Instructional Computer Animation: Effect On Secondary School Students' Interest In Chemistry In Awka Education Zone

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ABSTRACT: *This study investigated effect of instructional computer animation on secondary school students' interest in chemistry in Awka Educaiton Zone. Two research questions guided the study and three null hypotheses were tested. The study adopted a quasi-experimental design. The sample consisted of 186 students drawn from two out of 46 co-educational secondary schools in Awka Education Zone. One of the schools was randomly assigned to experimental group while the other was assigned to control group Chemistry Interest Scale (CIS) was the instruments used to collect data for the study. The CIS with 17 items was trial tested on an intact class of 40 students outside the study area. The reliability coefficient of CIS was established to be 0.78 using Cronbach alpha. CIS was administered to the students as pretest and posttest for data collection. Mean and standard deviation were used to answer the research questions while Analysis of Covariance was used to test the null hypotheses at 0.05 level of significance. The result revealed that instructional computer animation had significant effect on students' interest in chemistry. This implies that instructional computer animation enhances students' interest in chemistry. Based on the results of the study, it was recommended that instructional computer animation should be adopted by chemistry teachers for teaching chemistry concepts to secondary school students.*

Keywords: *animation, chemistry, bonding, equilibrium, interest*

INTRODUCTION

Science is nature. It is man's attempts to investigate, explore, interpret and operate with the materials and the forces of universe that surround man. Science started as early as the time of the early man from his experiences with nature. The early man disc**o**vered how plants grow, which plant flowers and which seeds are edible. From the earliest time, therefore, man has concerned himself with the study and interpretation of the universe. Science truly is not just talking about manufactured goods but also it is concerned with finding out about nature and how to use the gifts of nature to better his life.

Science has branches which include the earth sciences, the life sciences and the physical sciences. Chemistry is a subject in the physical science. By using the principles of chemistry, we are able to extract different types of metal and also create different types of plastics. The metals and plastics created are used to build electronic devices such as phones, tablets, laptops and a host of other products like cars, laboratory and hospital equipment (Solomon, 2013). Unfortunately, many chemistry students in secondary schools find some chemistry concepts difficult to understand (WAEC chief examiner's report, 2009). The abstract nature of chemistry made many chemistry students learn chemistry by memorization of concepts, principles and theories without necessarily understanding what they are memorizing (Ozmen,2009). Under this condition, chemistry students do not learn chemistry concepts meaningfully, perform poorly in chemistry at both internal and external examinations, and cannot apply their knowledge to solve everyday problems in the society in which they live. These challenges in the learning of chemistry dwindles the students' interest in learning the subject.

The difficulty in understanding of science concepts especially concepts in chemistry by secondary school students is not peculiar to Nigerian students. In the United States of America, for example, attention has been drawn to United States of American students falling behind other countries in mathematics and science.

Computer animation was used in their curriculum delivery to bridge the gap and achieve high academic standard (United States Department of Education, 2010).

Instructional computer animation is a combination of graphics and text presentation in which each can strengthen memory through observation of the images. Instructional computer animation has the potency of bringing down the difficult level of any concept taught with it to the barest minimum. It is audio-visual in nature. The use of audio-visual materials is important for teaching chemistry concepts. The benefits of instructional computer animation are enormous. Any learning associated with instructional computer animation provides a learning environment free of emotional stress and enhances emotional intelligence that provides fun. Instructional computer animation provides unique and interesting presentation given to each of the facts and concepts presented, making it beneficial to students. Modules aided with instructional computer animation, according to Akpinar and Ergin (2007a), is an effective way to attract attention and be able to provide concrete information on the movement and change of the object over time and this can reduce the level of abstract ideas. It attracts students' attention easily and delivery of message more appropriately. According to Jamalludin and Zaidatun (2003), the use of instructional computer animation facilitates explanation of a concept or demonstrates a skill and this enables students to utilize more senses in the process of gathering information as well as sustain the students' attention and interest for a longer period of time.

There exist some possible challenges associated with instructional computer animation. Instructional animation will not work well where there is epileptic supply of electricity. The students may be carried away and watch the video images as though they are watching film show without picking the important aspects of the lesson. The school may not have enough computers to go round the students at once. These notwithstanding, anyone using instructional computer animation shall bear these challenges in mind and make provisions to handle them so that students would not become frustrated and loose interest. When thinking of positive changes in education, it is important to think of things like interest as an enhancer to students' academic endeavours.

