in learning while poor and unfavourable environment acts as obstacle in the path of learning and opined that learning as a process is purposive, goal directed and leads to change in behavior and reconstruction of experience. As an audio-visual instructional aide, computer simulation plays vital roles in learning situation by helping the learner to achieve a set goal which involves guiding the learner to attain desirable change in behavior by enriching the teaching learning environment which helps to motivate the learner to learn (Taskin & Kandemir. 2010). According to Trundle and Bell (2010), computer simulation also makes learning purposeful by focusing the attention of the learner on the set goal of a learning event and arouse interest of a learner to overcome barrier, creates motivation and help the learner reconstruct experience in the light of superior evidences to provides valid responses to stimuli in a teaching learning process of Physics. Based on the forgoing, Sadideen, Alamoni *etal* (2012) opined that computer simulation creates a common visualization between students and the teacher which facilitates communication in teaching. Comparing audio virtual teaching strategies with other strategies in learning, it was found that limitations of using pictures and gestures in classical Physics lectures makes it difficult to convey fundamental concepts to students but computer simulation serves as a versatile audio-visual aid to instruction, increasing communication, interactive engagement through lecture demonstrations and concept test; allowing a learner to focus on critical information, develop skill and makes learning easier towards enhancing academic achievement of a learner. (Liu, Hmelosilver 2019; Musasia, Abacha & Biyoyo, 2012). According to Singh *etal* (2008), the level of achievement a learner makes in learning can be influence by the teachers understand of a learning curve which is described as a graphical representation of a learner's improvement in a given learning event brought about by experience and practice. Also, singh *etal;* (2008) opined that learning curve has unique features such as initial linear improvement and non-uniform rate of improvement regardless of how rapid or slow the learning session may be. This shows that achievement in learning does not necessarily follow a linear path; rather involves ups and downs until a learner reaches a point beyond which little or no learning takes place after repeated practice. Also, between the starting and terminal end of a learning curve is a static state know as stage of plateau where no effective learning takes place in the learner.

According to Parhi (2013), learning process can progress meaningfully if the learner overcomes stage of plateau with maximum improvement in learning opined that learning plateau is caused by lack of interest and motivation, unsuitable teaching method, difficulty of a subject matter, transference of error and lack of balance between different phases of a complex concept. Also, parhi (2013) opined that for a teacher to prevent or overcome stage of plateau in learning, the teacher should adopt appropriate and varying method of teaching to accommodate the nature and emotional state of the learner, ensure proper organization of subject matter, with development of interest. As an important factor in learning, motivation

is defined according to Parhi (2013) as a driving force that accounts for the arousal, selection, direction and continuation of behavior in education. To enhance motivation in learning, Parhi (2013) opined that the importance of classroom learning should be made real by relating it with real life situation to the leaner. This the teacher could achieve using computer simulation to present concepts, creates real life experience of Physics concepts, to reduce or eliminate the formation of plateau in learning thereby increasing motivation and interest encouraging student's participation in learning towards enhancing conceptual understanding and achievement in Physics. In the context of this study, Computer Simulation Demonstration Instruction Strategy (CSDIS) is the use of computer simulation to represent dynamic model of concepts in Physics for students to view and gain insight with understanding of the concepts. According to Aina (2013) computer simulation assisted instruction strategy in learning is the use of computer simulation for demonstration in the classroom to complement teaching methods. The CSDIS is not a teacher centered rather creates a virtual environment where students are active participants in a learning session while Traditional Lecture Demonstration Teaching strategy is the use static and didactic materials to represent and demonstrate concepts and event in learning which is teacher centered where the teacher for purpose of passing information present models of concepts in Physics for students to learn. According to Logar and Savec (2011), in the Traditional Lecture Teaching Method of teaching, the teacher transmits information and facts about a subject matter verbally to students which some time involves demonstration to the students with static material. As one of the core science subjects in senior secondary schools' curriculums and also studied as a career course in the universities, the word Physics as a concept which originated from the Greek word Physics meaning nature (Physicsstackexchange.com), Physics is defined as the study of natural phenomena such as land and sea breezes, waves, Thunder and lightning, force of gravity at its fundamental level (Nelkon & Parker, 1998). The scope of Physics can be understood from its concepts of mechanics which deals with the motion of bodies, optics which deals with light, acoustics which deals with sound, waves which deal with energy in the form of ripple effects, atomic and nuclear physics which deal with atomic properties of matter and radioactivity, and electromagnetism. As an empirical science, Physics has brought to man deeper understanding of the nature of the physical world and the principles that govern its natural phenomena.

