

Effects Of Computer Animation And Inquiry Teaching Methods On Chemistry Students' Interest In Onitsha Urban

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Abstract: *The study investigated the effects of the use of computer animation and inquiry method on chemistry students' interest in Onitsha Education Zone of Anambra state. Two research questions and three null hypotheses guided the study. A quasi-experimental research was used in the study. The population of the study consisted of all the 2,469 senior secondary year two chemistry students, out of which 233 students were involved. The instruments used for data collection was Chemistry Activities Interest Inventory (CAII). The reliability coefficient of CAII was established using Cronbach's Alpha to be 0.83. The research questions were answered using mean and standard deviation and the null hypotheses were tested using Analysis of Covariance. The findings revealed that computer animation and inquiry method had significant effects students' interest in chemistry. It indicated that computer animation was more effective than inquiry method in improving the interest of students in chemistry. It was recommended that chemistry teachers should be encouraged to attend ICT workshops and conferences to update themselves on the use of current technologies.*

Keyword: *animation, inquiry, chemistry, interest, computer*

I. INTRODUCTION

Science and technology have become integral parts of the culture of the world today. Experience has shown that the attainment of a viable economic order depends to a great extent on a vigorous and functional scientific and technological base. Osisioma (2012) noted that no nation could make any meaningful progress in the information and technology age particularly in economic development without technology whose foundations are science and mathematics. This is because the level of science, technology and mathematics education (STME) of any nation has been widely accepted to be indicative of that nation's socio-economic and political development. Giginna and Nweze (2014) affirmed that the development of any nation depends largely on the level of scientific and technological advancement. This is why the Federal Republic of Nigeria (FRN, 2013) in the National Policy on Education (NPE) emphasized the need to popularize the study of science and the production of adequate numbers of scientists to inspire and support national development.

Science is the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence. Chemistry is one of the science subjects specified for students to offer at the secondary school level and even up to the tertiary level. The performance of students at both internal and external examinations has also remained consistently poor. This can be seen in the work of researchers such as Aniodo and Eze (2014), Chukwu (2006), and Nwankwo (2007). Statistical analysis from West African Examination Council (WAEC) on the performance of students revealed that the achievement of students in chemistry over the years in SSCE is not encouraging. A lot of variables have been implicated for the poor achievement of students in chemistry at secondary school level and includes such related variables as teachers, students themselves, home and society, poor primary school background (Bada, Adekomi & Ojo, 2012; Counihan, 2012; Nwankwo, 2007). Methods employed by teachers have been seen by Bello (2012) as a greater force in fostering achievement. Eze (2012) opined that the abstract nature of chemistry promotes rote learning and memorization of facts in

chemistry classrooms. Learners, according to Eze do not have clear understanding of chemical concepts; materials vaporize as soon as they are learnt. Eze further asserted that learning could be meaningful if teachers can select teaching strategies that will stimulate the interest of the learners and get them actively engaged in the process of learning.

Osioma (2012) pointed out that variables that have both cognitive and sensory qualities are necessary in science teaching. It was also explained that the aim of chemistry education is not just to load the students with knowledge but to contribute to their mental development. Therefore, the content and methodology of chemistry teaching should be organized in such a way as to lead to this kind of change in students. Other weaknesses associated with candidates' performance according to WASSCE Chief Examiner's report, (2013) are non-adherence to rubrics, poor study habits, inability to properly define terms, poor knowledge of chemical concepts. These factors combined together leads to poor academic achievement which in turn dwindles interest in chemistry.

Interest according Harbor-Peters (2001) is a subjective feeling of concentration or curiosity over something. It is the preference for a particular type of activity, that is, interest can be expressed through simple statements made by individuals for their likes and dislikes. One is likely to do well in a discipline of interest. Interest according to Igboanugo (2013) is an important variable in learning because when one becomes interested in any activity, one is likely to be deeply involved in that activity. In other words, interest can influence how well students learn. There is therefore need to teach chemistry in a way to arouse and sustain the interest. It is therefore pertinent to look for instructional methods that could address the problems of teaching and learning chemistry in schools such as computer animation and inquiry method as recommended earlier by Azumi (2007).

