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EFFECTS OF ANIMATION AND CONCEPT MAP VISUALIZATION ELEMENTS ON ACHIEVEMENT, RETENTION AND INTEREST IN GEOGRAPHY AMONG SECONDARY SCHOOL STUDENTS IN WUSE, ABUJA

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ABSTRACT

This study investigated the effects of animation and concept map visualization elements on achievement, retention, and interest in geography among Secondary School Students in Wuse, Abuja, Nigeria. It also examined the influence of gender on students' achievement, retention, and interest. The research used a pre-test post-test experimental and control group design. 120 secondary school students were drawn from three secondary schools within the Abuja metropolis. A stratified random sampling technique was used to select 120 students (53 males and 67 females). Nine research questions and hypotheses guided the study; Weather Interest Questionnaire and Weather Achievement Test (WAT) were used as instruments for data collection while animation and concept map visualization was used as the treatment instruments. The treatment instruments, questionnaire, and achievement test were validated by educational technology experts and Geography Education experts respectively. Pilot tests were carried out and a Reliability coefficient of 0.87 was obtained using Pearson Product Moment Correlation (PPMC) for WAT and 0.75 was obtained using Cronbach alpha for the questionnaire. WAT was administered to students as pre-test and post-test. The students' pre-test and post-test scores and the questionnaire were analyzed using ANCOVA ($F = 8.839$, $p = 0.004$) and t-test statistics ($t(52) = 0.179$, $p = 0.947$) respectively. The results indicated that the students taught weather using animation and concept map visualization performed significantly better in the post-test and retention test than their counterparts taught weather using the lecture method respectively. However, there was no significant difference reported in the post-test achievement scores of male and female students taught weather using animation and concept map visualization respectively ($t = 1.916$, $p = 0.059$). These findings indicated that weather concepts in geography could be taught and learned meaningfully through the use of animation and concept map visualization. Based on these findings, it was recommended among others that Government and school administrators should make provision of infrastructure that support the learners through the use of technology, this will encourage and enable learners to communicate with each other and give them the opportunity to share and access different teaching materials that can aid their learning.

KEYWORDS

Achievement, Animation, Concept map, Effects, Geography, Interest, Retention, Students Visualization element.

INTRODUCTION

Science and technology occupy a predominant position in the contemporary world today, the characteristics of societies in this modern time is determined by the prolific advancement in the two interrelated human activities which are science and technology in the society (Nsofor, 2010). Brown (2001) opined that apart from the acceleration of man's standard of living, science and technology have facilitated the development of the third world nations to improve upon their needs and the desire to compete with the industrialized nations in all speres of development such as agriculture, medicine, engineering, architecture, communication and geography. The assumptions that modern developments had been made possible within the framework of science and technology is not an overstatement (Aiyede 2010). Consequently, it has become necessary that the teaching of science subjects such as Physics, Chemistry, Biology, geography and technology related courses be given adequate attention as they play a pivotal role in the advancement of the nation (Danmole and Femi – Adeoye 2004). In the past decade, the utilization of computers and other related technologies have expanded from been used primarily as instructional delivery medium to technology as a transformational tool and an integral part of the learning process (Abdullahi, 2004).

Basically, the proponents of the current reform agenda in Nigeria see technology as a veritable tool of a new educational tool paradigm in which the curriculum, teaching methods, and student learning outcomes are conceptualized (O'Day, 2006).Educational animations are produced for the specific purpose of fostering learning. It is associated with educational technology with the way it supports teaching and learning through the use of technological tools to facilitate learning and to improve critical thinking and performance. Current educational use of animations suggests the two main roles in learning. First purpose of animations in academics is to fulfill a cognitive function. In this role, animations are intended to support students' cognitive processes that ultimately result in them understanding the subject matter. Secondly, animation is used as an effective learning tool that attracts attention, engages the learner, and sustains motivation aspects. The use of animations instructions in teaching offers exciting possibilities for meeting the needs of 21st century learners as it enhances students' learning if properly designed and implemented.