According to Young and Freedman (2008), Physics deals with physical theories and laws whose ultimate validity are dependent on the agreement with observations of physical phenomena and experimental results which help man to understand cause-effect relationships in natural phenomena. Physics plays a vital role in the scientific and technological advancement of a nation especially the developing nation like Nigeria. According to Kaya and Boyuk (2011), Physics has helped man to generate energy not only from petrol and coal but also extracted energy from the sun through solar technology and from the core of the atom by harnessing the potentials of nuclear radioactivity which has changed the history of weaponry in the world. Today, Man can watch events happening in different continent of the world from a point through satellite technology, through the understanding of the principles of mechanics, new weapons and fastest computers are

manufactured using semiconductor and superconductor materials made from advancements in solid state Physics. In accordance with the forgoing, Adegoke and chukwunenye (2013), opined that Physics education helps students to understand the dynamics of the world around them by enhancing their creative power, cognitive ability and arousing in them positive attitude in this era of scientific and technological advancement.

Thus, to make understanding of abstract Physics concepts and phenomena easier to the students in their learning processes, and ensure inclusive education across gender, use of information and computer simulation technology in the form of computer simulation as an audio-visual instructional technology becomes inevitable. Expectantly, one of the purposes of learning in education is to ensure that the learner acquires the optimal understanding of the concepts taught in class and mastery of the skills required in learning to attain the required behaviour depicting the learners' level of achievement of the concepts taught in classroom. According to Akani (2015), academic achievement is the reflection of the ability of a learner to study, retain and remember facts acquire in learning and being able to communicate his knowledge orally or in written form in an examination condition. Also, babajide (2010), described academic achievement as a measure of a learner's ability to apply knowledge of concepts acquired in learning satisfactorily in reality which is an indication of the attainment of valuable knowledge for production of excellence. Furthermore, Kpolorie, Ololube and Ekwebelem (2011), described academic achievement as the evidence of the knowledge attained and skill acquired in the school subjects shown in the form of scores in a formal test or examination designed by the teacher or in a standardized examination. As a measurable index in education, academic achievement can be ascertained by test assessment which plays a significant role in any educational system as it depicts the level of a learner's cognitive ability, effective domain and psychomotor skills in learning.

Moreover, Godwin, Adrian and Johnbull (2015), opine that learning of Physics demands that the learner be strongly built in the three domains of learning in education and be successful in both the practical and theoretical aspect. In addition, Alameyeseiha and Kpolorie (2013), described academic achievement as a measure of the capabilities of a student from which the covert and overt abilities of a learner could be inferred and opined that academic achievement assessment is vital in learning; stressing that it would be irrational to think of teaching without assessment test, measurement and evaluation. As an aid to instruction, computer simulation is one of the ICT educational instructional technologies with potential effects to correct misconceptions in Physics, scaffold hidden features of the abstract concepts of systems in Physics through the use of dynamic model of such systems, improve the cognitive abilities of the students and encourage collaborative learning and learning by discovery in education, (Gambari, Yusuf & Olumorie, 2015). Computer simulation is described as the computer presentational model of a dynamic system or events in a real or imaginary world (Mengistu & Kahsay, 2015; Remero & Martinez. 2012). From their study, Romero and Martins (2012), classified computer simulation into Instructive Computer Simulation described as the type that provides information to the learner and includes symbolic computer simulation while Constructive Computer Simulation which includes experimental computer simulation is the type that

provides the learner with a contextual environment where they take active role. In accordance with this, Liu and Hmelosilver (2019), opined that computer simulation aids instruction and provides students the opportunity to observe abstract world experience, interact with it through virtual experiments and also allows students to monitor experiments, test new model and improve their conceptual understanding of scientific phenomena. Furthermore, computer simulation enables presentation of laboratories that are impractical, expensive or too dangerous to perform before engaging in real laboratory experience an also serves as alternative tool for learning where real equipment is either not available or impractical to set up and opined that computer simulation can change variables easily in response to students questions which could be difficult or impossible to change with real apparatus and reveal hidden aspects of Physics concepts with multiple model representation (Dejong, linn & zacharia 2013, Logar & Savec, 2011). Also, computer simulation provides students the opportunity to run on their own simulation of Physics concepts at home to go over it to extend classroom experience and strengthen their understanding rather than synchronized attendance by instructors and the learner. The importance of computer simulation is also evidence in distance education. According to Yacin and Bayraceken (2010), educators creating Distance Education Path Ways may be faced with the difficulty of including hands on laboratory experience which will entail learners to be present in a laboratory with laboratory materials.