Animation according to New World Encyclopedia (2017) is the illusion of movement created by showing a series of still pictures in rapid succession. In the world of computers, graphic software is used to create this effect. It is the articulation of models in a specific way, in order to achieve movement. The essence of animation is to create a believable movement of lifeless objects using principles of persistence vision. Ogbuoshi (2005) defined animation as an artificial motion or movement of inanimate objects. This according to him is done by photographing a series of drawings of objects or computer images. Computer animation is defined as the art of creating moving images through the use of computers (www.newworldencyclopedia.org, 2017). It is a subfield of computer graphics and animation. Animated films are distinguished from life action by the usual kinds of action and kinds of work that are done at the production stage. Instead of continuously filming an ongoing action in real time, animators create a series of images by shooting one frame at a time. Between the exposures on each frame, the animator changes the object being photographed. When projected, the images create illusory motion comparable to that of life action. Ogbuoshi (2005) opined that anything in the world or indeed in the universe can be manipulated to be animated by means of two dimensional drawing, three dimensional object or electronic information stored in a computer. The essence is to

create a believable image with reasonable behaviour, in order to achieve believability and acceptance to the audience. Cartoons on television are examples of animated programmes. In this study therefore computer animation is defined as the manipulation of image(s) or object(s) using computer to create movement. In other words, it is a technique whereby an inanimate object is made to move or perform some functions with the help of computer.

Inquiry method according to Shamsudin (2013) is a teaching method that focuses on student investigation and hands-on learning. In this method, the teacher's primary role is that of a facilitator, providing guidance and support for students through the learning process. Inquiry method is student-centered, in that students play an active and participatory role in their own learning process. Inquiry method according to Marcus (2017) is learning and teaching method that prioritizes student questions, ideas and analyses. From a student point of view, it is learning that focuses on investigating an open question or problem. Students must use evidence-based reasoning and creative problem-solving to reach a conclusion, which they must defend or present. Also from a teacher point of view, inquiry-based method focuses on moving students beyond general curiosity into the realms of critical thinking and understanding.

Methods such as computer animation and inquiry learning could help in teaching and learning chemistry. A little is known about the effects of these teaching methods in improving the interest of male and female chemistry students. The influence of gender on the achievement of students is widely researched but the results of studies have remained inconclusive (Amal & Samar, 2018; Chikendu, 2018). Gender differences in the interest of chemistry students is however, not widely known (Eze & Kalu, 2013). The difference in the interest of chemistry students may be related to the stereotyped classroom environment common among science learners. Science related course is often seen as a male discipline whereas, social sciences and arts are perceived as female courses (Gbodi, 2008). These connections of disciplines to gender has resulted in most female students perceiving sciences such as chemistry as a male subject with less number of females choosing science even in the secondary level of education. These disparities in gender perceptions influences interest of students and therefore, require further investigation.

PURPOSE OF THE STUDY

The purpose of this study was to investigate the effects of computer animation and inquiry teaching methods on chemistry students' interest. Specifically, the study sought to determine the:

- ✓ mean interest scores of students taught chemistry using computer animation, inquiry method and conventional method.
- ✓ influence of gender on the interest scores of the students.
- ✓ interaction effect of teaching methods and gender on the interest scores of students.

RESEARCH QUESTIONS

- The following research questions guided the study:
- ✓ What are the mean interest scores of students taught chemistry using computer animation, inquiry method and conventional method?
 - ✓ What are the mean interest scores of male and female students?

HYPOTHESES

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

- ✓ There is no significant difference between the mean interest scores of students taught chemistry using computer animation, inquiry method and conventional method.
- ✓ There is no significant difference between the mean interest scores of male and female students.
- ✓ There is no interaction effect of teaching methods and gender on the interest scores of students.