One of the cardinal components of school reforms is the desire for higher academic standards and stronger focus on higher order thinking, problem solving skills, and learning associated with "real world" applications, Federal Ministry of Education (FME, 2004). To achieve the above reforms, a need for new learning environment and learning tools for schools is necessary. Many people have advocated for the increasing application of new technologies in the schools based on the fact that the students' need to be technologically literate for success in the twenty first century, and that this literacy is best achieved in classrooms where technology become the integral part of the environment and where it is used as a daily tool for learning and solving "real world" problems (Micheal& John, 2008). Quite a number of people support increasing technology usage in schools for this reason this is supported by the assertion that for any nation to obtain the status of self-reliance, science and technology must be an integral component of the knowledge to be impacted to all the citizenry of that nation irrespective of race, creed or sex (Nsofor, 2001; 2010). Related to or associated with these technologies is the use of concept map and Visualization. Unfortunately, for majority of students, technological literacy is still lacking (Gana, 2013).

Concept mapping had been defined differently by various authors. According to Ezenwa (2005), concept maps are words used to illustrate some kind of object, event or idea, key to human learning

and meaning making a mental impression or mental constructs people have of words, objects, or events; source of human understanding, what we think with in science. Concept maps are diagram that represent knowledge as networks of concepts, pictured as nodes connected by labeled links. They present a way to visualize concept and the hierarchical relationship between them (Novak & Gowin, 1984). Researchers have shown great interest for the educational uses and potential benefits of concept maps. In 2006, the number of peer- reviewed articles related to concept maps was estimated to approximately five hundred (Nesbit and Adesope2006). Within the educational settings, concept maps can be used to help students consolidate their understanding of a given knowledge domain or to anchor collaborative earning activities. Concept maps constructed by learners illuminate their current knowledge about a particular issue, and can be used as assessment tools. It can also be used to organize and present information as learning material.

Visualization, however, is a part of all scientific fields such as construction, engineering, architecture, but also in geography and chemistry. Digital technology is becoming their organic components and brings a significant discovery of new knowledge, principles, and shift in the perception of existing theories. This was still significantly recognizing for most of the teachers, students and pupils of various grades of school systems. (Bamidele, 2009). Visualization is the thinking view of facts, when the results are shown so as to be perceived by the visual receptors. In education, visualization is associated with the application of clear rules. Průcha (2009) poised that visualization of information has universal clarity regardless of the diversity of languages, decoding speed, relativity, and more. The danger is that it is often weakened by ambiguity of the information. The current trend has allowed just thorough visualization speed up communication and creates a single and comprehensive tool that allows communication in routine matters, but also for the unification of terms in science and is a key of importance of education at school and lifelong learning. Prucha (2009) also points out that visual expression using different brands, diagrams and symbols becomes a permanent part of the communication of many professions and therefore, it is necessary to pay attention to the overall level of visual and aesthetic impact of phraseology, as it creates a new visual culture, a new sensibility of person. Active visual culture is characterized by the fact that a man is able to visually communicate and create visual communication itself.

To strengthen this ability, it is necessary to strengthen the development of visual culture by using didactic tools (what is intended to be taught – moral lesson). Visualization is encountered in science, where it is an important tool for performing the role of cognitive learning, also the presentation of science and technology. The advantage is that the computer technology in cooperation with visualization allows the development of critical thinking (Wiebe *et al*., 2001). Visual attribute has been used since the second half of the 19th century, thanks to technological breakthroughs associated with the use of pictures.

Geography is an academic science subject taught in senior secondary schools and tertiary institution in Nigeria. It involves the study of natural features and phenomena on the earth surface and in the atmosphere. The subject also focuses on location, space relationship and changes of physical phenomena on the earth's surface; it is geared towards teaching the interrelationship among phenomena on the earth surface and those in the atmosphere based on stated objectives (Abdulkarim, 2010; and Aderogba, 2011).