However, computer simulation provides distance laboratory with animation for the learners to engage in laboratory experience with virtual environment and enhance purposeful inquiry among the learners. According to Abungu, Okere and Wachanga (2014), computer simulation actuates science process skill such as observing, inferring, measuring, communicating, classifying and predicting skills. In addition, Honey and Hilton (2011), listed integrated science process skill as controlling variables, interpreting of data, experimenting and formulating hypothetical models. Kahiru (2014), investigated use of computer simulation as an inquiry tool and opined that computer simulation enhances students' inquiry procedure such as the ability to hypothesize, conduct experiment, observe and record data and draw conclusions; stressing that computer simulation arouses motivation and interest of the learner towards enhancing Physics conceptual understanding. In the learning of Physics, computer simulation combines animation and visualization of science phenomena, supports the development of insight to form gestalt into phenomena and positive conceptual understanding of Physics at the micro level by attaching metal images to these concepts (Ryoo & Linn, 2012). According to Nowak *etal* (2010), the formation of mental model images using computer simulation aids students understanding, interpretation of concepts and phenomena which is formed and reformed by experience, socio-cultural values and beliefs, historical and prior opinion. The use of model in computer simulation aids teachers to assist students in constructing model representation of concepts in Physics, which helps them build a mental model of concepts. According to Konecek *et al* (2015), learning of Physics continuously requires students to identify hidden aspects of concepts, define adequately quantities and explain underlying laws and theories using skill of reasoning. When students' mental model of a concept is concrete and similar to their prior knowledge, it influences their perception of concept and the constructing and restructuring

of their conceptual understanding in Physics (Stieff, 2011). Furthermore, Wieman, *etal* (2010), affirms that because computer simulation simplifies versions of the natural world with the potential to focus student's attention more directly on any targeted phenomena, it enhances students' understanding of Physics concepts and students' ability to apply the learned Physics concepts to scientific phenomena in everyday life situations which include the capacity to recognize new concept, construct explanation and make connections among scientific Phenomena. The effects of computer simulation on students' achievement in learning had been a subject of discuss among researchers in the field of education.

From their study, on the effect of computer simulation on first year general cause students, Dejong, Linn and Zacharia (2013), affirmed that combination of computer simulation with real laboratory experience offer advantage in time as laboratory portions was reduced in length stressing that students using computer simulation had better knowledge of practical activities. Zacharia (2017) investigated the effect of computer simulation on students learning of volume displacement and found that computer simulation was as effective as hands on laboratory experience and acts as alternative to laboratory experience in the performance of male and female students exposed to computer simulation contrary to the case of students exposed to real hand on tools laboratory experience and affirmed that computer simulation facilitates gender parity in learning of experimental Physics and help to eliminate learning deficiencies by helping to scaffold learning of those students whose spatial ability is relatively low which is critical in understanding the dynamics of systems in Physics.

Tolgar (2011) conducted a study on effect of computer simulation on achievement and attitude of students in Physics in turkey. The findings showed that there was significant different between achievement of students exposed to traditional Physics learning and computer simulation in favour of those exposed to computer simulation and further revealed that students felt challenged and prefer doing their work using computer simulation, with improved understanding of the basic principles of Physics and encourages teachers' use of computer simulation as aid to instructional strategy in the teaching and learning of Physics. Also, Alexandra , Antonia *eta*l (2013) conducted a study on the effect of experimental work, teachers mediation practice and computer simulation on the epistemic practices of primary teachers education students in Portugal and found that there was a significant difference in the epistemic practices of students using teachers mediation practices, computer simulation and experimental work in favour of the students exposed to computer simulation and opined that epistemic practices were better enhanced due to use of computer simulation and stressed that epistemic practices of students could be enhanced when teachers mediation practices are incorporated with computer simulation in the classroom or laboratory activities. Also, Sreeleka (2018) revealed that students exposed to computer simulation had higher achievement in Physics with higher acquisition of practical skill than the students exposed to conventional instructional strategy without computer simulation and stressed that the potential of computer simulations to creates visual environment and with animation help students to view models of abstract concepts in Physics, make them interactive and reflective in learning. Moreover, the study revealed that there was interaction effect between treatment