II. METHOD

RESEARCH DESIGN

The research design for the study is quasi-experimental. Specifically, the pre-test, post-test nonrandomized control group design was adopted. This is because there was no random assignment of the participants into experimental and control groups, rather intact classes were used. The choice of quasi-experimental design was because the administrative set up for the schools is such that they will not allow for disruption of the classes for the research.

AREA OF THE STUDY

The study was conducted in Onitsha urban in Onitsha Education Zone of Anambra State, Nigeria. There are two Local Government Areas (LGA) in Onitsha urban, namely; Onitsha North and Onitsha South. According to Post Primary Schools Service Commission (PPSSC) Onitsha Zone (2017), there are a total of 22 public secondary schools in the two local government areas that make up Onitsha urban. The study covered all the public schools found in Onitsha urban.

POPULATION OF THE STUDY

The population comprises of 2,469 senior secondary school year two (SS2) chemistry students in the 22 schools in Onitsha urban out of the 32 public secondary schools within Onitsha Education Zone of Anambra state.

SAMPLE AND SAMPLING TECHNIQUE

The sample comprised 233 SS2 chemistry students from public secondary schools in Onitsha urban. Onitsha urban was purposely selected from the Onitsha Education Zone. This was to provide classes where students of similar exposition will

work side by side under the same teacher, with the same classroom condition. Three out of the 22 schools in Onitsha urban were selected from two LGAs that make up Onitsha urban using purposive random sampling. The reason was to ensure that one school is selected from Onitsha South LGA having lesser number of schools and two schools from Onitsha North LGA. Also, to ensure that the schools selected have at least three or more science classes. The schools were purposively chosen also because they are in the urban area of Onitsha and are situated miles apart to avoid participants' interaction. Three intact classes were selected from each of the three schools by random sampling. The intact classes were randomly assigned to experimental groups one, two and control group. Experimental group one had 79 students, experimental group two had 81 students while these control group had 73 students.

INSTRUMENT FOR DATA COLLECTION

The researcher used Chemistry Activities Interest Inventory (CAII) for data collection. The Chemistry Activity Interest Inventory (CAII) is a 30-Item inventory developed by the researcher based on the work of Paul (2013) on the power of interest as a factor that drive learning. It has four point response scales of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The respondents were expected to indicate their level of agreement or disagreement on a number of statements (positive and negative) on teaching and learning of chemistry.

VALIDATION OF THE INSTRUMENT

CAII and CAT, the objectives of the study, research questions and hypotheses and lesson plans were given to three experts for validation. Two of the experts were from the Department of Science Education and one other expert from the Department of Educational Foundations (Measurement and Evaluation Unit, Nnamdi Azikiwe University, Awka. They were asked to assess the instrument in terms of clarity of items in addressing the purpose and provision of good basis for answering the research questions and testing the hypotheses. They also looked into the language and appropriateness of the materials to the level of students' comprehension and relevance. Their comments, suggestions and corrections were used to restructure, retain, drop or modify the items in the instrument.

RELIABILITY OF THE INSTRUMENT

The reliability of CAII was established using Cronbach's Alpha reliability technique. CAII was administered to 20 SS2 chemistry students who were not part of the study population. The generated scores were used to compute the reliability of CAII. The reliability coefficient was found to be 0.83.

TREATMENT OF EXPERIMENTAL AND CONTROL GROUPS

The experimental group one and two were taught using computer animation and inquiry instructional method

respectively. The lessons received by the experimental group one were prepared and stored in CD-ROM. Students received instructions based on the CD-ROM as presented by the teacher using computer animation for a period of four weeks and the students responded to the questions and activities accordingly. Each lesson was presented sequentially in the following manner; presentations of the concepts with computer animation illustrations, questioning in which the research assistants were expected to go round and correct students, evaluate and give them take home assignment.