The basic objectives of Education at the secondary school level includes; the acquisition of laboratory and field skills, meaningful and relevant knowledge, ability to apply scientific knowledge to everyday life in matters of personal and community health, agriculture and reasonable functional scientific attitudes, Federal Republic of Nigeria (FRN, 2009)

The objectives of teaching Geography as a science subject at senior secondary school level was spelt out by National Policy on Education of Federal Ministry of Education (FME, 2004) and reinforced by examination bodies such as the West African Examination Council, (WAEC, 2013) and National Examinations Council (NECO, 2013) and curriculum development body such as Nigerian Educational Research and Development Council (NERDC, 2008).

These objectives have been thought of in terms of what Geography can contribute to the realization of the aims of secondary education in Nigeria which includes, giving students a sound knowledge of their immediate environment, inculcate in them useful skills and outlooks that will enable them to make useful contribution to their community and nation at large, to develop in the student critical thinking ability, accuracy and objectivity to proper and logical investigation among others (Aderogba, 2012).

Weather is the condition of the atmosphere within short periods. Parameters of weather include temperature, cloud cover, precipitation, wind and pressure variance (Iwena, 2008). The concept of weather is a component of Geography course of study that develops students' skills of observation, measurement and recording, experimenting and drawing inference of geographic data (Abdulkarim, 2010). The elements of weather being directly observed, measured, recorded and predicted range from solar intensities; wind direction and velocity; humidity and precipitation indices; temperature variations; pressure gradients, cloud covers and soil moisture.

Academic achievement was defined by Ogundukun and Adeyemo, (2010) as the exhibition of knowledge attains or skills developed by students in a subject designed by test scores assigned by teachers. Academic achievement has long been recognized as one of the important goals of education the world over. It is a general observation that learners placed in an identical set of academic situations vary in their scholastic achievement. Research conducted to prove into the academic achievement phenomenon has convincingly demonstrated that it is the product of a number of factors operating within the individual and outside him.

Retention in this study is the ability to remember task, or material concepts, Bichi (2002) defined retention as the ability to retain and recall information or knowledge gained after learning. Retention is the repeat of performance of a task of learnt behavior earlier acquired. It is the preservative factor of the mind (Gana, 2013). Other researchers such as Mangal (2010) and Obeka (2010), investigated and defined several variables that affect retention. Factors effecting retention include the content or tasks to be performed, learners past experiences, the interval between lesson and evaluation and instructional strategies employed.

Interest could be defined as the focusing of the sense organs on or giving attention to some person, activity, situation or object. It is an outcome of experience rather than gift. It could either result or cause motivation. It is also regarded as a pre determinant of one's perception, that is, what aspect of the world one is most likely to see always. (McClnemey, Dowson, Young and Nelson, 2005).

Statement of the Problem

Despite an increasing availability of technological packages such as animation, concept maps, computer assisted instruction, digital video displayer (DVD) and textbooks; it has been observed that there is low academic achievement, low retention of the learned concepts as well as of WAEC limited interest by the student. This has been associated to inadequacy and dismal utilization of Geography equipment for teaching, like using computers, animations, concept maps, globes, meteorological stations, water reservoirs, forest reserve amongst others as well as poor teaching strategies characterized by teacher centeredness. Teachers often uses lecture method in teaching the subject, ignoring animations and concept maps, this gap in the application of technology to improve students' performance in weather concept, teachers consider the cognitive aspect of learners and neglects affective aspect (interest). There is limited literature on the effect of animation and concept map visualization on students' achievement, retention and interest in geography among secondary school students in the study area. Therefore, the need for a more efficient and effective method of instruction that will hopefully cover cognitive, affective, and psychomotor domains of students like the use of animation and concept map visualization strategy. An interactive strategy that can use for improving this present trend of poor performance may be the use of animated concept maps visualization. Based on the above, the current research problem is, what is the effects of animation and concept map visualization on achievement, retention and interest in Geography among secondary school students in Wuse, Abuja? It also investigated the moderating effects of gender on achievement, retention and interest.