and attitude on students' achievement and acquisition of practical skills in Physics. Candida, cravino and soares (2014), studied the effect of computer simulation on students understanding of Physics concepts and revealed that there was significant difference in conceptual understanding of students taught Physics with computer simulation and with hands on experiment alone in favour of those exposed to computer simulation in Physics but opined that the efficiency of computer simulation in Physics learning depends on the teacher's role in its implementation.

Moreso, Ozet (2016), investigated the effect of 5E learning circle with computer simulation on students learning of the concept of static electricity in Turkey and revealed that computer simulation enhanced students' comprehension of abstract static electricity concepts with high achievement in Physics than students exposed to traditional teaching method and stressed that careful attention should be paid in the design of lessons when using computer simulation as instructional strategy. However, Abungu, okereke and Wachanga (2014) revealed that there was no significant difference between performance of male and female student exposed to computer simulation in the learning of Physics and emphasized that if given equal opportunities, students will perform better irrespective of their gender. Also, Izzet and Ozkan (2008) opined that the use of computer assisted instruction in learning enhances gender parity in the learning of Physics. In addition, Adeyimi (2010) opined that there was no significant difference between male and female students' performance in Physics in a cooperative learning setting with computer simulation and proper interpretation of concepts. In accordance with this, Khan (2011), opined that challenges of gender differences in education can be overcome when supportive policies are made to ascertain positive expectations of academic achievement for inclusive education.

Statement of the problem

The enrolment of female students into pure science classes to do Physics as a science subjects in secondary schools had been comparatively low in Ohafia education zone of Abia state. This could also be applicable in other educational zone in Abia state and Nigeria at large. According to Parhi (2013), this is partly due to the female students' misconceptions that fields of study such as Mathematics, engineering and medicine are for the male gender with masculine body, due to the perception that Physics and Mathematics are hard subjects to learn in secondary schools and low cognitive ability of students to comprehend knowledge of the abstract concepts of systems in Physics. This has impacted negatively on the demographic data of female students taking career in Physics and other Physics related causes in the universities. Against this gap in gender inclusiveness in education in the learning of Physics as a science subject this study pivoted on the potential of computer simulation in education to arouse interest and motivation, scaffold learning of hidden features of abstract Physics concepts through the use of dynamic model of such systems to increase concept understanding in a virtual environment. Hence, the poser of the study: what is the Effects of Computer Simulation Demonstration Instruction Strategy on male and female students' achievement in Physics in Ohafia Education Zone Abia State.

Research Questions

1. What is the pretest and posttest mean achievement scores of male and female students in Physics when exposed to Computer Simulation Demonstration Strategy CSDIS?
2. What is the pretest and posttest achievement mean scores of male and female students in Physics when exposed to traditional demonstration teaching strategy TLDTS?
3. What are the interactive effects of treatment (CSDIS & TLDTS) and gender on students' academic achievement in Physics?

Research Hypotheses

1. H_{01}: There is no significant difference between the mean achievement scores of male and female students in Physics when exposed to CSDIS.
2. H_{02}: There is no significant difference between the mean achievement scores of male and female students in Physics when exposed to TLDTS.
3. H_{03}: There is no significant interaction effect of teaching strategy (CSDIS & TLDTS) and gender on students' academic achievement in Physics.

Research Method

The study adopted pretest posttest quasi-experimental research design involving non-randomized intact classes divided into experimental group and control group classes respectively. The dependent variable is the academic achievement of male and female students in Physics, the independent variables are the teaching strategies CSDIS and TLDTS while the intervening variable is the gender of the students. The study was conducted in Ohafia education zone of Abia state. Ohafia education zone is located in Abia North senatorial zone of Abia state which is a state in the south east of Nigeria divided into three educational zones (Ohafia Education Zone, Aba Education Zone & Umuahia Education Zone). The Ohafia Education zone of the state is comprised of four sub-zones with 86 public coeducational secondary schools distributed thus across the four sub-zones: Ohafia LGA, 28; Bende LGA, 25; Arochukwu LGA, 17; and Isukwuato LGA, 16; (SEMB, 2017).