The experimental group, E₂ was taught using inquiry method. The students were exposed to the procedures and materials involved in the learning of the concepts as well as the objectives and evaluations. They were asked to answer the questions involved using the objectives as they gather information on their own. Students who encountered difficulty in the course of study were helped by the research assistants (chemistry teachers). Each experimental group studied the same chemistry concepts.

The control group (C) was taught the same chemistry concepts using conventional lecture method by the research assistants. Lessons were taught for four weeks with the usual method employed by the teachers in their weekly lessons. The teachers used the lesson plans prepared by the researcher to teach so as to ensure uniformity. At the expiration of the treatment, the items of the research instruments were rearranged and re-administered to the group in the fifth week. The scores obtained by the second administration served as post-test scores of the study.

CONTROL OF EXTRANEOUS VARIABLE

The following measures were adopted for the control of some of the extraneous variables in the study.

Initial group difference: Randomization is one of the procedures of controlling initial group difference in experimental studies. However, this was not done in the present research, since the procedures would disrupt normal school administration. Instead intact classes were used. But to control the initial group differences of subjects in the intact classes, analysis of covariance (ANCOVA) was used.

Experimenter's bias: To avoid bias in the present study, the regular chemistry teachers in the schools under study were trained and used. The researcher occasionally monitored these teachers so as to ensure that they effectively adhere to the instructions. The use of the regular chemistry teachers also takes care of Hawthorne effect in the study.

Teacher variable: When different teachers are involved in an investigation, the problem of teacher variable arises since different teachers possess different standards in terms of knowledge or the content and the methodology. In order to control this variable in the present study, the researcher prepared lesson plans on the topic of the study, which were used to handle both the control and experimental groups. The researcher trained the teachers on how to effectively use these lesson plans. It was ensured that the teachers possessed a minimum qualification of first degree in chemistry or the related courses.

Variability of instructional situation: Homogeneity of instructions among groups was ensured as follows: The

researcher trained all the teachers in the instructional procedures involved. The teachers were directed to strictly follow the detailed lesson plans prepared. The experimental and control groups were taught the same topics and within the regular periods allotted to chemistry in the school timetable.

Tests knowledge: To minimize influences of memory and forgetfulness, the time lag between the pretest and posttest was six weeks which was considered to be neither too short nor too long. The pretest items were also rearranged or renumbered before being used as the posttest.

METHOD OF DATA COLLECTION

The instruments were first administered as pre-test without any feedback to the students. After the treatment, the instruments were again administered as post-test. The scale and scoring for CAII, accordingly were: For positive items Strongly Agree = 4, Agree = 3, Disagree = 2, Strongly Disagree = 1 while for negative items Strongly Agree = 1, Agree = 2, Disagree = 3, Strongly Disagree = 4. The scores of the students in each instrument was collated for data analysis.

METHOD OF DATA ANALYSIS

The research questions were answered using means and standard deviation. The null hypotheses were tested at 0.05 level of significance using analysis of covariance (ANCOVA). The pretest scores were used as covariates or control measure to the post scores. The ANCOVA helped to remove or control any initial differences between groups such as intellectual ability, motivation, socioeconomic factors, attitude etc. On the decision rule, if P value is less than 0.05 the null hypothesis was rejected and vice versa if it is greater.

III. RESULTS

RESEARCH QUESTIONS 1: What are the mean interest scores of students taught chemistry using computer animation, inquiry method and conventional method?

Method	N	Pre-test Mean	Post-test Mean	Mean Gain	Pre-test SD	Post-test SD
CA	79	44.68	61.63	16.95	8.81	8.31
IM	81	41.28	54.80	13.52	6.25	7.97
CM	73	41.29	44.38	3.09	9.15	8.34

Table 1: Mean Pre-test and Post-test Interest Scores of Students taught Chemistry using Computer Animation (CA), Inquiry Method (IM) and Conventional Method (CM)

Table 1 shows that the group taught chemistry using Computer Animation has mean gain interest score of 16.95, those taught using Inquiry Method has mean gain interest score of 13.52 while those taught using Conventional method has mean gain interest score of 3.09. The highest spread of scores in the post-test was among students taught using Conventional Method (8.34), followed by those taught using Computer Animation (8.31) while students taught using Inquiry Method had the lowest spread of scores (7.97).

