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Relative Effects of Computer Simulation with Narration and with Text Strategies on Senior Secondary School Students' Achievement in Environmental Education Content in Geography in Uyo Education Zone, Akwa Ibom State, Nigeria

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ABSTRACT

The relative effects of computer simulation with narration and computer simulation with text strategy on students' achievement in environmental education content in Geography were investigated among secondary school students in the Uyo Education Zone. A quasi-experimental design was adopted. The population comprises 20,966 senior secondary school two students (SS2) from the 77 secondary schools in the zone. The sample size consisted of 127 senior secondary school two students (SS2) of four intact classes. A purposive sampling technique was used to select four government-owned schools, while the simple random sampling technique was used to assign participants to experimental groups one and two. The Environmental Education Content Achievement Test (EECAT) was the instrument for data collection. The instruments were face validated by three (3) experts in the field. The reliability coefficient of the environmental education content achievement test was 0.88. Data were analysed using the mean, standard deviation and Analysis of Covariance (ANCOVA) at a 0.05 level of significance with the aid of the Statistical Package for Social Sciences (SPSS). The results show significant differences in the mean achievement scores of students taught Environmental Education Content in Geography using Computer Simulation with Narration Strategy (CSNS) and those taught using Text Strategy. Hence, teachers should utilise computer simulation with narration (CSVS) and computer simulation with text strategy (CSTS) as flexible tools that can enhance students' achievement in Geography teaching. Consequently, computer simulation strategies should be included in the Geography curriculum.

Keywords: *Computer simulation, narration, text strategy, achievement, environmental education, geography*

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INTRODUCTION

Over the years, there have been consistent reports of a decline in students' achievement in Geography. This unfortunate situation has been attributed to the continued use of conservative teaching methods, despite research demonstrating the effectiveness of technological strategies such as computer simulations. As a result, there is a growing concern among researchers about exploring the instructional effectiveness of computer simulations in improving the achievement of secondary school students in Geography.

Geography, defined as the study of places and the relationship between people and their environment, encompasses the examination of physical features and human activities, considering their impact on and the interaction with population distribution, resources, political dynamics, and economic activities (Chinanson, 2014). The subject delves into the description, distribution, and interaction of the diverse physical, biological, and cultural features of the Earth's surface. According to Artrivial (2017), Geography is a scientific field that studies physical and social environments, places, complexity, and the spaces of the Earth's surface, examining their interrelationships within space. It explores the interactions within the immediate environment. Geography's primary focus is the Earth itself, holding a distinctive position in the realm of education and learning. The study of Geography enables the mind to appreciate the relationship between human activities and the natural environment.

Geography is a social science discipline that uses a systematic process to study the Earth, human activities, and their associated problems. It is a subject with relevance across all aspects of human life and conditions in societies worldwide. Geography helps individuals explore and understand their environment, space, and place, recognising their vast differences in culture, political systems, economics, landscapes, and natural and social environments across the globe (Gregory, 2019). It explores the conditions between them, helping people understand their physical world and ecology, as well as the human environment, including societies and communities (Hungerford &Volk, 2020). Geography is a subject that can help students unravel some of the mysteries surrounding their environment.

Furthermore, Geography studies human activities and their consequences on the environment. Gregory (2019) suggests that Geography can even help us understand why towns and cities are arranged the way they are. It also provides insight into the physical systems underlying critical current issues, such as climate change, water systems, landslides, flooding, air pollution, noise pollution, water pollution, erosion, and deforestation. The ability to comprehend this interconnectedness makes Geography an essential part of education. Geography's role in communicating environmental awareness led to the integration of ecological education content into the Geography curriculum (Hungerford & Volk, 2020).

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Environmental education is a process that allows individuals to explore environmental issues, engage in problem-solving, and take action to improve the environment. It serves as a strategy for educating individuals about matters and issues that affect our immediate surroundings, aiming to enhance environmental awareness and promote a change in attitude toward our environment. This, in turn, arouses concern about the physical problems in our surroundings. According to Anijah (2017), environmental education refers to organised efforts to teach how the natural environment functions, and more importantly, how human beings can manage behaviour and ecosystems sustainably. It communicates environmental consciousness and a desirable attitude toward natural features, while evaluating acceptable environmental behaviour (UNESCO and UNEP, 2012). Environmental education is considered the foundation of a healthy environment (United Nations Conference on Environment and Development (UNCED), 2014).