The target population comprised of the Senior Secondary School one (SSS1) Physics students in all the 86 public coeducational secondary schools in Ohafia education zone Abia state. Students in SSS1 were selected for the study because they are foundation class in senior secondary schools and equivalent in their Foundation knowledge of Physics. Purposive sampling technique was adopted to select Ohafia education zone out of the three education zones in Abia state and two LGAs in Ohafia education zone. Used for the study. Two schools were also purposively selected 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 assessable power supply willingness to support and assist the researcher in conducting the research. The sample size was 93 (SSS1) Physics students. The control group has 46 students comprised of 18 male and 28 females. The Experimental Group has 47 students comprised of 20 male and 27 females. The instrument for data collection was Physics

Achievement Test PAT adapted from West African Examination Council WAEC and National Examination Council NECO past question papers. The PAT was face and contents validated by three experts in the field of science education one from measurement and evaluation while two are from department of Physics education and tested for reliability using Kudar-Rechardson (KR-20) formular and a reliability coefficient of 0.82 was obtained.

Method Data Collection

The computer simulation assisted instruction package used contains static electricity concepts simulation adopted from Physics Education Technology PhET designed by Physics Education Research PER group of the University of Colorado through the internet and copied into a flash drive. The computer simulations used were extracted from the flash with laptop computer projected on a white screen to give the assisting Physics teachers brief orientation before the actual treatment commenced. The CSDIS was presented to the students using a projector on a white screen by the teacher in front of the students during the teaching sessions intermittently at different stages of the class adapting maxims of learning. Only relevant sections of the lessons that require computer simulation were presented to assist in explaining Physics concepts to the students. The Pretest assessment was administered to both groups before treatment. After treatment, the posttests were administered to the two groups 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 while t-test analysis and ANCOVA at (0.05) level of significance were used to analyze the research hypotheses.

Result and Discussion

In this section, the result of the data analyses, discussion, conclusion and recommendation made from the study were presented.

Research Question 1:

What are the effects of Computer Simulation Demonstration Instruction Strategy on mean achievement scores of male and female students in Physics?

Table 1: Mean Achievement scores and standard deviation of male and female students taught Physics with Computer Simulation Demonstration Instruction Strategy (CSDIS)

Group	Gender	N	Pretest Mean	Mean Diff	Std. Dev.	Posttest Mean	Mean Diff	Std. Dev.	Mean Diff
CSDIS	M	20	48.60	0.56	6.60	61.30	4.78	9.26	12.5
	F	27	48.04		7.94	56.52		7.49	8.48
	Total	47							

That the difference between the pretest mean achievement scores of male and female students in the CSDIS group is 0.56 in table (1) showed that the students were equivalent in their foundation knowledge in Physics before the treatment. Also, that the mean differences

gained in CSDIS group by the male is 12.5 and female is 8.18 indicates that there is positive effect of treatment with Computer simulation demonstration instruction strategy on male and female students' achievement in Physics with the male students having higher mean achievement score of 61.30 standard deviation of 9.26 than the female students with mean achievement score of 56.52 and standard deviation of 7.49.

Hypothesis 1:

H_{01}**:** There is no significant difference between the effects of treatment (CSDIS) on male and female Students' mean achievement scores in Physics.

Table 2: t-test analysis of the mean achievement scores Of Male and Female students taught Physics with CSDIS.

Group	Gender	N	Pretest Mean	Std Dev	Posttest Mean	Std Dev	Df	T_{crit}	T_{cal}	Remark
CSDIS	**M**	20	48.60	6.60	61.30	9.26	45	2.01	1.91	S
	F	27	48.04	7.94	56.52	7.49				
	Total	47								

S=Significant, Df= degree of freedom, T_{crit} =table t-value, T_{cal} = Calculate t-value

Table 2 shows that the calculated t-value ($t_{cal.}$=1.91) is lower than the table t-value (t_{crit}=2.01). When analyzed at the (0.05) level of significance, the H_{01} was not rejected. This implies that CSDIS Affected positively mean achievement scores of male and female students equivalently in Physics.