Interest is the ability of an individual to show positive attitude towards an object, situation or value. Nwoye (2005) described interest as an internal state that influences individual's personal behaviour. The behaviour could be positive or negative. Okeke (2016) stated that in psychological and educational measurement, interest is seen as a motivational construct. Njoku (2003) noted that interest is a response expressing liking or disliking of an activity. There is need therefore to foster students' interest in learning chemistry using appropriate instructional strategies and materials so as to enhance students' involvement in the learning process of chemistry. The researcher was therefore poised to investigate whether the use of instructional computer animation could arouse and sustain students' interest in learning chemistry.

PURPOSE OF THE STUDY

The purpose of the study was to investigate the effects of instructional computer animation on secondary school students' interest in chemistry. Specifically, the study investigated the:

1. effect of instructional computer animation on students' interest scores in chemistry when compared with those taught with conventional teaching method.
2. find out the effect of instructional computer animation on the male and female students' interest in chemistry.
3. interaction effects of instructional methods and gender on the students' interest in chemistry.

RESEARCH QUESTIONS

The following research questions guided the study.

1. What are the mean interest scores of students' taught chemistry concepts using instructional computer animation and those taught using conventional method?
2. What are the mean interest scores of male and female students' taught chemistry concepts using instructional computer animation?

HYPOTHESES

The following hypotheses were tested at 0.05 level of significance:

1. There is no significant difference between the mean interest scores of students' taught chemistry concepts using instructional computer animations and those taught using the conventional method.
2. There is no significant difference in the mean interest scores of male and female students' taught chemistry concepts using instructional computer animation.
3. There is no significant interaction effect of teaching methods and gender on students' mean interest scores.

METHOD

Research Design

The study adopted a quasi-experimental research design. Specifically, non-equivalent control-group design was used. Quasi-experiment is an experiment where random assignment of subject to experimental and control groups is not possible rather intact or pre-existing groups are used (Nworgu, 2015). The researcher used two streams of a class as experimental and control groups respectively. This research design is considered suitable because participants were not randomly assigned to groups rather treatment condition was randomly assigned to two intact groups which were already organized.

Area of the Study

The area of the study was Awka Education Zone in Anambra State. Awka Education Zone consists of five local government areas namely; Awka North, Awka South, Njikoka, Anaocha and Dunukofia. The zone is the heart of Anambra State capital territory. It has basic modern facilities such as good roads and electricity. The people living in the zone have high value for education. The area has two universities and a teaching hospital with 61 public secondary schools. This study is better carried out here because it is an urban center, the seat of the government of the Anambra State. The people working there have value for qualitative education.

Population of the Study

The population of the study comprised 2,927 senior secondary school year two (SS 2) chemistry students in 61 public secondary schools (46 coeducational schools and 15 single-sex schools) in Awka Education Zone of Anambra State. (Source: Post Primary School Services Commission 2016/2017).

Sample and Sampling Technique

The sample for the study consisted of 186 senior secondary year two (SS 2) chemistry students drawn from four classes in two coeducational schools in Awka Education Zone. Simple random sampling technique was used to select two co-educational schools out of the 46 co-educational secondary schools in Awka Education Zone. Using a lucky dip, one of the schools was designated the experimental school and the other, the control school. From the experimental school, two intact classes were chosen with 45 males and 50 females giving a total of 95 students. From the control school, another two intact classes were chosen with 40 males and 51 females giving a total of 91 students. The classes were chosen that way so that the same chemistry teacher would teach them, this was done to check teacher variable.

Instrument for Data Collection

The instrument used for data collection was Chemistry Interest Scale (CIS). CIS was adapted from Psychology Interest Scale developed by Linnenbrink-Garcia in 2010. It is a 17-item interest scale. The original reliability index of the scale was 0.95. The researcher modified some of the statements to suit her purpose by replacing the word psychology with chemistry in the items. She also included some of the concepts taught the students in the items. The CIS was measured on a four point interest scale of strongly agree (SA), agree (A), disagree (D) and strongly disagree (SD) to enable the students indicate their level of interest. It was used for both the pretest and posttest.

Validation of the Instrument

The Chemistry Interest Scale (CIS) is a 17-item test sent to the experts in the Departments of Science Education, and Educational Foundation in Nnamdi Azikiwe University, Awka for face validation. The experts were specifically requested to find out the suitability of the language used in the construction of the CIS with regard to the students' level of understanding; and extent to which the statements on the CIS assess interest of students in the area of study. After the validation, some of the items were modified, some deleted and some negatively worded items were included.

Reliability of the Instrument

The CIS items were trial-tested. CIS was administered on the same 40 SS2 students in the same secondary school in Ogidi Education Zone in Anambra State. The original reliability index of the psychological instrument was 0.95 but because it was adapted a new reliability was established using Cronbach Alpha method and a reliability index of 0.78 was obtained.