Therefore, environmental education enlightens the masses about the various environmental problems and the need for environmental sustainability. It raises awareness of environmental issues, drives action for improvement and sustainability. Egbonyi and Onnoghen (2016) assert that the relevance of environmental education lies in imparting environmental knowledge, increasing awareness, and fostering positive attitudes, behaviour, and skills toward the environment. In ensuring the extent to which the environmental education content is understood by students, measuring students' academic achievement is utilised

Academic achievement is to assess the knowledge, skills, attitudes, and values someone has acquired during the learning process. It entails accomplishing tasks, often through personal effort or skill and the performance outcome that shows the extent to which a person has achieved specific goals set in instructional environments. According to Alhadabi and Karinskin (2020), academic achievement entails the progress made towards acquiring knowledge, educational skills, and certifications, usually spanning various disciplines. It is a manifestation of learning effectiveness and a valid indicator of effective teaching and learning of different subjects. Thus, academic achievement indicates the extent of academic performance over a period in an educational setting and determines the understanding of each subject matter. In secondary schools, academic achievement is used to evaluate learners' effectiveness.

Academic achievement is measured through students' grade point averages and linked to excellent and outstanding performance. It serves as a yardstick for teachers and scholars to determine whether each subject matter was handled effectively. The extent of achievement depends on the teaching strategies used by the teachers. Teaching strategies are approaches employed by teachers in the teaching and learning process. These include concept mapping, lecture method, inquiry method, play method, computer simulation method, etc. The concern of this study was computer simulation strategies.

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Computer simulation is defined as the organised representation of real-world phenomena. It is a virtual recreation of reality depicted on a computer to teach instructional content to learners. It is a learning strategy in which learners experience replicated scenarios on a computer through a projector, often using a mouse or keyboard to interact with the environment. It emphasised that computer simulation is a virtual strategy that can demonstrate abstract concepts, allows interaction between users and a simulated world, and provides feedback that helps them improve their knowledge and skills. Through computer-based instructional simulations, a teacher can present a wide variety of learning experiences to learners. Law (2022) noted that computer simulation is a model of behaviour that helps learners gain a better understanding of that behaviour. It has the task of simulating an abstract model of a particular scenario to gain a better insight into the model or system.

One of the primary exceptional roles of computer simulation instructional strategy is that it enables a teacher to explain a given scenario to learners as it appears in the learners' immediate environments. It allows learners to explore questions about a given scenario to find out the cause, effects, and solutions to the situation. It helps students identify the actual cause of a problem. In support of this view, Shiflet A. and Shiflet G. (2021) noted that computer-simulated practices are alternative teaching methods that can be used in place of hands-on laboratory practices while teaching and learning some concepts. Steinharanser (2016) explained that computer simulation enables learners to interact with the real world and carry out difficult tasks that motivate brainstorming. Law (2022) noted further that teaching using computer simulation improves learners' understanding by providing a degree of reality that is unachievable when traditional teaching methods are used. Thus, when learners interact with computer simulations, they become highly motivated, understand different phenomena from diverse perspectives, and develop collaborative study habits. Learners are motivated to learn ambiguous concepts through observation and discovery methods instead of memorisation. This enables them to comprehend, distinguish, and recall the content learned more effectively.

However, during the preparation process, it provides teachers with practical feedback when designing real-world scenarios. This helps the teacher improve the process during the planning stage, identify factors that may jeopardise the process, and discover hidden aspects of the given scenarios that the teacher did not initially consider. However, as confirmed by Jimoyianmis & Komis (2016), a specific simulation strategy cannot be used to teach all content of instruction, except in situations where the content of instruction is related. The idea of any simulation can be used to conceptualise other imminent simulations. Thus, computer simulation or any other type of simulation is planned based on the content of instruction. No one simulation teaching strategy can be used to teach all the content of instruction in a subject or different subjects. Simulated

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concepts are created based on the specific content of instruction (Costin, Brien & Slattery, 2019). There are types of computer simulations by individuals based on the content of instruction, such as continuous modeling and mixed modeling. Others are computer simulation with narration strategy (CSNS) and computer simulation with text strategy (CSTS).

