International Journal of Studies in Education [Special Edition] – [2025], Vol. 21, Issue 3:482-493
ISSN: 2636-632O [ONLINE] - 2636-6339 [PRINT]

EFFECTS OF STOP MOTION ANIMATION INSTRUCTIONAL TECHNIQUES ON SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN ENVIRONMENTAL EDUCATION CONTENTS OF GEOGRAPHY

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Abstract

The study examined the effect of stop motion animation instructional techniques on Students' Achievement in Environmental Education Contents in Secondary Schools` Geography Curriculum in Ikot-Ekpene Educational Zone of Akwa-Ibom State. Specifically, the nonequivalent control group design was adopted. The population involved the 17,985 SS2 students in all the 88 public secondary schools in the zone. Purposive sampling technique was used to select 180 SS2 Geography students from four intact classes. Environmental Education Contents Achievement Test in Geography was used for data collection. Data collected were analyze using mean and standard deviation in answering all the research question while analysis of covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance. The findings revealed that, stop motion animation techniques significantly enhance students' achievement in EE contents in Geography compared to conventional method. It was recommended among others that curriculum development agencies such as the Nigerian Educational Research and Development Council (NERDC) should consider a review of the SSS Geography curriculum in order to incorporating stop motion animations instructional technique into curriculum activities.

Keywords: Stop motion animation, students, achievement, environmental education

Introduction

Major advancement in technology has brought to limelight some new innovations and skills to teaching and learning in all aspects of education. In this regard, increasing growth in educational technology and its application in numerous learning forms expedite some novel learning ecosystem that offer students different approaches to learning opportunities and resources. These technological interventions are vital and relevant to teaching and learning of geography. Geography is a subject that deals with the study of the earth and its people. It studies variation from place to place in terms of physical features and human activities; it also focuses on man and his environment (Emielu, 2014). Further, Geography is seen as a subject that develops learners' critical thinking ability and that helps to comprehend spatial relationship among various features of the earth surface (Anlimachie, 2019). The National Policy on Education (FRN, 2013) provides that, Geography as a subject should be taught at the senior secondary school and rated among other subjects as elective subject at senior secondary school level in Nigeria. Geography deals with human-environment relationships and it is interdisciplinary; overlapping between Natural Sciences, Social Sciences and Humanities (Aman, 2011). The interdisciplinary nature of Geography can provide a holistic approach to teaching EE as such Geography is regarded as an important vehicle through which Environmental Education can be taught, (Commission on Geographical Education of the International Geographical Union IGU-CGE, 2016).

Environmental Education (EE) refers to organized efforts to teach how natural environments function, and particularly, how human beings can manage behavior and ecosystems to live sustainably **(**Ekpo, 2016**).** It is a multi-disciplinary field integrating disciplines such as Biology, Chemistry, Physics, Ecology, Earth Science, Atmospheric Science, Mathematics, and Geography **(**Major, 2018**).** The objectives of teaching EE which has close relationship with those of Geography at the secondary school level were highlighted in UNESCO-UNEP (1988) to include creation of awareness about the total environment and the associated challenges, helping learners develop Knowledge, awareness, values, skills and attitudes required for environmental protection and sustainable living, and encourage learners to participate or engages in environmental friendly practices (possibly, by involving students in real life experiences). The goals of EE programmes, include fostering environmental sustainability, healthy living and economic development through EE programmes at national and international levels.

In view of the above objectives within the Nigerian educational context, the National Educational Research and Development Council NERDC recommends the infusion of recurrent and emerging issues such as pollution, global warming, climate change, environmental hazards, environmental depletion and conservation etc, into the senior secondary school Geography curriculum in Nigeria (NERDC, 2008). This inclusion provides the necessary justification for teachers to teach emerging trends or global Environmental Education contents through the senior secondary school Geography curriculum in Nigeria, it is therefore clear that the new Geography curriculum is enriched with many EE contents to warrant investigation into teaching and learning (Ezeudu, Gbendu & Umeifekwem, 2014) using the appropriate instructional techniques. Instructional technique encompasses any type of learning technique a teacher uses to help students learn or gain a better understanding of the course material. Furthermore, Technological-based instructional techniques are the art of using technology to deliver training and educational materials (Mohammed & Ogar, 2023). However, technological pedagogical innovative technique has contributed a lot to the education industry especially in secondary schools. It tries to alleviate some of the challenges in learning Geography as a subject (Gambari, Falode, & Adegbenro, 2014). Application of different pedagogy in the learning process, especially technologically based pedagogies may help the students to understand the subject matter and be able to apply in solving challenge that arise in teaching and learning EE content in Geography (Wu & Chiang, 2013, Amarin, 2016 and Musa, Ziatdinov, Sozcu, & Griffiths, 2015). It has become very necessary therefore, to device new teaching techniques that can be used in teaching students to enable them master contents instead of memorization (Orji & Ogar, 2019).