RESEARCH QUESTION 2: What are the mean interest scores of male and female students?

Method	Gender	N	Pre-test Mean	Post-test Mean	Mean Gain	Pre-test SD	Post-test SD
CA	Male	31	48.68	64.42	15.74	8.92	6.66
	Female	48	42.10	59.83	17.73	7.77	8.82
IM	Male	35	41.23	53.00	11.77	6.40	7.69
	Female	46	41.33	56.17	14.84	6.21	7.99
CM	Male	38	40.84	43.47	2.63	8.66	8.03
	Female	35	41.29	45.37	4.08	9.97	8.68

Table 2: Mean Pre-test and Post-test Interest of Male and Female Students

Table 2 shows that male students taught using computer animation has mean gain interest score of 15.74 while the females have a mean gain interest score of 17.73. The male students taught chemistry using inquiry method has mean gain interest score of 11.77 while the females have 14.84 whereas the male students taught using conventional method has mean gain interest score of 2.63 with the female having 4.08.

HYPOTHESIS 1: There is no significant difference between the mean interest scores of students taught chemistry using computer animation, inquiry method and conventional method.

Source of variation	SS	Df	MS	F	P-value	Decision
Corrected Model	18652.081 ^a	6	3108.680	85.398	.000	
Intercept	4708.035	1	4708.035	129.333	.000	
Pre-test	6589.511	1	6589.511	181.018	.000	
Method	8357.527	2	4178.764	114.793	.000	S
Gender	112.092	1	112.092	3.079	.081	NS
Method * Gender	100.041	2	50.020	1.374	.255	NS
Error	8226.958	226	36.402			
Total	702640.000	233				
Corrected Total	26879.039	232				

Table 3: ANCOVA on Difference between the Mean Interest Scores of Students taught using Computer Animation (CA), Inquiry Method (IM) and Conventional Method (CM)

Table 3 shows that at 0.05 level of significance, 1df numerator and 232 df denominator, the calculated F is 114.793 with Pvalue of .000 which is less than 0.05. Thus, the null hypothesis was rejected. Therefore, there is a significant difference in the interest scores of students taught chemistry using Computer Animation, Inquiry Method and Conventional Method.

(I) Method	(J) Method	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Animation	Inquiry	4.755*	.992	.000	2.800	6.709
	Conventional	14.939*	1.012	.000	12.944	16.934
Inquiry	Animation	-4.755*	.992	.000	-6.709	-2.800
	Conventional	10.184*	.978	.000	8.256	12.112
Conventional	Animation	-14.939*	1.012	.000	-16.934	-12.944
	Inquiry	-10.184*	.978	.000	-12.112	-8.256

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

Table 4: Scheffe PostHoc

Table 4 reveals that a significant difference exists between the mean interest scores of students taught using computer animation and inquiry method in favour of computer animation. Table 4 also reveals that a significant difference exists between the mean interest scores of students taught using computer animation and conventional method in favour of computer animation. Table 4 further shows that there is

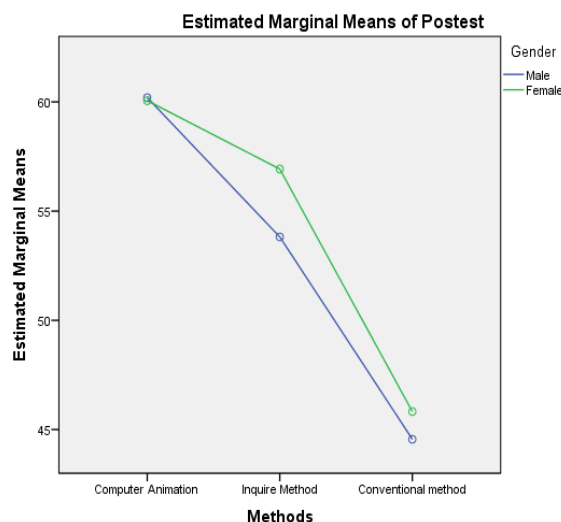
significant difference between the mean interest scores of students taught using inquiry method and conventional method in favour of inquiry method. Computer animation followed by inquiry method significantly improved students' interest in chemistry more than conventional method.