Research Questions

The following research questions were raised to guide the research study:

1. What are the effects of animation, concept mapping visualization and conventional method on students' achievement in weather concepts?
2. Will gender influence students' achievement when taught weather concepts using animation?
3. Does gender influence students' achievement when taught weather concepts using concept maps visualization?
4. What are the differences in the students' retention score when taught weather concepts using animation, concept mapping visualization and conventional method?

Research Hypotheses

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

HO_1: There is no significant difference in the mean achievement scores of students taught weather concepts using animation, concept map visualization and lecture method.

HO_2: There is no significant difference in the mean achievement scores of male and female students taught weather concepts using animation.

Ho_3 There is no significant difference in the mean achievement scores of male and female students taught weather concept using concept maps visualization.

Ho_4: There is no significant difference in the mean retention scores of students taught weather concept using animation, concept maps visualization and lecture method.

METHODOLOGY

The research design used in this study is the quasi-experimental design. A pre-test, post-test, non-equivalent, non-randomized experimental and control group research design. Quasi-experimental design can be used when it is not possible for the researcher to randomize the subjects and assign them to treatment groups without disrupting the academic programs of the schools involved in the study (Gall, Gall & Borg, 2007). The study used three groups; experimental group I, II, and control group. Experimental Groups are groups exposed to experimental treatment (X_1 and X_2). That is, teaching using animation and concept map visualization instructional strategy. While, control group is taught using lecture method (X_0 that is no treatment). There were two levels of independent variables namely; animation and concept map visualization, three levels of dependent variables which are; achievement, retention, and interest, and two levels of gender (male and female) which is the moderating variable.

Research Design Layout

Table 1

Group	Pretest	Treatment	Achievement	Retention
EXP1	O_1	X_1	O_2	O_3
EXP2	O_4	X_2	O_5	O_6
CONTR	O_7	X_0	O_8	O_9

Where:

O_1, O_4, O_7: Observation of pretest scores for the experimental and control,

O_2, O_5, O_8: Observation of achievement scores for the experimental and control,

O_3, O_6, O_9: Observation of retention scores for the experimental and control,

The sample of the study includes 120 SS II Geography students drown from a population of 300 Geography students using the multistage sampling technique to arrive at the final sample. Instruments used for collecting data were five researcher-designed instrument which are; Animated Weather Visualization Video Instructional Package, Weather Concept-mapping Chart, Visualization and Weather Concept-map Interest Questionnaire, Weather Concept Achievement Test, and Lesson Plan. To ensure the validity of the instruments, all instruments was validated by at least two experts from the department of education technology Federal University of Technology Minna, and experts from Geography departments and as well as Geography teachers. Collected data were analyzed using descriptive Mean and Standard deviation, and inferential statistics of ANCOVA which were used to answer the research questions and the formulated hypotheses respectively.

RESULTS

Presentations in this section in based on research questions and hypotheses.

Research Questions

Research Question One: What are the effects of animation, concept mapping visualization and conventional method on students' achievement in weather concepts?

To answer research question one, mean and standard deviation was used to analyse the pretest and post test scores of students as shown in table 2

Table 2: Mean and Standard Deviation of Pre-test and Post-test Scores of Students taught Weather Concepts using Animation, Concept Map Visualization and Lecture Method.

Group	N	Pretest		Posttest	
		Mean	SD	Mean	SD
Exp Grp I	**52**	14.04	2.505	36.58	4.016
Exp Grp II	**27**	13.89	2.65	35.78	5.066
Control	41	13.37	3.399	34.00	6.152

Table 2 shows that at pre-test the mean achievement scores of the students in the experimental and control groups were 14.04,13.89 and 13.37 with standard deviations of 2.505, 2.65and 3.399 respectively. There were differences in the variability of their scores judging from the gap in their standard deviations. However, at post-test, the treatment groups had mean achievement scores of 36.58, 35.78 and 34.00 and standard deviations of 4.016, 5.066 and 6.152 for experimental and control groups respectively. This result indicates that the experimental group achieved higher than the control group. In effect, using animation and concept map visualization proved superior to the lecture method in enhancing students' achievement. To ascertain whether the observed differences is significant, hypothesis one is tested at 0.05 level of significance in Table 3.