There is no doubt that technology has brought massive innovative changes into the education sector in all ramifications. It is based on this premise, nonetheless, that different techniques other than teacher centered instruction have risen and are making major breakthrough in secondary schools. Hence, the teaching-learning process is significantly enriched with innovative instructional techniques such as animation. Animation comes from the Latin Word Anima which means "soul". To animate is to give life to an inanimate object, drawing or image **(**Hamzat, Bello, & Abimbola, 2017**)**. Animation is a method in which pictures are manipulated to appear as a moving image. According to Bello (2014), animation is expressed as an enriched device in which pictures are synchronized in the teaching and learning process in order to make it real. It is the capturing of sequential, static image, drawing or photos of inanimate objects and playing them in rapid succession to mimic real world motion. However, the utilization of

animations has been firmly energized as a creative, useful and students-centered alternative to the traditional learning approaches. Animation is much better at representing ideas which involve changes over time because of its ability in creative/imaginary thinking, therefore concretizing abstract temporal ideas (Rias & Zaman, 2011).

Animation has the power to attract learners' attention and increase their motivation to learn which will lead to better achievement of contents (Ejimonye et al., 2020b), Animation give external help for mental recreations along these lines, permitting the student to perform a higher measure of subjective handling (Bada, Adekomi & Ojo 2012). Generally, the flexibility of learning through animation allows for a wider range of stimuli, thus increasing students' engagement in learning (Gambari, Falode, &Adegbenro, 2014). However, there are different types of animation: traditional animation, 2D animation (vector-based), 3D animation, motion graphics. However, the study is interested in stop motion because it is suitable for graphical presentations especially in Geography instruction. To this end, the present study is out to determine the effect of stop motion animations techniques on academic achievement of Geography students in Environmental Education contents. The stop motion animation was designed to provide illustrations on the materials so that teaching-learning process will not be monotonous but more interesting, especially material related to the flow of events. The use of digital devices and visual media such as stop motion animation can allow the students to explore and question learning processes (Sun, Wang, & Liku, 2017). The existence of stop motion animation could provide opportunities for the teachers and the students to imagine and develop their thoughts. Stop motion animation could also be used as learning media in the industrial era as it is today (O'Byrne, Radakovic, Hunter-Doniger, Fox, Kern & Parnell, 2018). The students could use this media to learn independently without any meeting or face to face interaction in class. This was supported by previous research that explained the created learning media could be used to help in learning outside of the classroom or as teaching materials independently and improve students' ability to express ideas and communicate with others (Maryanti & kurniawan, 2018; Sun, Wang, & Liku, 2017, Hoban & Nielsen, 2013; Wilkerson et al. 2018).

The existence of stop motion animation could indeed help the students in class. it can be used for any animation because the basic process is the same namely something is manipulated, moved gradually, and taken pictures. The objects taken can be dolls, pencil drawings, piles of sand, clay, computer drawings or pieces of paper (Ashrafzadeh & Nimehchisalem, 2015).On the other hand, the teacher also had a problem in making Stop Motion animation as a learning media, the teacher perceived that making Stop Motion animation needed a long time. This was because each background or each shift in an object must be photographed one by one or gradually to produce an object that seems to move. Moreover, in making Stop Motion animation it is needed to use other tools such as paper, dolls, cameras, computers, and so on (Lotulung, Chrisant, Ibrahim & Tumurang, 2018). The procedure in stop motion are first, position an object in front of the camera in its starting position, secondly, expose one frame of the film then slightly move the object and expose a second frame. This process is repeated until the object reaches its final position. Finally, when frames are played in sequence, they give the viewer the illusion of a moving object across the screen (Selby, 2013). Therefore, Stop Motion animation can be developed on both Android and IOS operating systems and has therefore become increasingly popular among smart phone users. This substantially reduces the costs of design and development (Grabuloska, Taleski, Trajanoska & Zdraveska, 2013). With the capability and advancement of digital technology, Stop Motion animation has become the

educational technology employed widely in all levels of instruction (Kahraman, 2015). There is the need to further investigate the instructional effectiveness of stop motion technique on student's achievement.

