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Effects of Computer Simulation Teaching Strategy on Senior Secondary Two (SS II) Students' Achievement in Geography in Jos Metropolis, Plateau State, Nigeria

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ABSTRACT

This study was conducted to examined the effects of computer simulation teaching strategy on senior secondary two students' achievement in Geography in Jos Metropolis, Plateau State, Nigeria. The study The study adopts pretest posttest quasi experimental design where intact class was used. The population consisted of 1,337 students drawn from 33 public senior secondary schools. The sample of the study was 56 for both the experimental and control groups selected using simple random sampling. The instruments for data collection was Physical and Regional Geography Achievement Test (PRGAT). Content validity of the instruments was determined by experts from University of Jos. The reliability of the PRGAT was measured using Cronbach alpha statistics. A reliability coefficient of 0.74 for PRGAT was obtained. Research questions were answered using mean and standard deviation while the null hypotheses were tested using analysis of covariance (ANCOVA) at 0.05 level of significance. Findings of the study revealed that There is a significant difference between the posttest achievement in Geography mean scores of Senior Secondary Two students in the experimental and control groups. in favour of the experimental group. Moreso, there is no significant difference between the posttest achievement in Geography mean scores of Senior Secondary Two male and female students in the experimental group. meaning that computer simulation strategy is a gender friendly. Base on the findings of the study, it was recommended that computer simulation strategy should be adopted by teachers at all level of education. Also, teachers should be trained on the use of CSTS in order to improve students' achievements in school as it is a gender friendly strategy.

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INTRODUCTION

Geography involves the description, analysis and interpretation of spatial phenomena such as weather, soil, vegetation, drainage, population and the general topography of places. Geography also explains the relationship between different phenomena in a given Geographical region and how they interact within themselves. This deals with how human beings interact with phenomena on the earth surface, including the interaction between biotic and abiotic components of the environment and the interaction between the biotic components themselves.

Geography is a science that is concerned with the study of the interaction of phenomena in space. It deals with the description, analysis and explanation of the types and patterns of interaction of phenomena on the earth's surface (Dakur, 2021). This definition focuses on the interaction existing between phenomena on the earth surface, such as the interaction between climate and vegitation. There are other interactions and processes taking place beneath the earth's

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surface that are of geographical interest. This includes the plate tectonic, earthquake and volcanic activities.

The National Curriculum of Geography (2019) posit that the scope of Geography includes: physical, human and regional Geography, map reading, Geographical Information Systems (GIS) and Remote Sensing as well as Climate Change. Physical Geography is a branch of Geography that focuses on the natural features of the earth, including landforms, climate, vegitation and ecosystem. This provide a picture of the environment and forms of life that characterize the changes that occur in the exterior of the earth's structure which constitutes the biosphere, hydrosphere, lithosphere and the interior of the earth which is made up of the mantle and core. Students' knowledge of physical Geography could be useful for environmental protection.

The aspect of Human Geography deals with the activities of man in his environment including how to utilize available resources to satisfy the needs of man for sustainable growth and development. It covers human activities like industrialization, mineral resources exploration, mining, transportation, population, agriculture and sources of energy. Learners can use the knowledge of human Geography to provide solutions to environmental problems caused by different processes and raise the per capita income and gross domestic product (GDP) across different regions and localities. Regional Geography on the other hand consists of the various cultural and human activities conducted across different regions of Nigeria, West Africa, Africa and the world at large. It deals with population, agriculture, commercial activities, mining, tourism, transportation, industrialization and technological development of different region that can be conceptualized using sketch maps to locate and site these environmental features and activities.

Map reading is an aspect of Geography that enables individuals to understand and navigate both physical, social and human environments. Whether using traditional paper maps or digital mapping services like google maps, the Scope of map reading includes scale, relief and drainage, physical and human features, enlargement and reduction, cross-section, cross profile, bearing, distance calculation and vertical exaggeration.