Research Question Two: Will gender influence students' achievement when taught weather concepts using animation?

To answer research question two, mean and standard deviation was used to analyse the pretest and post test scores of students as shown in table 3.

Table 3: Mean and Standard Deviation of Pre-test and Post-test Scores of Male and Female Students taught Weather Concept using Animation.

Gender	N	Pre-test		Posttest		
		Mean	SD	Mean	SD	Mean Gain
Male	16	14.16	2.266	37.18	3.786	23.16
Female	36	14.12	2.614	35.41	4.083	21.2

Table 3 shows the Mean and Standard Deviation of Pre-test and Post-test Scores of male and female students taught weather concepts with the use of Animation package. Male students had achievement mean score of 14.16with a standard deviation of 2.266 at the pre-test while their female counterparts had achievement mean score of 14.12 with a standard deviation of 2.614. Mean gain scores of 23.16 and 21.2 for the male and female students respectively indicates that male students achieved higher

than their female counterparts. Whether the difference in the mean achievement scores is significant is shown in Table 4.

Research Question Three: Does gender influence students' achievement when taught weather concepts using concept maps visualization?

To answer research question three, mean and standard deviation was used to analyse the pretest and post test scores of students as shown in Table 4.

Table 4: Mean and Standard Deviation of Pre-test and Post-test Scores of Students taught Weather Concepts with the use of Concept Map Visualization.

Gender	N	Pre-test		Posttest		
		Mean	SD	Mean	SD	Mean Gain
Male	09	14.16	2.266	38.17	3.786	24.03
Female	18	14.12	2.614	34.51	4.083	20.39

Table 4 shows the Mean and Standard Deviation of Pre-test and Post-test Scores of male and female students taught with the use of concept map package. Male students had achievement mean score of 14.16with a standard deviation of 2.266 at the pre-test and a mean achievement score of 38,17 with a standard deviation of 3.786 at post test while their female counterparts had achievement mean score of 14.12 with a standard deviation of 2.614 at pretest and a mean achievement score of 34.51 with a standard deviation of 4.083 at posttest. Mean gain scores of 24.03and 20.39 for the male and female students respectively indicates that male students achieved higher than their female counterparts. Whether the difference in the mean achievement scores is significant is shown in Table 5.

Research Question Four: What are the differences in the students' retention score when taught weather concepts using animation, concept mapping visualization and conventional method.

To answer research question four, mean and standard deviation was used to analyse the retention scores of students as shown in Table 5.

Table 5: Mean and Standard Deviation of Post-test and Retention Scores of Students taught Weather Concepts using Animation, Concept Map Visualization and Lecture Method.

Group	N	Posttest		Retention		Mean Difference
		Mean	SD	Mean	SD	
Exp Grp I	52	36.58	4.016	22.22	6.320	14.36
Exp Grp II	21	35.78	5.066	23.62	6.168	12.16
Control Grp	28	34.00	6.152	21.18	5.786	12.28

Table 5 shows the mean and standard deviation of posttest and retention scores of students taught using animation, concept map visualization and conventional method. The table reveals that at posttest the mean achievement scores of the students in the experimental group I, II and control groups were 36.58, 35.78and 34.00with standard deviations of 4.016, 5.066and 6.152respectively. There are differences in the variability of their scores judging from the gap in their standard deviations. However, at retention-test, the treatment groups had mean scores of 22.22, 23.62 and 21.18 with standard deviations of 6.320, 6.168 and 5.786for both experimental and control groups respectively. In addition, the experimental group one, two and control groups had a mean difference of 14.36, 12.16 and 12.28. This result indicates that the experimental group one had the highest retention. In effect, using animation proved to enhance students' retention more.