Experimental Procedure

This was done in two stages: training of the research assistants in the experimental group and treatment to the experimental and controls groups. The researcher introduced herself to the two research assistants who were the chemistry teachers of the sampled schools. The researcher assigned for the training explained the aim of the research to the research assistants and introduced the method as instructional computer animation. She gave them detailed tutorial on how to use instructional computer animation in teaching chemistry concepts. She gave lesson plan to the research assistants to guide them. The training was done for one week of three hours in four contacts. The conventional method was used for the control group. No serious training was given to the two research assistants in this group because they were allowed to use the conventional method they were conversant with. The researcher gave them the lesson plan that guided them during the lesson periods. Both the teachers in the experimental and control groups had Bachelors of Science (B.Sc.) degree in education/ chemistry. They had all taught chemistry for not less than five years.

Before the experiment began, the CAT and CIS were administered as pretests to the experimental group and control group. At the end of the test, the experimental group was taught some chemistry concepts using computer animation involving pictorial designs of animated chemistry concepts by one of the two chemistry teachers for the experimental group while the other teacher was a standby or reserve. This was done so that in case of any accident or illness the standby teacher would take over to avoid stopping the experiment abruptly. The teacher introduced the topic as chemical bonding, explained the periodic table of Group O elements as noble gases with stable atomic structure. She showed animated moving images of different shapes

and colours of Group O elements carrying two or eight electrons in their outer most shells. Students seeing these moving images smiled and began to whisper to one another.

The teacher listed types of bonding differentiating each with moving pictures of varying colours indicating different bonds. The students seeing them widened their eyes, touching one another, discussing their observances. The teacher discussed electrovalent bonding using animated Na and Cl atoms that were flapping their wings. Students watching them started flapping their two hands like birds on flight. As Na atom was donating its electron to Cl atom, students dived as someone who wants to catch a ball. They shouted, clapped and laughed. Students hands were up to ask questions, discuss their observations, to demonstrate the actions and to make contributions. They were allowed to air their views one by one. So it continued till the end of the lesson.

DAY 2

The teacher introduced the topic of the day as co-ordinate covalency bonding. She explained that the shared pair of electrons is contributed by one of the atoms involved in sharing rather than by each atom. The teacher displayed animated structure of ammonia and hydrogen as examples with three hydrogen atoms sharing three pairs of electrons with nitrogen atom forming covalent bonds. The students were pointing to the remaining lone pair of electrons on nitrogen arguing why it was not bonded. Animated proton (H^+) danced across to bond with the lone pair of electrons forming co-ordinate bond. The students nodded in apprehension. A student from behind shouted "parasite!". The whole class busted into laughter. When asked what she meant by that, she said that the proton was being parasitic to ammonia because it gained or shared two electrons with ammonia without contributing anything to the combination. With many more examples and displays using instructional computer animation the class lively continued with other types of bonding.

DAY 3

The teacher introduced the lesson as chemical equilibrium and explained it with Le Chaterliers' principle saying that Le Chatelier gave three conditions that affect equilibrium to be pressure, concentration and temperature. The teacher displayed three animated objects that danced out representing pressure, concentration and temperature. The students made bodily movement as if they themselves wanted to dance too.

The teacher explaining effect of concentration on equilibrium said that a definite concentration of A, B, C and D exist together in equilibrium.

$$A+B \rightleftharpoons C+D$$

The teacher explained that if the concentration of A is increased the equilibrium is disturbed and it will shift to oppose the increase. To oppose the increase B reacted with A producing more C and D making equilibrium position shift to the right. The teacher displayed animated A which increased and increased with B reacting with it, producing more C and D. The students were interacting, watching and discussing, pointing to the direction of the increase. Many were excited when B began to react with A to form C and D.

A student suggested that C should be reduced so that they would see the effect. The students were talking in low voices sharing their observations. In the same manner, effect of pressure was discussed and displayed.

DAY 4

The teacher discussed and interactively displayed the effect of temperature on equilibrium. She explained that effect of temperature on equilibrium is either exothermic or endothermic. She explained that if the forward reaction is exothermic, the reverse reaction must be endothermic and vice-versa.

$$A+B \rightleftharpoons C,\ \Delta H = -ve$$

Animated alphabets A, B and C were shown flapping their wings and the students flapped their hands as if they were about to fly with the birds.