The GIS and Remote Sensing are innovative technology for studying the environment that uses ICT for capturing, analysing, presenting and storing both data and information with the help of their coordinates. These skills are of paramount importance to teachers and learners in providing answers to Geographical questions like why environmental degradation, climate change and environmental pollution and applying different instructional strategies that employ the use of technology in teaching and learning. It is an educational paradigm shift from traditional to innovative strategies using computer softwares that provide the required skills and manpower needed for the development of the human race.

The essence of Geographic knowledge therefore is to ensure that the interaction of human and their environment enhances the sustainability of the ecosystem in order to prevent environmental use. Thus, Geographic knowledge helps students offering Geography to have meaningful understanding of the environment. The international communities and the world can facilitate the achievement of the Sustainable Development Goals(SDGs) (2015) through encouraging the learning of Geography at all levels of education. Again, students offering geography can have improved on their curiosity and attitude in geography, so as to be able to create environmental awareness among their peers for sustainability.

The reason for the inclusion of Geography on the senior secondary school curriculum is because of its relevance to the National development. The objectives of Geography curriculum in Nigeria include: Development of understanding and importance of spatial planning, ensuring continuity of human and natural growth and development in the environment. Also, it enabling students to acquire knowledge of natural resources and developing in students an understanding of how environment and climatic factors influence our environment.

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Achievement is concerned with the accomplishments of set objectives as a result of good mastery of learning material and it varies among learners based on different factors such as attitude, intelligent quotients, socioeconomic background, gender and type of schools as well as teaching method. Achievement varies between gender groups. Thus, there existing differences among researchers and scholars on the disparity between male and female students' achievement in Geography. For instance, Hursen and Asiksoy (2015) asserted that student's gender has no effects on their achievement in education. While Ilojeme and Okorieocha (2021) states that gender of students affects their achievement in education at large. This means that gender difference in academic achievement is still a controversial issue.

There is thus, inconsistency in the effects of gender on the achievements of students in Geography and Science subjects in general. For instance, Jibril and Dakur (2022) reported that there is no significant difference in Geography achievement between male and female Students. On the contrary, another study conducted by Irfan and Shabana (2018) found that there was a gender difference in Achievements of Secondary School Students in Physics. This indicates how gender and students' achievement remained a controversial issue among educationists and researchers up till today. In Subjects that requires less mathematical application like Biology, Literature, Government and English language, female students performed better (Ilojeme & Okorieocha, 2021). In subjects like mathematics, physics and Geography because of their calculation and outdoor activities, male students performed better than their female counterparts (Felix & Mogege, 2023). These suggest the need for continued investigation into the gender differences in Geography achievement and other disciplines by utilising teaching strategy that allow the learner to be learner cantered using technology.

Computer simulation teaching strategy is an approach that aims at providing students with realistic learning experiences and simplified abstract and complex learning experiences. Visualization of the mode of formation especially through the senses of seeing and hearing can easily help the learner to conceptualize the needed Geographical knowledge. It involves creating imitation scenarios that mirror real-life situations. It allows students to actively participate and apply their knowledge and skills in a controlled environment. This strategy is professed to have improved students' achievements in subjects like physics, chemistry, biology and agricultural sciences and Basic Science and Technology. This is as a result of its ability to enhance critical thinking, decision-making and problem-solving skills (Magaji, 2018). Therefore, the use of the Computer simulation teaching strategy could activate multiple skills in learning Geography. Such skills as observing, sketching, calculating, measuring, predicting, controlling variables, formulating hypotheses and interpreting results could be fostered by simulation strategy. Computer simulation teaching strategy may imply the forms of representation (images, animations, graphics and digital data) for a better understanding of concepts. This may lead to students' active engagement with the subject matter which enables them to develop critical thinking skills that can change the scenario of poor students' achievement in Geography.

If the poor achievement in Geography continue, it would affect the demand for skilled labour by the government and private establishments. Also, the deterioration of the environment will continue leading to degradation, climate change, pollution and intervention into the natural environment negatively because of shortage of skilled manpower that will work towards environmental protection and management. Example, lands officers, environmental protection officers, town planners, land reclamation officers, and geographic information officers. It is against this backdrop that the study is set to determine the effects of computer simulation teaching strategy on senior secondary II students' achievement in Geography in Jos Metropolis, Plateaus state, Nigeria.