Computer simulation with narration strategy (CSNS) is a self-conceptualised teaching strategy that involves the use of sight and speech (voice) to explain the content of instruction as it occurs in the learners' environment. It is an audiovisual teaching method, and graphs are recorded to teach selected environmental problems as they appear in the students' immediate environment. Environmental problem images, as well as sound, were used to process information simultaneously according to a stipulated lesson plan to teach the environmental education content in Geography. During the lesson, a mouse or keyboard was used to control each step of the presentation. The records of the narration were done using smartphones, and the lesson was based on a well-validated lesson plan. This speech teaching strategy was compared with another self-conceptualised non-speech strategy known as Computer Simulation with Text (CSTS) to test its efficacy.

Computer simulation with text strategy (CSTS), on the other hand, is a term used to describe a self-conceptualised visual experience through the sense of sight. It involves the use of images and captions to explain the simulated contents of instruction. It is a non-speech approach where text is used to simulate video graphics in a voiceless presentation. Bostrom (2018) opined that any strategy with text and image is known as visual-text. Thus, this visual-text strategy illustrated environmental problem graphics on the computer using text captions rather than spoken words. The written text explains simulated ecological issues as they are displayed on the computer system through a projector. During the lesson, a mouse or keyboard is used to control each step of the presentation.

The difference between the two models of computer simulation strategies is that in simulation with narration strategy (CSNS), there is a vocal narration that explains each step of the lesson, much like in a traditional classroom where a teacher teaches and students listen. In this case, the teaching has been done, and it explains each step of the lesson; simulated graphics or models are displayed according to the narration.

In a computer simulation with text strategy, text (captions) is used to explain each step of the lesson, and the text is displayed based on the content of the instruction. The text presents each step of the lesson in the environmental graphics displayed on a computer screen. However, there is no difference in the graphics and steps. The similarities between the two strategies are that both actualise the same computer-simulated graphics or models of environmental problems. The use of computer simulation strategies in teaching encourages students' collaboration and makes lessons

interactive and interesting. Ukozor (2020) stated that students in the simulation game performed better than those in the traditional method. El-Yakubu (2016) reported a significant difference between those taught map reading using computer simulation and those taught using the lecture method. Oluwole, Hussan, Sobowade, and Falode (2019) showed that students taught map reading in Geography using a computer simulation package performed better than their counterparts taught using the lecture method, irrespective of their gender.

Gender refers to the distinction in physical, biological, and behavioural characteristics describing the difference between the feminine and masculine populations. It has been assumed to be a factor in students' learning and achievement. Lynch (2017) reported that male students have higher achievement in Geography and other science subjects than their female counterparts. Some of the factors identified to account for the observed differences in the achievement of males and females in Geography include the masculine image of Geography, female socialisation processes, sex-role stereotypes, and poor retention of Geography content. Danmole and Femii-Adeoye (2014) found no significant difference in the achievement of students based on their gender. Instead, they opined that the achievement of males and females could be attributed to poor retention of concepts, teaching, and learning styles. Due to the inconsistency in the findings, two simulation strategies that had not been used recently were applied to examine gender differences in some environmental education content in Geography for both males and females. Apart from students' gender, the study considered the possible influence of school location on students' achievement.

School location refers to the particular place or area in the physical environment (rural or urban) where the school is established. Schools may be in urban or rural areas, depending on where a school is sited. Urban schools are those found within municipalities or towns, while rural schools are those located in villages or semi-urban areas. School location has been reported to be a factor in student achievement. Ajai (2018) and Njoku (2017) reported that students in urban areas performed better than those in rural areas. Artivial (2017) argued that pupils in rural areas performed significantly better than their urban counterparts. Based on the inconsistency in the findings, the present study investigated the effect of school locations on student achievement.

Purpose of the Study

The general purpose of this study was to determine the effects of two modes of simulation teaching strategies (Computer simulation with narration and computer simulation with text strategy) on students' achievement in environmental education-related contents of secondary school II Geography. Specifically, the study sought to:

1. Find out the effect of computer simulation with narration and computer simulation with text on students' academic achievement in the environmental education content of Geography.
2. Determine the influence of gender on students' achievement in the environmental education contents of Geography.
3. Determine the influence of school location on students' achievement in the environmental education content of Geography.