Research Question 2:

What are the effects of treatment (Traditional Lecture Demonstration Teaching Strategy) on mean achievement scores of male and female students in Physics?

Table 3: Mean Achievement scores of male and female students taught Physics with Traditional Lecture Demonstration Teaching Strategy (TLDTS).

Group	Gender	N	Pretest Mean	Mean Diff	Std. Dev.	Posttest Mean	Mean Diff	Std. Dev.	Mean Gain
	M	18	47.94		7.15	56.61		8.58	8.67
TLDTS	F	28	47.96	0.02	5.14	53.64		7.41	5.68
	Total	46							

That the difference in pretest mean scores of male and female students is 0.02 in table 3 showed that the male and female student in the TLDTS group were equivalent in their foundation knowledge in Physics before the treatment commenced. Also, from table 3, that the mean differences gained by the male is 8.62 and female is 5.68 indicates also that there is positive effect of treatment with Traditional Lecture Demonstration Teaching Strategy on male and female students' achievements in Physics with the male students having higher mean achievement score of 56.61 and standard deviation of 8.58 more than the female students with mean achievement score of 53.64 and standard deviation 7.41.

Hypothesis 2:

H_{02}: There is no significant difference between the effects of treatment (TLDTS) on male and female students' mean achievement scores in Physics.

Table 4: t-test Analysis of the mean achievement scores Of Male and Female students taught Physics with TLDTS.

Group	Gender	N	Pretest Mean	Std Dev	Posttest Mean	Std Dev	Df	T_{crit}	T_{cal}	Remark
	M	18	47.94	7.15	56.61	8.58				
TLDTS	F	28	47.96	5.14	53.64	7.41	44	2.01	3.91	NS
	Total	47								

NS=Not Significant, Df= Degree of freedom, T_{crit} =Table t-value, T_{cal}= Calculate t-value.

Table 4 shows that the calculated t-value ($t_{cal.}$=3.91) is higher than the table t-value (t_{crit}=2.01). When analyzed at 0.05 Significance Level, the H_{02} was not accepted. This indicates that the treatment (TLDTS) affected also mean achievement scores of male and female students in Physics with the achievement between male of female significantly different in favour of the male than the female students.

Research Question 3:

What is the interaction effect of teaching strategies (CSDIS & TLDTS) and gender on mean achievement scores of students in Physics?

Table 5: Interaction Effect of the Teaching Strategies (CSDIS & TLDTS) and Gender on Mean Achievement Scores of Students in Physics.

Method Interaction	Male And Female Gender	Mean	Std. Deviation	N
	FEMALE	54.89	7.38	28
TLDTS	MALE	56.50	9.08	18
	Total	55.52	8.03	46
	FEMALE	57.26	7.38	27
CSDIS	MALE	60.05	8.91	20
	Total	58.45	8.10	47
	FEMALE	56.05	7.41	55
Interaction effects	MALE	58.37	9.05	38
	Total	57.00	8.15	93

N= 93; TLDTS= Traditional Lecture Demonstration Teaching Strategy; **CSDIS**=Computer Simulation Demonstration Instructional Strategy.

Result in Table (5) showed that male students taught with CSDIS had more mean achievement score than the male students taught with TLDTS as indicated by the mean scores of 60.05 and 56.50 respectively, female students taught with CSDIS strategy had also

more mean score than the female students taught with TLDTS as indicated by the mean levels of 57.26 and 54.89 respectively. However, the interaction effects of teaching strategies (CSDIS & TLDTS) and gender on students' achievement in Physics favoured both male and female students as indicated by pooled mean of 58.37 male and 56.05 female; but in favour of male and female students taught Physics with CSDIS.

Hypothesis 3:

H_{03}: There is no significant interaction effect of teaching strategies (CSDIS & TLDTS) and gender on mean achievement scores of students in Physics.