Despite the importance of Geography to National development, students' achievement in the subject has been consistently poor in external

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examinations such as the Senior School Certificate Examination SSCE of West African Examination Council WAEC and National Examination Commission NECO (Chief examiners' reports, 22018-2023). For many years, Geography students' results revealed poor achievement. Wakjissa (2016) found that the Geography performance of secondary school students in Plateau State is as low as 3.2% and 3.7% in WAEC and NECO SSCE. This level of poor achievement is attributed to inappropriate teaching methods used by Geography teachers. Other factors include negative attitude of students towards Geography. In the same vein, Dakur's (2018) study revealed that more than 50% of the credits in Geography for many years were credits 5 and 6. Some schools only pass the subject with credit levels ranging from 0% to 17% in Plateau State. Likewise, the WAEC SSCE Chief examiner's reports for 2019, 2020 and 2021 depict under-achievements of students

Students' achievement in Geography in the WASSCE and NECO is very low. Poor attitude of students towards Geography may lead to students neglecting the subject, resulting in lower grades and a lack of understanding of the environment. From the researcher's teaching experience, students' poor achievement in physical and regional Geography has been consistently recorded in WAECSSE and NECO SSCE. This is as a result of utilisation of inappropriate teaching strategies. Also, students developed phobia in Geography as they tagged the subject *''Mugun ciwo''.* Meaning, a wicked disease. The Chief Examiners' reports of WAEC and NECO for the past six years (2018- 2023) consistently pointed to the poor achievement of Students in Geography, particularly physical and regional Geography. The analysis of the results of WAEC SSCE in Nigeria, shows that 49% to 58% of students pass the subject while the remaining 42% to 51% of candidate that sat for the examination fail (WAECSSE Chief Examiners Report, 2023.

Similarly, students gender which describe the biological sex of the student in a class is a variable that need to be studied. This is because of the dwindling effects it has on student's achievements. In some studies, student gender affects their achievement while other studies resale gender friendliness when students are exposed to threesome teaching strategy (Nwosu, & Ndanwu, 2020; Jibril, & Dakur, 2022).

Aim and Objectives of the Study

The aim of the study is to investigate the effects of computer simulation teaching strategy on Senior Secondary Two students' attitude and achievement in Geography in Jos Metropolis, Plateau State, Nigeria. The objectives of the study are to:

1. determine the pretest and posttest achievement scores of Senior Secondary Two students in Geography in the experimental and control groups.
2. investigate the posttest achievement in geography scores of Senior Secondary Two male and female students in the experimental group

Research Questions

The following research questions are raised to guide the study.

1. What are the pretest and posttest achievement mean score of Senior Secondary Two students in Geography in the experimental and control group?
2. What is the posttest achievement in geography mean score of Senior Secondary Two male and female students in the experimental group?

Hypotheses

The following null hypothesis will be formulated and tested at 0.05 level of significance:

1. There is no significant difference between the pretest and posttest achievement in Geography mean scores of Senior Secondary Two students in the experimental and control groups.
2. There is no significant difference between the posttest achievement in Geography mean scores of Senior Secondary Two male and female students in the experimental group.

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This study adapts the Connectivism theory propounded by George Siemens and Stephen Downes in 2005. Connectivism theory states that learning is not solely an individual activity but rather a collective and social process that is facilitated by technology and networks. Connectivism emphasizes the importance of connections and networks in the learning process. When it comes to learning Geography using computer simulation, connectivism theory can provide valuable insights into how students can develop a deeper understanding of geographic concepts. The principles of connectivism theory include: connecting information, networked learning, adapting to new information and constructive learning.