Research Questions

The following questions guided the study:

1. What are the Mean $(\bar{x})$achievement scores of students taught the Environmental Education content in Geography using the computer simulation with narration strategy and those taught using the computer simulation with text strategy?
2. What is the influence of gender on the Mean $(\bar{x})$achievement scores of students in the Environmental Education content of Geography?
3. What is the influence of school location on the Mean $(\bar{x})$ achievement scores of students in the Environmental Education content of Geography?

Hypotheses

The following Null hypotheses were formulated to guide the study and were tested at a 0.05 level of significance:

$H_0$1: There is no significant difference in the mean $(\bar{x})$achievement scores of students taught the Environmental Education content in Geography using computer simulation with narration strategy and those taught using computer simulation with text strategy.

$H_0$2: There is no significant difference in the mean $(\bar{x})$achievement scores of male and female students in the Environmental Education content of Geography.

$H_0$3: There is no significant difference in achievement scores of urban and rural students in the Environmental Education content of Geography.

METHOD

The study adopted a pre-test post-test non-equivalent quasi-experimental design. The area of the study was the Uyo Education Zone. The population consists of all 20,966. Senior secondary school two (SSII) in all the 77 secondary schools in the Uyo Education Zone. The population also comprised 12,822 students in the urban areas and 8144 students in the rural areas. The researcher decided to use SSII because they were about to be enrolled in senior secondary examinations, and poor achievement was reported from the chief examiner of the West African Examinations Council (WAEC) (2019-

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2022).The sample size of the study was 127 senior secondary two (SS II) Geography students of four (4) intact classes. The one hundred twenty-seven (127) students comprised 89 males and thirty-eight (38) females, while 66 students are in the urban areas and 61 students are in the rural areas. The intact classes of SSII students of four government-owned secondary schools in the Uyo Education Zone were used as the sample size. Purposive sampling technique was used to select four government-owned schools from four local governments in the zone, while the simple random sampling technique was used to assign the intact classes to experimental group 1 (which was a computer simulation with narration) and experimental group 2. (Which was a computer simulation with text) Computer simulation with narration strategy comprised 68 participants, 45 males and 23 females, and Computer simulation with text comprised 59 participants, 44 males and 15 females. The researcher used the Environmental Education Content Achievement Test (EECAT) and the Environmental Education content for data collection. The instrument was developed by the researcher using a scheme of work. Data were analysed using the Statistical Package for Social Sciences (SPSS). The results of mean and standard deviation were used to answer research questions, while analysis of covariance (ANCOVA) was used to test null hypotheses.

RESULTS

Table 1: Mean($\bar{x}$) analysis of the achievement scores of students taught the Environmental Education content in Geography using computer simulation with narration strategy (CSNS) and those taught using computer simulation with text strategy (CSTS)

Computer simulation strategy	**N**	**Pre-test**		**Post-test**		**Adjusted**
		($\bar{x}$)	**SD**	($\bar{x}$)	**SD**	**mean**
Computer simulation with narration (CSNS)	67	65.70	15.89	82.94	15.58	84.95
Computer simulation with text (CSTS)	60	71.33	14.25	89.90	10.05	90.99

Table 1 shows that the students who were taught the Environmental Education content in Geography using computer simulation with narration strategy had a pre-test mean achievement score of ($\bar{x}$)= 65.70, *SD* = 15.89) and a post-test mean achievement score of ($\bar{x}$)= 82.94, *SD* = 15.58), while those taught the Environmental Education content in Geography using computer simulation with text strategy had a pre-test mean achievement score of ($\bar{x}$) = 71.33, *SD* = 14.25), and a post-test mean achievement score of ($\bar{x}$)= 89.90, *SD* =10.05). The adjusted mean ($\bar{x}$) scores of 84.95 and 90.99 for the students taught the Environmental Education content in Geography using computer simulation with narration strategy (CSTS) and those taught using computer simulation with text strategy (CSTS) respectively, indicate that the students taught using computer simulation with text strategy had higher post-test mean achievement score than those