The teacher explained that if the equilibrium of the above reaction is disturbed by increase in temperature, according to Le Chartalier, the equilibrium must shift to oppose the increase in the direction from where the heat is coming favouring backward reaction to produce A and B. If forward reaction is to be favoured heat has to be decreased. The students were pointing to the direction of the increase. A student asked for the reduction of heat to see how C would be produced. The teacher explained that decrease in temperature slows down the rate of reaction but to increase the rate of chemical reaction without disturbing the equilibrium, catalyst is introduced at optimum temperature of 450^{0c} --500^{0c}. A student demanded to see and feel the catalyst.

It is important to note that at any point where the students indicated difficulty, the teacher would pause and replayed the stage. Both the teacher and the students would ask questions for clarity. The lesson lasted for 90mins (double periods) each day. The control group was taught by one of the other two class teachers using conventional method of instruction. The researcher observed the class, taking note on classroom processes. The lesson lasted for 90 minutes (double periods) as well. The whole experiment lasted for four weeks using the normal school time table of 90 minutes. At the end of the experiment, the CAT and CIS were reshuffled and administered again to both the experimental and control groups as post-test by the class teacher.

Control of Extraneous Variables

In experimental research of this nature, there is likelihood that some extraneous variables may introduce some bias into the study. This the researcher checkmated by adopting the following strategies:
Experimenter Bias: The presence of the researcher sometimes brings in faking by subjects. To avoid this, the normal class teachers in the selected schools taught their own students in both the experimental and control groups. They equally administered the research instrument to the students as class test. The researcher came in as external observer.
Non-Randomization Effect: It was not possible to assign participants at random to both experimental and control groups, hence, the researcher employed Analysis of Co-variance (ANCOVA) for data analysis in order to eliminate the error of non-equivalence. This controlled the initial differences of the participants in the intact groups. In this case, the pretest scores were used as covariate measures
Testing Effect: The effect of pre-test and post-test were checked. Influence of memory and forgetfulness were minimized by the time lag between the pretest and post-test. A period of four weeks was used for the experiment which was not too short or too long. The relatively short period for the experiment controlled the pretest sensitization and as well minimized the effect of maturation by the students.
Teacher Variable: Normal chemistry teacher in each of the schools under study was used. The researcher specified and operationalized the two teaching methods by outlining their distinctive procedural steps as well as developed edited lesson plan that served as operational guides for each method.

Method of Data Collection

The instrument for data collection was Chemistry Interest Scale (CIS). CIS was administered on the research participants (experimental and control groups) before the actual experiment began. The experiment started after the pretest and lasted for four weeks of eight lesson periods. Each lesson period was forty five minutes. At the end of the treatment, the items were reshuffled and administered again to the students as posttest. The chemistry teachers in both experimental and control groups were used to administer CIS to their students.

Method of Data Analysis

Mean and standard deviation scores were used to answer the research questions while two-way analysis of variance (ANCOVA) was used to test the hypotheses at 0.05 alpha levels. Two-way ANCOVA was used to analyse the experiment because the experiment has two independent variables and because there are three basic types of effects that are tested; main effect for independent variable A, main effect for independent variable B, and effect for the interaction of A and B. For the hypotheses, When the P-value was greater than 0.05, null hypothesis was not rejected, however, when p-value was less than 0.05, null hypothesis was rejected.

RESULT

Research Question 1: What are the mean interest scores of students taught chemistry concepts using instructional computer animation and those taught using conventional method?

Table 3: Mean Pretest and Posttest Interest Scores of Students Taught using Computer Animation and Conventional Methods

Method	N	Pretest mean	Posttest mean	Gain in mean	SD pretest	SD posttest
Instructional computer animation	95	39.23	77.57	38.34	9.89	7.50
Conventional method	91	36.26	59.72	23.46	13.33	7.19

Table 1 shows that the group taught chemistry concepts using instructional computer animation has a gain in mean interest score of 38.34, while those taught using conventional method has a gain in mean interest score of 23.46. This reveals that students taught chemistry concepts using instructional computer animation technique have higher mean interest gain scores in chemistry than students taught using the conventional method. The use of instructional computer animation decreases the spread of scores among the students from pretest to posttest. The use of conventional method also decreases the spread of scores among the students.

Research Question 2: What are the mean interest scores of male and female students taught chemistry concepts using instructional computer animation?

Table 2: Mean Pretest and Posttest Interest Scores of Male and Female Students Taught using Computer Animation

Gender	N	Pretest mean	Posttest mean	Gain in mean	Pretest SD	Posttest SD
Male	45	45.71	79.42	33.71	8.106	7.70
Female	50	33.40	75.90	42.50	7.431	6.97

Table 2 shows that the male students taught chemistry concepts using computer animation have a gain in mean interest score of 33.71, while the females have a gain in mean score of 42.50. Female students taught chemistry concepts using instructional computer animation have higher mean interest scores in chemistry than their male

counterparts. The use of instructional computer animation decrease the spread of scores in both males and females students.

