

## Effects of animated-media instructional strategy on students' achievement in chemistry when compared to those taught using conventional method using their pretest and posttest mean scores

Pius Promise Obinna, Abumchukwu Angela Adanna and George Patience Chinaza

Department of Science Education Nnamdi Azikiwe University Awka

Email: [promisepius850@gmail.com](mailto:promisepius850@gmail.com); [aa.abumchukwu@unizik.edu.ng](mailto:aa.abumchukwu@unizik.edu.ng)

---

### ABSTRACT

Academic achievement is the display of knowledge attained or skills developed by students in the school subject regularly designated by test scores or by marks assigned by teachers which can be low or high. It is the extent to which students achieve the goal of instruction. The design of the study was quasi-experimental, specifically the pretest-posttest non-equivalent control group design. The aim of this research was to evaluate the effects of animated-media instructional strategy on students' achievement in chemistry when compared to those taught using conventional method using their pretest and posttest mean scores. The result of this research shows that the group taught chemical combination using animated-media gained mean score in achievement of 41.71, while those taught using conventional method gained mean score of 17.16. With posttest of 75.64, animated-media strategy was effective in enhancing students' academic achievement in chemistry. In conclusion the results of this shows that the effect of animated-media instructional strategy on students' achievement in chemistry is significant compared to those taught using conventional method using their pretest and posttest mean scores.

Keywords: Animated-media, strategy, achievement, chemistry and conventional methods

---

### INTRODUCTION

Chemistry is an academic subject taught in senior secondary schools and tertiary institutions in Nigeria. It also focuses on nature and effect of any complex phenomenon [1,2,3]. Chemistry is the scientific study of matter, its properties, and interactions with other matter and with energy. An important point to remember is that chemistry is a science, which means its procedures are systematic and its hypotheses are tested using the scientific method [4]. The objectives of teaching chemistry at senior secondary schools level were spelt out by Federal Republic of Nigeria [5] in the National Policy on Education and reinforced by examination bodies namely, the West African Examination Council (WAEC) and National Examination Council (NECO) and curriculum development body such as Nigerian Educational Research and Development Council [6]. These

objectives have been thought of in terms of what chemistry can contribute to the realization of the aims of secondary education in Nigeria. Strategies for teaching chemistry outlined by scholars range from the use of laboratory activities, lecture, discovery, inquiry, demonstration, problem-solving, process approach, deductive and inductive, simulation, animation methods among others. In addition, the efficacy of the strategies and their effects on student's academic achievements were also outlined. [7] revealed the inquiry and demonstration methods were among the most effective strategies of teaching because students' cognitive achievement, interest, and retention of chemical combination of chemistry are attained and facilitated faster than in the other methods. [8] posited that discovery method enhances the academic achievement of students.

[9] reinforced this idea through the outdoor laboratory activities for junior secondary Basic Science, while [10] recommended the use of media technology because it holds promises of boosting academic achievement beneficially. Academic achievement was defined by [11] as the exhibition of knowledge attained or skills developed by students in a subject designed by test scores assigned by teachers. The Chief Examiner's Report showed that the raw mean score of students in chemistry paper 1 and paper two examinations have never been up to the stanine pass score of 50. Thus, the

students' achievement in chemistry has remained poor. The poor achievement in chemistry according to the Science Teachers Association of Nigeria is as a result of gross underfunding, large class size, shortages of qualified science teachers, and poor teaching strategies among others. Reports by [12] earlier noted that the problems still existed in schools. Other challenges in learning chemistry outlined by [13] include large classes, students' limited interest in chemistry compounded by limited teaching aids and poor teaching techniques.

#### Purpose of the Study

The purpose of this research was to investigate the effects of animated-media instructional strategy on students' achievement in chemistry

when compared to those taught using conventional method using their pretest and posttest mean scores in Awka EducationZone.

#### Significance of the Study

The result of this study will be of great benefit to principals, chemistry

teachers, students, textbook publishers, writers and researchers.