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taught using computer simulation with narration strategy (CSNS). Besides, the post-test standard deviations of 15.58 and 15.05 for the students taught the Environmental Education content in Geography using computer simulation with narration strategy (CSNS) and those taught using computer simulation with text strategy (CSTS) respectively, indicate that the individual scores of the students taught using computer simulation with narration strategy (CSNS) differed more from their mean achievement score than those of the students taught using computer simulation with text (CSTS)

Table 2: Mean($\bar{x}$) analysis of the achievement scores of male and female students in the Environmental Education content in Geography

Gender	N	Pre-test		Post-test		
		($\bar{x}$)	SD	$\underline{x}$	SD	Adjusted mean
Male	90	69.02	16.13	84.17	14.71	84.20
Female	37	66.76	13.29	91.24	9.00	91.73

Table 2 shows that male students had a pre-test mean achievement score of ($\bar{x}$)= 69.02, *SD* = 16.13) in the Environmental Education content in Geography and a post-test mean achievement score of ($\bar{x}$)= 84.17, *SD* = 14.71), while the female students had a pre-test mean achievement score of ($\bar{x}$)= 66.76, *SD* = 13.29), and a post-test mean achievement score of ($\bar{x}$) = 91.24, *SD* =9.00). The adjusted mean scores of 84.20 and 91.73 for the male and female students, respectively, indicate that the female students had higher post-test mean achievement score than the male students. Besides, the post-test standard deviations of 14.71 and 9.00 for the male and female students, respectively, indicate that the individual scores of the male students differed more from their mean achievement score than those of the female students.

Table 3: Mean ($\bar{x}$)analysis of the achievement scores of urban and rural students in the Environmental Education content in Geography

Location	N	Pre-test		Post-test		
		($\bar{x}$)	SD	$\underline{x}$	SD	Adjusted mean
Urban	65	75.35	12.58	90.77	11.50	90.96
Rural	62	61.03	14.61	81.47	14.20	81.68

Table 3 shows that students in urban schools had a pre-test mean achievement score of ($\bar{x}$)= 75.35, *SD* = 12.58) in the Environmental Education content in Geography and a post-test mean achievement score of ($\bar{x}$) = 90.77, *SD* = 11.50, while the students in rural schools had a pre-test mean achievement score of ($\bar{x}$)= 61.03, *SD* = 14.61), and a post-test mean achievement score of ($\bar{x}$)= 81.47, *SD* = 14.20). The adjusted mean ($\bar{x}$) scores of 90.96 and 81.68 for the students in urban and rural schools respectively, indicate that the students in urban schools had higher post-test mean achievement score than the

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students in rural schools. Besides, the post-test standard deviations of 11.50 and 14.20 for the students in urban and rural schools respectively, indicate that the individual scores of the students in rural schools differed more from their mean achievement score than those of the students in urban schools.

Table 4: Analysis of covariance of the effect of computer simulation strategy on students' achievement in the Environmental Education content in Geography

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3633.709[a]	4	908.427	5.576	.000	.155
Intercept	33405.922	1	33405.922	205.041	.000	.627
Pretest	689.101	1	689.101	4.230	.042	.034
Treatment	944.176	1	944.176	5.795	.018	.045
Gender	1467.474	1	1467.474	9.007	.003	.069
Treatment * Gender	2.851	1	2.851	.018	.895	.000
Error	19876.669	122	162.924			
Total	967797.000	127				
Corrected Total	23510.378	126				

Table 4 reveals that there is a significant difference in the mean $(\bar{x})$ achievement scores of students taught the Environmental Education content in Geography using computer simulation with narration strategy (CSNS) and those taught computer simulation with text strategy in favour of the students taught using computer simulation with text strategy, F (1, 122) = 5.795, p = .018. Thus, the null hypothesis is rejected since the p-value of .018 is less than the .05 level of significance. Moreover, the effect size of .045 implies that a 4.5% improvement in the achievement of students in the Environmental Education content in Geography is attributed to the effect of computer simulation with text strategy. (CSTS).