Academic achievement represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in schools, colleges, and university. Nwagu (2015) viewed academic achievement as academic proficiency which is basically quantified in exams and tests. Importantly, the performance of students in Senior School Certificate Examination (SSCE) conducted by WAEC Chief Examiners Report May/June 2017, 2018, 2019 and 2020). Particularly, WAEC (2020) students have continued to record poor performance in Geography over the year. WAEC**,** 2017, 2018 and 2020, (see appendix, R. pg, 236) shows the performance of the candidates' decline/dropped below when compared with that of the previous year's shown geography student's inadequate explanation of points, inadequate preparation and poor presentation of geographical features and contents, it was reported that 49.98% of all candidates who sat for the May/June 2020, failed grossly in some Environmental Education contents in Nigeria secondary schools. Geography paper 2, indicated that, students performed poorly in question 6a and 6b which dealt with thermal energy and renewable energy in Nigeria, the report further indicated that very few candidates attempted the question and the performance of most of the Geography students was poor (WAEC Chief Examiner's Report, 2020). In this category were 389,655 males and 396,361 females, representing 47.32% and 52.92% respectively. It was also reported that 19,781 candidates who sat for Geography examination and 3,851 or 19.46 per cent passed at credit level (WAEC Chief Examiner's Report, 2020). According to Yegoh, Kiplagat & Tuimur (2016) that shows the teaching of Geography in Senior Secondary Schools is with lots of challenges (Aderogba, 2012). These challenges, ranges from teachers' factor, inadequate funding, overcrowded classrooms, inadequate instructional materials, ill equipped libraries and poor method of teaching. These challenges have become stop-gap in the progress and development of education in Nigeria. These challenges have serious implication which includes not limited to shake foundation for occupational option in Geography and lack of interest in Geography programme at post-secondary levels of education (Suwopoleme, Sababa & Filgona, 2016).

Poor academic achievement of students in Geography especially in (EE contents) has been a source of concern to many researchers (Suwopoleme, Sababa and Filgona, 2016). Students' academic achievement, according to Obondo, Too &Nabwire (2013) revealed that poor performance/decline in academic achievement in Geography is as a result of negative recall of students towards the subject. They suggested that in order to improve students' academic achievement in Geography the innovative teaching techniques as against teacher's conventional teaching method examinations, the conventional approach of teaching should be complemented with technological innovations which would help students to develop positive academic achievement towards EE contents in Geography. Therefore, this study seeks to investigate the effect of stop motion animation techniques to see if it can enhance students' achievement in EE contents in Geography.

Research Questions

The following research questions guided the study:

1. What is the difference in the mean ($\overline{x}$) achievement scores of students taught in Geography using stop motion animation instructional technique?
2. What is the influence of gender on mean achievement scores of students in EE contents in Geography?

3. What is the interaction effect of instructional technique and gender on students' academic achievement scores in EE contents in Geography?

Hypotheses

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

Ho_1: There is no significant difference in the Mean ($\bar{x}$) achievement scores of students taught EE contents in Geography using stop motion animation and those taught conventionally

Ho2: There is no significant difference in the Mean ($\bar{x}$) achievement scores of male and female students in EE contents in Geography.

Ho3: There is no significant interaction effect of gender and instructional techniques on students' academic achievement in EE contents in Geography.

Methods

The study adopted quasi-experimental research design. This study was carried out in Ikot Ekpene zone of Akwa Ibom State. The population of the study comprised all the 17,985 SS2 Geography students drawn from Ikot Ekpene zone of Akwa Ibom State in the 88 co-educational public senior secondary schools in Ikot Ekpene zone of Akwa Ibom State. A sample size of 180 SS2 Geography students was used for the study. The study adopted multi-stage sampling procedure in drawing the sample for the study. The researcher developed instrument titled "Environmental Education Contents Achievement Test in Geography" (EECATG) was used for data collection. The Environmental Education Contents Achievement Test in Geography (EECATG) is made up of 50 multiple-choice items with four options lettered A-D each. Students have to choose the correct answers from the list of options provided. Questions 1-10 of the test covered information from Renewable and Non-renewable Resources, 11-30 covered Environmental Problems, 31-50 covered Environmental Conservation. The test items were scored as follows, one (1) mark for each correct answer and a zero (0) for any wrong answer total of 50 marks. Environmental Education Contents Achievement Test in Geography (EECATG), the lesson plans and the packages developed for the study were subject to face validation. The face validation was done by three experts (professors). Each expert was given a copy of the instrument (EECATG), lesson plans and the packages for scrutiny/vetting. To further ensure the effectiveness of the validation exercise, the experts were requested to check the appropriateness of the instruments in terms of clarity, simplicity of vocabulary, and relevance of items to the study. To establish the content validity of the instrument (EECATG), a well-constructed table of specification developed by the researcher was used in the construction of the test items. In order to establish the internal consistency of the instrument (EECATG), the instrument was administered to 30 SS II Geography students in Oruk Anam local government area which is not part of the sampled local government for the study but shares similar characteristics with the sampled schools. The scores obtained from the trial testing were subjected to Kudder Richardson- 20 (KR-20) method of internal consistency estimate and it yielded a reliability coefficient of 0.84. The K-R20 was considered appropriate because according to Nworgu (2018), it is the most suitable method for instruments that are dichotomously scored (that is 0, or 1/pass or fail). To establish the temporal stability of the instrument, the instrument was re-administered to the same students on two separate occasions after two weeks' interval. The scores of the students on the two administrations of the test were correlated using Pearson's product moment correlation technique and this yielded a reliability coefficient of 0.90. The experiment lasted for six weeks. Mean and standard deviation was used in answering all the research questions, while analysis of covariance (ANCOVA) was used in testing the