#### Research Questions

The following research question guided the study: What is the effect of animated-media instructional strategy on students' achievement in chemistry

when compared to those taught using conventional method using their pretest and posttest mean scores?

#### Hypothesis

The following null hypothesis was tested at 0.05 level of significance: Effect of animated-media instructional strategy on students' achievement in

chemistry is not significant when compared to those taught using conventional method using their pretest and posttest mean scores.

### REVIEW OF RELATED LITERATURE

#### Conceptual Framework

##### Animation-media Instruction Strategy

Educational animated-media according to [14] are animations produced for the specific purpose of fostering learning. The popularity of using animated-media to help students understand and remember information has greatly increased since the advent of great graphics-oriented computers. This technology allows animated-media to be produced much more easily and cheaply than in former years. Previously, traditional animated-media required specialized labour-intensive techniques that were both time-consuming and expensive. In contrast, software is now obtainable that makes it possible for individual educators to author their own

animations without the need for specialist expertise. Teachers are no longer limited to relying on static graphics but can readily convert them into educational animated-media that can be used for instruction.

Animated-media instructional strategy is an animation-oriented instruction where the teacher employs the use of animated texts, graphics, cartoons and others in the instructional process. The use of animated-media instruction can be accomplished through the use of animated-media teaching aids. According to [15], animated-media teaching aids are devices that have the facial appearance of both audio and

visual representations that are used in the teaching/learning process for effective dissemination of knowledge. According to [16], animated-media has three characteristics namely: the simulation; display of movements and picture. Animated-media instruction must correspond to the context of the topics, otherwise, it becomes distracting, and the objective intended in using it is defeated. The study, therefore, centres on animations as the rapid display of a sequence of pictures on a computer screen that has the potential to provide feedbacks in

student's achievement, interest and retention in learning. [17] reiterated that animated-media as a means of facilitating teaching and learning processes in the schools, is not just a means of transforming knowledge, but more importantly, it can be an extension of both the teacher and the chalkboard. Animated media Instructional strategy is, therefore, the use of motion text, pictures or graphics, cartoons and model mimics as an instructional aid in the teaching and learning process.

#### Academic Achievement

Academic achievement is the display of knowledge attained or skills developed by students in the school subject regularly designated by test scores or by marks assigned by teachers which can be low or high [18]. It is the extent to which students achieve the goal of instruction [19]. Academic achievement depicts the students' mastery of learning which is indicated by grades obtained in standard test or authentic assessments. Researchers [20,21,22,23,24

] found that the persistent decline in academic achievement is attributed to teacher instructional strategies among others. Thus, instructional strategies used by teachers in teaching-learning process have an important effect on learner's academic achievement. In this study, academic achievement is the score obtained by students from the standardized achievement test given which indicates the level of mastery of the concepts taught.

#### Theoretical Framework

##### Achievement in chemistry and other Science Subjects

The history of students' low achievement in science subjects on a prominent scale is not new in Nigeria. According to [25], what is new is that this trend has continued unabated, and seems to loom longer since Nigeria's political independence. Chemistry as one of the science subjects is not left out. Infact, the trend of low achievement in chemistry and sciences, in general, has persisted for the past three decades. [26] reported that less than 20% of candidates who entered for WAEC 'O' level in chemistry obtain up to credit pass. Furthermore, [27] also explained that there is a persistent declining trend in students' achievement in science subjects at the secondary school level. In terms of students' achievement, [28] stated that interest and retention are correlates of achievement. [29] placed interest after intelligence as factors that effect students' achievement, retention and

also asserted that interest is determinants of success. Low achievement in science is attributed to lack of interest and retention in science subjects [30]. Teachers should, therefore, stimulate and sustain their students' interest through the use of varieties of teaching techniques. This would go a long way in promoting students interest in the sciences which would, in turn, stimulate high academic achievement in the area. Efforts at improving interest in science have also attracted the interest of researchers [31]. Although speculations point to the inability of science instructors to utilize electronic and other technological media as a major cause of poor interest and retention in science, enough research evidence has not been provided. As a result, the extent to which animated-media strategy could affect achievement, retention and interest and facilitate instruction in

science to the benefits students need to be investigated. Hence, this study explored the extent to which animated-

media strategy can enhance achievement, retention and interest in chemistry.