Studies on computer simulation teaching strategy according to studies revealed that computer simulation is an effective teaching strategy that improve students' achievement. Uwambajimana and Minani (2023); Ju (2023); Laurence and Wenceslas (2022); Mhamed, Mohamed, Abdesselam, Taoufik and El-Mehdi (2021) discovered that CSS improved the achievements of students significantly more than the control groups that were taught using conventional method. Similarly, gender of students when exposed to computer simulation, indicated that there is no significant gender difference. For example, Felix, and Mogege, (2023); Mengfan, Qiwei, Sabrina & Liqiang, (2022); Philip, Dauda, and Ndampon, (2023) mentioned that gender does not affects students achievement when exposed to the same teaching strategy.

METHODOLOGY

The study adopts pretest posttest quasi experimental design where intact class was used. The population consisted of 1,337 students drawn from 33 public senior secondary schools. The population is made up of 626 males and 386 females. The researcher selected Senior Secondary Two students for the study because they have offered Geography right from Senior Secondary one. The sample of the study was 56 for both the experimental and control group that were selected using simple random sampling. This comprised 24 (16males and 8 females) in the experimental group and 32 (21 males and 11 female) in the control group.

The instruments for data collection was Physical and Regional Geography Achievement Test (PRGAT**).** Content validity of the instruments was determined by experts from University of Jos. The reliability of the PRGAT and the SATGQ were measured using Cronbach alpha respectively. A reliability coefficient of 0.74 for PRGAT was obtained by calculating the reliability of the multiple-choice items and the essay items. After which the average of the two was sections was obtained. Research questions were answered using mean and standard deviation while the null hypotheses were tested using analysis of covariance (ANCOVA) at 0.05 level of significance.

RESULTS

Research Question One

What is the pretest and posttest achievement scores of Senior Secondary Two students in Geography in the experimental and control group?

Table 4: Summary of Pretest and Posttest Achievement Scores of Senior Secondary Two students in Geography in the Experimental and Control Group

		Pretest		Posttest		
Group	**N**	**Mean**	**SD**	**Mean**	**SD**	**Mean Gain**
Experimental	24	26.25	6.23	69.83	8.12	26.49
Control	32	27.06	9.92	43.34	5.13	

Table 1 revealed that the number of students in the experimental and control were 24 and 32 respectively. The pretest achievement mean scores of the experimental group was (26.25) with SD (6.23). While the pretest achievement mean scores of the control group

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was (27.06) with SD (9.92). The pretest achievement mean scores difference for the experimental and control groups was (0.81). Again, the posttest achievement mean scores for the experimental group was (69.83) with SD (8.12). The Posttest achievement mean scores of the control group was (43.34) with SD (5.13). Posttest achievement mean scores difference between the experimental and control group was (26.49). The study clearly revealed that the posttest achievement mean score difference between the experimental and control group is higher than that of the pretest. The posttest achievement mean scores difference (26.49) between the two group was in favour of the experimental group. This indicates that the treatment improves students' achievement towards Geography.

Hypothesis One

There is no significant difference between the pretest and posttest achievement in Geography mean scores of Senior Secondary Two students in the experimental and control groups.

Table 2: ANCOVA Results of Effects of Computer Simulation Strategy on Senior Secondary Two Students' Achievement in Geography

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
Corrected Model	9629.018[a]	2	4814.509	109.664	0.000
Intercept	15560.812	1	15560.812	354.442	0.000
Pretest	5.731	1	5.731	0.131	0.719
Treatment	9623.708	1	9623.708	219.207	0.000
Error	2326.821	53	43.902		
Total	179491	56			
Corrected Total	11955.839	55			

a. R Squared = .805 (Adjusted R Squared = .798)

The results in table 2 revealed that F (1, 53 =219.207), P = 0.000). This shows that P < 0.05 level of significance. At this point, the null hypothesis is rejected. Therefore, there is a significant difference in pretest and posttest achievement mean scores of Senior Secondary Two students in Geography in both the experimental and control groups. The Adjusted R Square (0.798) implies that 79.8% of the changes in student's achievement in the group was due to the changes in the treatment. That is the use of computer simulation strategy while others were due to factors captured as error. This means that CSS as the treatment was effective in improving students' achievement in Geography.