Research Hypothesis 1:

HO_1: There is no significant difference in the mean achievement scores of students taught Weather concepts using animation, concept map visualization and lecture method. To test this hypothesis, ANCOVA was used to analysed the achievement scores of students taught using animation, concept map visualization and conventional method as shown in Table6.

Table 6: Analysis of Covariance of Posttest Scores of Experimental Groups One, Two and Control Groups

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	221.912[a]	2	110.956	4.952	.010
Intercept	2779.816	1	2779.816	124.070	.000
Covariate (Pretest)	103.895	1	103.895	4.637	.034
Main Effect (Treatment)	93.109	1	93.109	4.156	.045
Error	1702.797	76	22.405		
Total	102588.000	79			
Corrected Total	1924.709	78			

**: Significant at 0.05 level*

Table 6 shows the ANCOVA result of the comparison of posttest score of students in experimental group one, two and the control groups. An examination of the Table shows a significant main effect (F = 4.156, p = 0.045). On the basis of this, hypothesis one was rejected. Therefore, the achievement scores of students taught weather concept using animation, concept map visualization and control methods differed significantly and do, hypothesis one was rejected. To determine the location of the significant difference between the three groups, Scheffe's post hoctest was conducted on the data. The result is shown in Table 7.

Table 7: Scheffe's Post Hoc Analysis of the Groups Mean Scores

Sources of Variation	Mean Scores	Exp I	Exp II	Control
Experimental I	40.12		*0.000	*0.000
Experimental II	37.10	*0.000		*0.000
Control	21.90	*0.000	*0.000	

** The mean difference is significant at the 0.05 level.*

The data in Table 7indicates that there was significant difference in the posttest mean scores of students exposed to animation (X=40.12) and those exposed to concept map visualization (X=37.10) in favour of experimental I (animation). It also indicates that significant difference exists in the posttest scores of students exposed to concept map visualization (X = 37.10) and those exposed to conventional method (21.90) in favour of experiment group II (concept map visualization).Also, significant differences was established in the posttest scores of students exposed to animation(X=40.20) and those exposed to control group (X=21.90) in favour of experimental group one.

HO_2: There is no significant difference in the mean achievement scores of male and female students taught Weather using animation package.

To test hypothesis two, the mean achievement scores of male and female students in experimental group one was computed and analyzed using t-test as presented in Table 8.

Table 8: t-test Analysis of Achievement Score of Male and Female Students in Experimental Group One

Group	**N**	**Mean**	**SD**	**df**	**T**	**P**
Male	16	14.16	2.27			
				50	0.179*	0.947
Female	36	14.12	2.61			

**: Significant at 0.05 level*

Table 8 shows the t-test comparison of pretest score of male and female Weather students in experimental group. An examination of the Table shows that there is no significant difference between the two groups (t (52) = 0.179, p = 0.947). Hence hypothesis two was retained.

HO_3: There is no significant difference in the mean achievement scores of male and female students taught Weather using concept map visualization. To test hypothesis three, the mean achievement scores of male and female students in experimental group two was computed and analyzed using t-test as presented in Table 9.

Table 9: t-test Analysis of Mean Achievement Scores of Male and Female Student in Experimental Group Two

Group	N	Mean	SD	Df	T	P
Male	09	37.18	3.789			
				25	1.964*	0.054
Female	18	35.41	4.083			

**: Significant at $p \leq 0.05$*

Table 9 shows the mean achievement score of male and female students taught with the use of Animation. Although Male Biology students (M =19.91, SD = 7.223) scoring lower than Female Biology students (M = 19.56, SD = 5.719) with t(52) = 1.964, p = 0.783 (p > 0.05), the p-value indicate that there was no significant difference in the score between male and female. Hence, the null hypothesis is retained.