#### Factors Related to Achievement, Retention and Interest in Chemistry

Achievement, retention and interest in chemistry have been the major objects of research over the years. Achievement, according to [31] is partly a yardstick for measuring the extent of understanding of the nature of science. [32] defined interest as an internal state that effects the individual's personal actions. From the above definition, interest in chemistry refers to individual reactions, feelings and impressions about chemistry and chemistry related tasks or situations. [33] referred retention as the ability to retain and later recall information or knowledge gained after learning. Several researchers have worked on factors that effect achievement in chemistry. [34] observed that chemistry teaching in Nigeria schools has been predominantly lecture or expository in approach. [35] also attributed the apparently consistent poor results in chemistry to

the poor approach to chemistry instruction. Although it is widely acknowledged that there is no one best approach or method of teaching since research findings had revealed that some of these teaching methods interact in a well-defined manner with some personal attributes of learners to produce a more effective teaching and learning. Science has to do with the organization of knowledge which will contribute significantly to a better appreciation of natural phenomena. As such, science learning, therefore, requires the development of rational, critically thought out processes in the students to enable them to explore, invent, discover and develop some of the tools of inquiry appropriate to the field of study [35]. [36] established a positive relationship between achievement, retention and interest in chemistry.

#### Empirical Studies

##### Effect of animated-media instructional strategy on students' achievement

[37] conducted a study on computer animation and the academic of Nigerian secondary school students in Biology. The purpose of the study was to investigate the effects of computer animation on the academic achievement of Nigerian senior secondary school students in biology. The moderating effects of mental ability and gender were also investigated. Four hypotheses were tested in the study. The pretest-posttest, control group, quasi-experimental design with a 2x2x2 factorial matrix was adopted for the study. The population of the study was senior secondary school Year II biology students from selected Federal Government Colleges in two states in Southwestern Nigeria. The sample for the study was 189 SS2 students. The instrument for data collection was Biology Achievement Test (BAT) validated and yielded reliability coefficient of 0.71 with KR-20 formula. Data obtained were analysed using

ANCOVA. Findings show that there is a significant main effect of treatment on students' achievement in biology. The computer animation was effective in improving students' achievement, therefore, computer animation was recommended as a means of teaching biology to students in Nigerian secondary schools. [38] examined the effects of cartoons on students' achievement and attitude in biology teaching. The purpose of this study was to determine the effect of cartoons animation as a teaching tool towards student's achievement and attitudes about endocrine system and biology. Three hypotheses were tested in the study. In the research, mixed research design which consists of interview form with open-ended questions and quasi-experimental non-equivalent pretest-posttest control group was used. The study involved 56 students that include 28 students in control group and 28 students in

the experimental group in a secondary school in Erzurum. An achievement test, attitude test and interviews were used to generate data for analysis. The validities of the instruments were done by experts and their reliability of the achievement test was 0.76. The data generated from the instruments were analysed using t-test. The findings of this study show that students' knowledge and understanding and attitude of biology were positively changed on the unit of endocrine system with the use of cartoons animation. The research recommended the use of animation in teaching biology. [39] investigated the effectiveness of animation and multimedia teaching on students' performance in science subjects. The purpose of the study was to investigate the effect of animation and multimedia teaching on the academic performance of students in sciences. Three research questions guided the study and three hypotheses were tested. The research design employed for this study was quasi-experimental research design of two groups' pretest, posttest control design. The population of this study

consisted of all Senior Secondary School Two (S.S.S 2) students in public schools within Ado Ekiti Local Government Area of Ekiti State. 100 students were randomly selected from four secondary schools in Ado Ekiti Local Government Area of Ekiti State. The instrument for the study was Science Achievement Test (SAT) validated by science experts and yielded inter-rater reliability coefficient of 0.82. The data were analysed using t-test in line with the three hypotheses were postulated. The result confirmed the effectiveness of the treatment of animation on the performance, but with no significant difference in the performance of male and female students at 0.05 level of significance. The findings, therefore, revealed that there was a significant difference in the performance of students exposed to cartoon style multimedia teaching and those that are conventionally taught. It was therefore recommended that the use of cartoon-style animation and multimedia teaching should be encouraged so as to complement other methods of teaching science in schools and colleges.