formulated hypotheses at 0.05 level of significance. The pre-test scores were used as a covariate to the post-test scores. ANCOVA however, served as a control for the initial differences across groups as well as increasing the precision due to the extraneous variable thus, reducing the error variance.

Results

Research Question One: What is the difference in the mean ($\bar{x}$) achievement scores of students taught in Geography using stop motion animation instructional technique and those taught the EE contents conventionally?

Table 1: Mean and standard deviation of students' achievement scores

Instructional Technique	Pre-test		Post-test		Mean Gain Scores	Mean Gain Difference
	N	Mean	SD	Mean	SD		
Stop motion Animation	85	19.20	4.38	28.66	4.18	9.46	1.73
Control Group	95	17.46	4.48	25.19	5.51	7.73	

The result in Table 1 showed that stop motion animation instructional technique was more effective in improving the achievement scores of students in EE contents.

Hypothesis One: There is no significant difference in the Mean ($\bar{x}$) achievement scores of student's taught EE contents in Geography using stop motion animation and those taught conventionally

Table 2: ANCOVA on difference in achievement scores of students

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	909.367[a]	4	227.342	10.066	.000	.187
Intercept	5384.556	1	5384.556	238.418	.000	.577
Pretest	102.045	1	102.045	4.518	.035	.025
Gender	138.360	1	138.360	6.126	.014	.034
Technique	411.792	1	411.792	18.233	.000	.094
Gender *Technique	200.028	1	200.028	8.857	.003	.048
Error	3952.295	175	22.585			
Total	134413.000	180				
Corrected Total	4861.661	179				

Result in Table 2 showed that the F-value of 18.233 was obtained with an associated probability value of 0.000. The associated exact probability value of 0.000 obtained is less than 0.05 level of significance set for decision making. Hence, the null hypothesis was rejected. Inference drawn is that, there is a significant difference in the mean achievement scores of student's taught EE contents in Geography using stop motion animation and those taught conventionally. More so, Table 2 shows a partial eta square (η^2_p) of 0.094. This means that 9.4% of the increase in the mean achievement scores of student's taught EE contents in Geography was due to the effect of instructional techniques.

Research Question Two: What is the influence of gender on mean achievement scores of students in EE contents in Geography?

Table 3: Mean and standard deviation of the influence of gender on mean achievement scores of students in EE contents in Geography

Gender		Pretest		Posttest		Mean Gain	Mean Difference
	N	Mean ($\bar{x}$)	SD	Mean ($\bar{x}$)	SD		
Male	93	17.89	4.70	27.56	5.17	9.67	2.32
Female	87	18.70	4.28	26.05	5.17	7.35	

The result in Table 3 shows the influence of gender on the mean ($\bar{x}$) achievement scores of students taught EE contents in Geography using stop motion animation instructional technique and those taught conventionally. The result further shows a mean difference of 2.32. The result implies that male students had improved academic achievement compared to their female counterpart.

Hypothesis Two: There is no significant difference in the Mean ($\bar{x}$) achievement scores of male and female students in EE contents in Geography.
Result in Table 2 was also used to test hypothesis two. The result shows that an F-value of 6.126 was obtained with an associated probability value of .014. The associated exact probability value of .014 obtained is less than 0.05 level of significance set for decision making. Hence, the null hypothesis was rejected. Inference drawn is that, there is a significant difference in the mean achievement scores of male and female students taught EE contents in Geography. More so, Table 2 shows a partial eta square (η^2_p) of 0.034. This means that 0.3.4% of the increase in the mean achievement scores of male students taught EE contents in Geography was due to the effect of gender.