Hypothesis 1: There is no significant difference between the mean interest scores of students taught chemistry concepts using instructional computer animations and those taught using conventional method.

Table 3: Analysis of Covariance for the Test of Difference in Interest of Students Taught Chemistry Concepts using Instructional Computer Animation and those Taught with Conventional Method

Source	SS	Df	Mean Square	F	P-value	Decision
Corrected Model	15675.358[a]	4	3918.839	79.203	.000	
Intercept	39553.507	1	39553.507	799.414	.000	
Pretest	412.084	1	412.084	8.329	.004	S
Gender	381.270	1	381.270	7.706	.006	S
Method	13221.419	1	13221.419	267.217	.000	S
Method * Gender	51.148	1	51.148	1.034	.311	NS
Error	8955.546	181	49.478			
Total	669268.000	186				
Corrected Total	24630.903	185				

Table 3 shows that at 0.05 level of significance, there was significant main effect of the treatment in the interest scores of the students, F (1,185) = 267.217, P-(0.000) < 0.05. Thus, the null hypothesis is rejected. Therefore, the effect of instructional computer animation on students' interest in chemistry is significant when compared with those taught with conventional method.

Hypothesis 2: There is no significant difference in the mean interest scores of male and female students taught chemistry concepts using instructional computer animation.

Table 3 also shows that at 0.05 level of significance, there was significant main effect of the treatment in the interest scores of the male and female students, F (1,185) = 7.706, P- (0.006). Therefore, the null hypothesis is rejected. Therefore, there is significant difference between the mean interest scores of male and female students taught chemistry concepts using instructional computer animation.

Hypothesis 3: There is no significant interaction effect of teaching methods and gender on students' interest in chemistry.

Table 3 also further that at 0.05 level of significance, there was no significant interaction effect of teaching method and gender on the interest scores of the students, F (1,185) =1.034 P- (0.311) > 0.05. .Therefore, the null hypothesis eight is not rejected. Therefore, there is no significant interaction effect of teaching methods and gender on students' mean interest score.

DISCUSSION

The findings of the study showed that the mean interest gain of students taught with instructional computer animation was higher than that of those students taught with conventional method. The findings in Table 3 showed that there was statistically significant difference in the mean interest score of students taught with instructional computer animation than that of those taught with conventional method of instruction. This finding is in line with that of Falode, Sabowale, Saliu, Usman and Falode (2016) who reported that students perform better through the use of innovative method of instructional computer animation. In contrast to the findings of other researchers Akpina and Ergin (2008) reported that instructional computer animation does not enhance students' interest.

The result of the study on male and female students' mean interest score in chemistry revealed that female students had higher interest score in chemistry than their male counterparts. The finding is in contrast with Onoh (2005) who carried out an experimental research on the effect of advance organizer on students' interest on Algebra and found out that female students achieved more than male students in both the experimental and control groups. The study also revealed that female students performed better than the male counterparts in both the experimental and control groups in their level of interest. Iweka (2006) who investigated the effect of inquiry and laboratory approaches of teaching geometry on students' interest observed no significant difference in the mean interest scores of the male and female students which is not in line with this study.

The female students had higher interest scores than their male counterparts. The interaction effect of instructional methods and gender on students mean interest scores in chemistry was not significant. The findings of this study with respect to instructional method is in line with the findings of Anaduaka (2007) who found no significant interaction effect between gender and instructional treatment on students' interest in chemistry. In line with this study, Iweka (2006), found a significant interaction effect of treatment and gender on the effect of inquiry and laboratory approaches of teaching geometry on students interest. Contrary to the findings of this study, Anaduaka (2007) in his study on students' interaction patterns on interest in chemistry, found no

interaction effect of gender and instructional treatment on students' interest. Ugwuadu (2011) also found no interaction effect between instructional method and gender on the effect of discourse patterns on students' interest in biology.

CONCLUSION AND RECOMMENDATION

The study established that instructional computer animation is effective in arousing, sustaining and enhancing students' interest in chemistry**.** The following recommendations were made based on the findings:

1. Instructional computer animation should be adopted in the chemistry curriculum delivery in all public secondary schools.
2. The ministry of education and other government bodies should mandate and help the professional bodies in terms of providing adequate fund to ensure that the workshops and seminars do not end on paper. Curriculum planners should incorporate and lay emphasis on computer animation as an alternative to conventional lecture method.

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