HO4: There is no significant difference in the mean retention score of students taught Weather using the animation package, concept map visualization and conventional method.

To test hypothesis four, Analysis of Covariance (ANCOVA) was used to compare the retention score of the three groups and determine whether significant difference exist when covariate effect (posttest) is controlled. The result is presented in Table 10.

Table 10: Analysis of Covariance of Retention Scores of Experimental groups One, Two and Control Groups Using Concept Map Visualization

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	124.945[a]	2	62.473	1.773	.179
Intercept	971.881	1	971.881	27.577	.000
POSTTEST	64.069	1	64.069	1.818	.183
GROUP	87.780	1	87.780	2.491	.120
Error	2044.071	58	35.243		
Total	37835.000	61			
Corrected Total	2169.016	60			

**: Significant at 0.05 level*

Table 10 shows the ANCOVA result of the comparison of retention score of students in experimental groups one, two and control groups. An examination of the Table shows a significant main effect (F = 2.491, p = 0.120). On the basis of this, hypothesis four was retained. The result revealed that there is no significant difference between the mean retention score of students taught Weather using animation package, concepts maps and those taught with lecture method when covariate effect (posttest) was controlled.

Discussion of Findings

Finding of this study on the difference in mean achievement scores of students taught weather concepts using animation and lecture method indicated that the experimental group achieved higher than the control group. In effect, using animation proved superior to the conventional lecture method

in enhancing students' achievement. This finding is in line with the earlier findings of Danmole and Femi-Adeoye (2004), Aremu and Abiodun (2010), and Neumann (2011), who found out that students taught weather with animation perform better than those taught with lecture method. Moreover, since the finding from this study revealed that experimental group achieved higher than the control group, the study further investigates if the differences in the Weather achievement test between the experimental and control group is significant or not.

Hypothesis one finds out if there is significant difference between the mean achievements scores of students taught weather concepts using animation package and lecture method. The result shows a significant difference between the two groups ($t(79) = 2.531$, $p = 0.018$). The result revealed that there is significant difference between the mean achievement score of students taught weather using animation and those taught with lecture method when covariate effect (pre-test) was controlled. This finding is in line with the earlier findings of Danmole and Femi-Adeoye (2004), Aremu and Abiodun (2010), and Neumann (2011), who found out that students taught Weather with animation perform better than those taught with conventional method. The students taught with animation performed better than those taught with conventional method because they can feel and see what they are taught with the aid of instructional materials and can complement their learning with their textbooks.

Finding that emanated from this study on the difference in mean retention scores of students taught weather concepts using animation package and lecture method. The result indicates that the experimental group achieved higher than the control group. In effect, using animation proved superior to the conventional lecture method in enhancing students' retention. This finding is in line with the earlier findings of Ezenwa (1993); Chang et al (2002); Budd (2004); Chalrut and DeBacker (2004); Freeman and Jessup (2004); Harpaz, Balik and Enhrenfeld (2004); Vanides, Yin, Tomta and Ruiz – Primo (2005) who found out that students taught weather with animation retained more knowledge than the control group taught with lecture method. Since the finding from this study revealed that experimental group achieved higher than the control group, the study further investigates if the differences in the Weather retention test between the experimental and control group for significance.

Hypothesis two finds out if there is significant difference in the mean retention score of students taught weather using the animation package and that taught using lecture method. The result shows that experimental group had the highest mean gain scores of 12.96 while the control group had mean gain scores of 14.78. Results revealed that animation improved the retention of students in Weather better than lecture method. This finding is in agreement with the earlier findings of Freeman and Jessup (2004); Harpaz, Balik and Enhrenfeld (2004) who found out those students taught weather with animation retained more knowledge than the control group taught with lecture method. The students taught with concept mapping retained better than those taught with conventional method because hearing is not as good as seeing. This study contradicts the earlier finding of Dantani, Kure and Usman (2013) who found out that there was no significant difference in the retention level of experimental group and control group.