Research Question Three: What is the interaction effect of gender and modes of instruction on students' mean achievement scores in EE contents in Geography?
Table 4: Mean and standard deviation on the interaction effect of gender and modes of instruction on students' mean achievement scores in EE contents in Geography

Gender	Instructional Technique		Pretest		Posttest	
		N	Mean ($\bar{x}$)	SD	Mean ($\bar{x}$)	SD
Male	Stop Motion Animation	44	18.18	4.80	30.36	3.13
	Conventional	49	17.63	4.64	25.04	5.36
Female	Stop Motion Animation	41	20.29	3.62	26.83	4.42
	Conventional	46	17.28	4.36	25.35	5.72

Result in Table 4 shows the interaction effect of gender and modes of instruction on students' mean achievement scores in EE contents in Geography. The results showed that both male and female taught using stop motion had higher achievement although male students recorded higher achievement compared to females.

Hypothesis Three: There is no significant interaction effect of gender and mode of instructions on students' achievement in EE contents in Geography.
Result in Table 2 was also used to test hypothesis three. The result shows that F-value of 8.857 was obtained with an associated probability value of 0.03. The associated exact probability value of 0.03 obtained is less than 0.05 level of significance set for decision making. Hence, the null hypothesis was rejected. Inference drawn is that, there is a significant interaction effect of gender and modes of instruction on students 'achievement in EE contents in Geography. More so, Table 2 shows a partial eta square (η^2_p) of 0.048. This means that 4.8% of the increase in the mean achievement scores of student's taught EE contents in Geography was due to the interaction effect of gender and mode of instruction.

Discussion

The finding authenticates the fundamental tenets of Bandura (1983) social cognitive theory which lay emphasis that learning can take place through observation, imitation and modeling. Besides, the finding agrees with the earlier findings of Vikiru (2013) found out that students taught animations improvement in scores for all the pupils who had viewed the animations, with the mean score differences being most significant for pupils of aptitude. However, it has also been proved efficacious in Environmental Education content in Geography as seen in the findings of this present study. The result of the findings revealed that gender significantly influence students' achievement in EE contents in Geography in favour of the male students. The result indicated that instructional techniques used in the study enhance both male and female students' achievement in EE contents in Geography. This implies that male and female students benefited equally from the treatment.

The finding is in agreement with the earlier findings of Falode et al. (2016), Gbendu (2020) and Abidoye (2015) who in their independent studies concluded that, gender exerted a significant influence on students' achievement in Geography. The finding of this study however, contradicts with the earlier findings of Sakiyo, Aishatu and Kawu (2018), Estawul, Sababa and Filgona (2016) who in their respective investigations revealed that, gender had no significant effect on students' achievement in Geography, this implies that male students perform better than female students. Makinde and Yusuf (2019) study showed that there is a decrease in the gap in gender difference in student performance in Geography, but female representation in Geography is still low in comparison with their male counterparts. Thus, from the result of this study, it is clear that, an inconsistency exists between some of the earlier findings and the present finding. Hence, a gap has been created for prospective future investigators to fill.

The findings of the study with respect to the interaction effect of gender and mode of instructions on students' achievement in EE contents in Geography revealed a significant interaction effect of gender and mode of instructions. The male and female students exposed to stop motion animation instructional technique performed better than the male and female students in the stop motion instructional technique. The result implies that students' achievement across gender was not consistent. The findings of the study contradict with the earlier findings of Abidoye (2015) and Estawul, Sababa and Filgona (2016) who in their respective studies found out that, teaching-method and gender exerted no significant interaction effect on students' mean achievement in Geography. Meanwhile, the finding contradicts those of Filgona and Sababa (2017) and Makinde and Yusuf (2019) who in their independent studies revealed that, gender and method had significant interaction effect on students' academic achievement in Geography.

Recommendations

Based on the findings and educational implications of this study, the following recommendations were made:

1. Teachers should adopt and use animations instructional technique for effective Geography instructions since the study revealed its significant effect in enhancing students' achievement in EE content in Geography.
2. Since animation technique was effective in enhancing academic achievement, curriculum development agencies such as the Nigerian Educational Research and Development Council (NERDC) should incorporate animations instructional

technique into SSS Geography curriculum to minimize the gender related differences between male and female mean achievement scores in Geography.

3. Government in collaboration with Federal and State Ministries of Education should sponsor and organize periodic regular seminars, workshops and conferences to train and re-train both new entrants and ins-service teachers on the use of animation packages for effective classroom instructions.

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