HYPOTHESIS 2: There is no significant difference between the mean interest scores of male and female students.

Table 3 also shows that at 0.05 level of significance, 1df numerator and 232 df denominator, the calculated F is 3.079 with Pvalue of .081 which is greater than 0.05. Thus, the null hypothesis was not rejected. Therefore, there is no significant difference between the mean interest scores of male and female students.

HYPOTHESIS 3: There is no interaction effect of teaching methods and gender on the interest scores of students.

Table 3 further shows that at 0.05 level of significance, 1df numerator and 232 df denominator, the calculated F is 1.374 with Pvalue of .255 which is greater than 0.05. Thus, the null hypothesis was not rejected. Therefore, there is no significant interaction effect of teaching methods and gender on the critical thinking scores of students.



Covariates appearing in the model are evaluated at the following values: Pretest = 42.44

Figure 4: Plot of interaction effect of teaching methods and gender on the interest scores of students

IV. DISCUSSION

The result of this study revealed that the use of computer animation instructional method in teaching significantly facilitated the interest of students in chemistry more than inquiry method and conventional method. This could be attributed to the reduction in the abstraction in the learning of chemistry since most of the concepts were animated. Thus, little or no information was left to the students' imagination since they could visualize the concept the teacher was trying to teach. The engagement of both the audio and visual senses of the students in this manner explains why students taught using animated media strategy significantly achieved higher than other students.

This finding was supported by the earlier findings of Salisu (2015) who proved that students exposed to animated media strategy showed greater interest and retention than those taught with lecture method. The findings show that the effect of the use of the computer animation method on interest of students in chemistry is significant. This is in line with the findings of researchers like Chikendu (2018) who pointed out that computer animation instructional method had significant effect on interest and achievement. Also Salihu and Umar (2018) in their study indicated that use of computer animation was significant on the interest of students in economics concepts. Those taught economics with computer animation had significantly higher interest scores than those taught with conventional method.

Result of the finding also indicated that the use of inquiry method in teaching improved the interest of students in chemistry than conventional method. This was in accordance with the findings of Ogbuanya and Owodunni (2013) as they asserted that reflective inquiry instructional technique is more effective in improving students' interest. The findings revealed that the effect of the use of inquiry method in teaching on the interest of students in chemistry is significant.

The interaction of teaching methods and gender on the interest of the chemistry students was disordinal. Thus, in one group males were more favoured whereas in another teaching method group, females were favoured. The effect of the teaching methods on interest of the students was therefore gender sensitive. The finding by Salihu and Umar (2018) and Ogbuanya and Owodunni (2013) contravene the findings of the present study that there was no significant influence of gender on students' interest whereas they reported a significant influence of gender on interest.

V. CONCLUSION

It can be concluded that computer animation positively enhances and significantly improves students' interest in chemistry more than inquiry method and conventional method. On the other hand, inquiry method improves interest in chemistry more than conventional method.

VI. RECOMMENDATIONS

Based on the finding and conclusion of the study, the following recommendations were made:

- ✓ Science Teachers Association of Nigeria should organize regular workshops to intimate science teachers on the use of computer animation and inquiry instructional methods in teaching chemistry.
- ✓ There is also need that chemistry teachers should be encouraged to attend ICT workshops and conferences to update themselves on the use of current educational technologies.
- ✓ The Ministry of Basic Education and Post Primary Schools Service Commission should organize periodic workshops for chemistry teachers on the use of computer animation and inquiry instructional methods to enable them to acquire the skills.

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