Research Question Two

What is the posttest achievement towards geography scores of Senior Secondary Two male and female students in the experimental group?

Table 3: Summary of Posttest Achievement Towards Geography Scores of Senior Secondary Two male and female students in the Experimental Group

Group	N	Mean	SD	Mean Gain
Male	16	71.25	8.11	4.25
Female	8	67.00	7.86	

Table 3 revealed that the number of students in the experimental 24 (16 males and 8 females). The Posttest achievement mean scores of male students was (71.25) with SD (8.11) while the posttest achievement mean scores of female students was (67.00) with SD (7.86). The posttest

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achievement mean score difference between the male and female students in the experimental group was (4.25) in favour of male students. This indicates that the treatment improves male students' achievement more than their female counterparts in Geography.

Hypothesis Two

There is no significant difference between the posttest achievement in Geography mean scores of Senior Secondary Two male and female students in the experimental group.

Table 4: ANCOVA Results of Posttest Achievement Towards Geography Mean Scores of Senior Secondary Two Male and Female Students in the Experimental Group.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	104.124[a]	2	52.062	0.775	0.474
Intercept	4857.542502	1	4857.543	72.284	0.000
Pretest	7.791103096	1	7.791	0.116	0.737
Gender	104.1065093	1	104.107	1.549	0.227
Error	1411.208897	21	67.200		
Total	118556	24			
Corrected Total	1515.333333	23			

a. R Squared = .069 (Adjusted R Squared = -0.020)

Table 4 revealed that the F (1, 21 = 1.549), P (0.227). Since the P value > α 0.05. The researcher failed to reject the null hypothesis. Therefore, there is no significant mean score difference in the achievement of male and female students that were exposed to treatment using CSS. The Adjusted R Square (-0.20) implies that < 1% of the changes in student's achievement in the group was due to the changes in the treatment, which is the use of computer simulation strategy while others were due to factors captured as error. This means that CSS as the treatment was effective in improving students' achievement in Geography irrespective of gender difference.

DISCUSSION OF FINDINGS

Findings of the study revealed that The posttest Geography achievement mean scores difference (26.49) between the two group was in favour of the experimental group. This indicates that the treatment improves students' achievement towards Geography. Similarly, the results in table 2 revealed that F (1, 53 =219.207), P = 0.000). This shows that P < 0.05 level of significance. At this point, the null hypothesis was rejected. Therefore, there is a significant difference in pretest and posttest achievement mean scores of Senior Secondary Two students in Geography in both the experimental and control groups. This finding corroborates the findings of Laurence and Wenceslas (2022); Mhamed, Mohamed, Abdesselam, Taoufik and El-Mehdi (2021) which mentioned that computer simulation strategy improved students' achievement significantly.

Furtherer, The Posttest achievement mean scores of male students was (71.25) with SD (8.11) while the posttest achievement mean scores of female students was (67.00) with SD (7.86). The posttest achievement mean score difference between the male and female students in the experimental group was (4.25) in favour of male students. The ANCOVA results revealed that the F (1, 21 = 1.549), P (0.227). Since P value > α 0.05. The researcher failed to reject the null hypothesis. Therefore, there is no significant mean score difference in the achievement of male and female students that were exposed to treatment using CSS.

The Adjusted R Square (-0.20) implies that < 1% of the changes in student's achievement in the group was due to the changes in the treatment, which is the use of computer simulation strategy while others were due to factors captured as error. This is not different from the result findings of Mengfan, Qiwei, Sabrina & Liqiang,

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(2022); Philip, Dauda, and Ndampon, (2023) that gender is not a factor that influence students' achievement. This means that CSS as the treatment was effective in improving students' achievement in Geography irrespective of gender difference.

RECOMMENDATION

Base on the findings of the study, it was recommended that computer simulation strategy should be adopted by teachers at all level of education. Also, teachers should be trained on the use of CSTS in order to improve students' achievements in school as it is a gender friendly strategy.

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