Table 6: Analysis of Covariance (ANCOVA) for the interaction effect of Teaching Strategies (CSDIS & TLDTS) and Gender on Students' Mean Achievement Scores in Physics

Source	Type III Sum of Squares	Df	Mean Square	F	P-value
Corrected Model	2922.742[a]	4	730.685	20.149	.000
Intercept	609.383	1	609.383	16.804	.000
Pretest	2606.055	1	2606.055	71.863	.000
Group	20.951	1	20.951	.578	.449
Gender	10.287	1	10.287	.284	.596
Strategies(*) Gender	.735	1	.735	.020	.887
Error	3191.258	88	36.264		
Total	308271.000	93			
Corrected Total	6114.000	92			

From Table 6, it could be observed that the Probability (P)-value associated with the calculated F_{cal} (0.020) value for the interaction effect between teaching strategies (CSDIS & TLDTS) and gender is 0.887. Since this calculated P-value is greater than 0.05 Significance Level, the null hypothesis H_{03} when tested at the 0.05 level of significance is hereby upheld. Hence, there was no significant interaction effect of teaching strategies (CSDIS & TLDTS) and gender on students' mean achievement scores in Physics. This implied that the gender of the students did not actually combine with the learning strategies to influence their achievement in Physics; rather the increase in the students' achievement is not connected with the gender of the students but based on the learning strategies used in Favour of the students taught Physics with CSDIS.

Discussion of Findings

The findings in Table 1 and table 3 showed positive effects of teaching strategies (CSDIS & TLDTS) on male and female students' achievement in Physics with male and female students exposed to CSDIS having higher mean achievement scores than the male and female students taught Physics with TLDTS. The Findings of Table 2 and Table 4 showed that out of the two strategies (CSDIS & TLDTS), Computer Simulation Demonstration Instruction Strategy enhanced gender parity in the achievement of male and female students in Physics more than the Traditional Lecture Demonstration Teaching Strategy. Furthermore, the findings showed there was no interaction effect between teaching strategies (CSDIS &

TLDIS) and gender on students' achievements in Physics. These findings were attributed to the potential effect of computer simulation to create visual environment to the student's using presentation of the dynamic models of the Physics concepts taught and presented which enhanced conceptual understanding, aroused interests and motivation of both genders to learn Physics.

Computer simulation in Physics learning enhance male and female students' cognitive understanding of Physics concepts; providing them equal opportunities to ask and respond to questions thereby making the learning process interactive and participatory. The findings of the study corroborated with other previous findings which showed that computer simulation enhanced male and female students' achievement in Physics higher than the traditional teaching methods (Musasia, Abacha & Biyoyo, 2012; Tolgar, 2011; Ozet, 2016; Abungu, Okereke & Wachanga, 2014), The findings are also consistent with the previous findings which revealed that computer simulation enhances gender parity in the learning of Physics (Izzet & Ozkan, 2008; Zacharia, 2017). However, the findings of the study were at variance with the findings of Aina (2013) who found that there was significant different between achievement of male and female students in Physics when exposed to computer simulation instruction strategy and Sreeleka (2018) who opined that there was interactive effect of computer simulation and intervening variable attitude on student's achievement and acquisition of practical skills in Physics.

Conclusion

This study revealed that computer simulation Demonstration Instruction Strategy had positive effect on male and female students' achievements in Physics than the Traditional Lecture Demonstration Teaching Strategy and enhances gender parity. The study further showed that there was no significant interaction effect of treatment (CSDIS & TLDTS) and gender on students' achievement in Physics. This indicates that the observed positive effect of male and female students in Physics where due to the teaching strategies used with the CSDIS haven higher effect on the student's achievements than the TLDTS.

Recommendations

Based on finding of the study, the following were recommended:

1. Since the study revealed the positive potential effect of Computer simulation in learning, Physics teachers are encouraged to adopt use of dynamic computer simulation models to demonstrate concepts to enhance conceptual understanding of students in Physics across gender.
2. The national Physics curriculum developers should incorporate computer simulation into the Physics curriculum to ensure school administrators support integration of computer simulation as audio visual ICT instructional technology in the learning of both Practical and theoretical Physics.
3. Time allotted to Physic learning in public senior secondary schools should be increase to accommodate use of computer simulation in the classroom.
4. Government should invest generally in area of computer and information technology to modernize education and learning in public secondary schools in Abia

state; and through seminars and workshops train and retrain in service Physics teachers and teacher educators who would introduce computer simulations and its usage in Physics learning at colleges of education and faculty of education in the universities.

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