Table 5: Analysis of covariance of the influence of location on students' achievement in the Environmental Education content in Geography

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4289.767[a]	4	1072.442	6.807	.000	.182
Intercept	33697.939	1	3369739	213.893	.000	.637
Pretest	1.299	1	1.299	.008	.928	.000
Treatment	1460.128	1	1460.128	9.268	.003	.071
Location	2114.433	1	2114.433	13.421	.000	.099
Treatment * Location	48.505	1	48.505	.308	.580	.003
Error	19220.611	122	157.546			
Total	967797.000	127				
Corrected Total	23510.378	126				

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Table 5 reveals that there is a significant difference in the mean $(\bar{x})$ achievement scores of urban and rural school students in the Environmental Education content in Geography in favour of the students in urban schools, F (1, 122) = 13.421, p = .000. Thus, the null hypothesis is rejected since the p-value of .000 is less than the .05 level of significance. The inference drawn is that the location of schools influences students' achievement in the Environmental Education content in Geography.

The findings revealed that students taught environmental education content in Geography using computer simulation with text (CSTS) had mean $(\bar{x})$achievement scoreshigher than those taught using simulation with narration (CSNS). It was further revealed that there was a significant difference in the mean achievement scores of students taught environmental education content in Geography using computer simulation with narration (CSNS) and those taught using computer simulation with text (CSTS) in favour of those taught with text. Thus, the null hypothesis which states that there is no significant difference in the mean achievement scores of students taught environmental education contents in Geography using computer simulation with narration (CSNS) and those taught using computer simulation with text (CSTS) was rejected. The difference in achievement in favour of those taught using simulation with text (CSTS) might be due to the framing, representation of action and salient features possessed by computer simulation with text strategy (CSTS) that directs the students' attention and makes them more focused than computer simulation with narration (CSNS) with oral presentation.

Mean $(\bar{x})$achievement scores of female students were higher than their male counterparts in environmental education content in Geography. There was a significant difference in the mean achievement score of male and female students on environmental education using computer simulation with narration (CSNS) and computer simulation with text (CSTS) in favour of females. Therefore, the null hypothesis, which stated that there is no significant difference in the mean achievement score of male and female students taught environmental education content in Geography using the same the strategies, was rejected. The difference in achievement in favour of female gender in computer simulation with text (CSTS) is due to the framing, representation of text and salient features possess by computer simulation with text strategy (CSTS) that directs the female gender's attention and makes them more focused than their male counterparts in computer simulation with narration (CSNS) with oral presentation. The outstanding performance of females is therefore attributed to the focus on text reading.

There is a significant difference in the mean $(\bar{x})$ achievement scores of urban and rural schools students in environmental education content in Geography in favour of urban school students. Thus, the null hypothesis, which states that there is no significant difference in the Mean $(\bar{x})$achievement scores of urban and rural students in the Environmental Education content in Geography, was rejected. The inference drawn is

that the location of schools influences students' achievement in Environmental Education content in Geography. This means that school location has significant effect on students' achievement in environmental education content in Geography, with urban students achieving higher than their counterparts. However, the achievement in favour of urban schools is attributed to the distinguished character of the urban schools' students, who can assimilate both the characteristics of oral presentation and written words as features possessed by the two modes of computer simulation.

CONCLUSION

Relative Effects of Computer Simulation with Narration and Text Strategy on Students' Achievement in Environmental Education content in Geography among Senior Secondary School Students was investigated in Uyo Education Zone, Akwa Ibom State, Nigeria. Based on the findings, it was concluded that Computer simulation with narration strategy (CSNS) and computer simulation with text teaching strategy (CSTS) are flexible tools that enhance academic achievement in Geography. However, computer simulation with text strategy (CSTS) is significantly beneficial to students taught the environmental education content in Geography than those taught using simulation with narration (CSNS). Moreover, gender and school location are significant determinants of students' achievement in the environmental education content of Geography.

RECOMMENDATIONS

Based on the findings the following recommendations were made:

1. The use of computer simulation strategies such as computer simulation with narration (CSNS) and computer simulation with text strategy (CSTS) should be included among the innovative strategies in the curriculum by the curriculum planners and instructional designers for teaching Geography and other subjects.
2. Computers should be made available in schools that do not have computers by Government and stakeholders and projectors also should be made available by Government and stakeholders in those schools where the study was carried out, as well as other schools to enable teachers carryout simulation strategies at will and to avoid renting by the teachers and future researchers when the need arises.
3. State ministries of education should motivate teachers to conceptualised strategies for effective learning through workshop (training and re-training) and motivation through giving them awards that would encouraged competition.

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