Finding of this study on the difference in the mean achievement scores of male and female students taught Weather using animation. The result indicates that the male students had achievement mean score of 14.16 with a standard deviation of 2.266 at the pre-test while their female counterparts had achievement mean score of 14.12 with a standard deviation of 2.614. The result indicates that male

students achieved higher than their female counterparts. This finding is in line with the earlier findings of Novak and Mosunda (1991) and Danmole (1998) who found out those male students have higher achievement than their female counterparts. This study contradicts the earlier findings of Damole (2004). Moreover, since the finding from this study revealed that the male students achieved higher than their female counterparts, the study further investigates if the differences in the achievement test between the two groups are significant or not.

Hypothesis three finds out if there is significant difference in the mean achievement scores of male and female students taught weather using animation package. The result indicated that there was no significant difference in the score between male and female students which indicated that animation is equivalent in improving the achievement of both male and female weather students. This study is in line with the earlier finding of Nusbaun 2000; Gambari, 2004, Yisa (2014) who found out that there was no significant difference between males and female students exposed to animation. There was no significant in the achievement score of both male and female students because the two groups were exposed to the same treatment.

Finding of this study on difference in the mean retention scores of male and female students taught weather using animation show those male students retained higher than their female counterparts. This study is not in line with the earlier finding of Dantani, Kure and Usman (2013) who found out that there was no significant difference in the retention level of experimental group and control group. Since the finding from this study revealed that the male students achieved higher than their female counterparts, the study further investigates if the differences in the achievement test between the two groups are significant or not.

Hypothesis four finds out if there is any significant difference in the mean retention scores of male and female students taught Weather using Animation package. The male group had the highest mean gain scores of 8.54 while the female group had mean gain scores of 8.67. Results of the statistical analyses of the retention score of the male and female Weather students revealed that concept map animation is equivalent in improving the retention of both male and female Weather students. This study is not in line with the earlier finding of Dantani, Kure and Usman (2013) who found out that there was no significant difference in the retention level of experimental group and control group. This study contradicts the earlier finding of Udeani and Okafor (2012) who found out that the female learners taught with the animation taught by the same method. The assumptions are always that since males are more pre disposed to the use of technology they may benefit more from the integration technology and learning. Contrarily females may be limited in their learning when is involves technology.

Finding of this study on difference in the mean interest inventory scores of student taught weather using Animation and lecture revealed that there was difference in the mean response of control and experimental group with a mean score of 30.56 and standard deviation of 4.409 for control group and mean score of 26.92 with standard deviation of 3.575 for experimental group.

CONCLUSION

Findings of this study has revealed that students taught with animation and concept mapping visualization perform better than those taught with lecture methods and there is significant difference between mean achievement score of students taught with animation and concept map visualization. There is gender difference in the achievement mean score of male and female students. The male students achieved higher than their female counterparts. The study revealed further that the students taught with animation and concept map visualization retained more knowledge than the control group taught with lecture method. There is gender difference in the retention mean score of male and female students. The male students retained higher than their female counterparts. Furthermore, the study revealed that there was difference in the mean response of students taught with animation and concept map visualization and those taught with lecture method. There is gender difference in the interest mean score of male and female students. The female students have more interest than their male counterparts when taught with animation and concept maps. The use of animation and concept maps visualization when it is well tailored would in no doubt improve the teaching and learning process.

Recommendations

Based on the findings that emanated from this study, the following recommendation were made:

i. Teachers in secondary school should be encouraged by the school administrators and management to adopt the use of animation and concept map and other instructional packages to complement their teaching. This will enhance their teaching methods and provide them with supplementary materials for teaching.
ii. Government and education board should make provision for continuous sensitizations, trainings and workshops for teachers in secondary schools. This will further encourage them to engage in the use of technology for teaching.
iii. Government and school administrators should make provision for infrastructure that support the learners through the use of technology, this will encourage and enable learners to communicate with each other and give them opportunity to share and access different teaching materials that can aid their learning.

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