METHODS

Research Design

The design of the study is quasi-experimental, specifically the pretest-posttest non-equivalent control group design. Quasi-experimental design is one that seeks to establish the cause and effect relationship between the variables of interest in the study but where the random assignment of subjects to experimental and control groups is not possible [40]. According to

[41], in such research, intact or pre-existing groups are used. The study used two groups; experimental and control. The design was adopted for this study because the administrative set-up in the secondary school system would not allow for randomization of students into experimental and control groups, thus, intact classes were used. The design of the study is shown in figure 1.

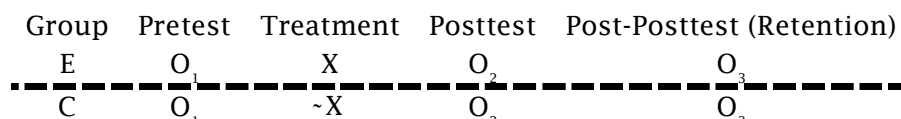


Figure 1: Design of the experiment

Where

E = Experimental group

C = Control group

O<sub>1</sub> = Pre-test administration

X<sub>1</sub> = Experimental Treatment (teaching using animated-media instructional strategy)

X<sub>0</sub> = Control Treatment (teaching using conventional method)

O<sub>2</sub> = Post-test administration

O<sub>3</sub> = Post-posttest administration (Retention)

#### Area of the Study

The area of the study was Awka Education Zone in Anambra State. Anambra State is located in the old Eastern Region of Nigeria. The geographical location of the boundaries are as follows; in the North is Kogi State, in the South is Imo State and River state, in the East, is Enugu State and the in the West is Delta State. Anambra State comprised the six Education Zones namely; Aguata, Awka, Onitsha, Nnewi, Ogidi and Otuocha Education zones. The State Education Commission centrally controls these Zones. The curriculum, textbooks,

school year, examination trends and instructional practices are the same for these zones making it possible that what happens in each of these Zones can be generalized to other Zones in the state. There are 59 secondary schools in Awka Education Zone out of which 24 are co-educational secondary school for the 2015/2016 academic session (Source: Zonal Education Office Amawbia 2015/2016 Statistical returns). Most people living in Awka are civil servants, lecturers, teachers, students and traders.

#### Population of the Study

The population of this study is 1250 SS2 chemistry students from the 24 co-educational public secondary schools in Awka Education Zone. This constituted 500 males and 750 females (Source: Planning, Research and Statistics Department, Post Primary School Service Commission, 2017). The SS2 class was chosen for the study because at this stage, students can comprehend

and understand chemical concepts; organize themselves independently as may be required during research studies. Also in SS2 class, students are likely to show more interest in chemistry since they are approaching their final examination in chemistry at the West African Secondary School Certificate level.

#### Sample and Sampling Technique

The sample for the study was 122 SS2 chemistry students. First, simple random sampling (balloting with replacement) was used to select two schools from the co-educational schools. The two schools were categorized into experimental and control groups. In both schools, since

the chemistry students are only in two arms, both arms were used. Thus, two intact classes (one from experimental group and one from control group) were used for the study. The experimental group consisted 27 males and 50 females and the control group had 20 males and 25 females.

#### Instruments for Data Collection

The instruments for the study were Chemical Combination Achievement

Test (CCAT) and Chemistry Interest Scale (CIS).

#### Chemical Combination Achievement Test (CCAT)

CCAT contained 40 questions developed by the researcher to determine the level of achievement and retention of students in chemical combination concept. The instrument was developed from the chemical combination concepts of senior secondary school chemistry curriculum. The CCAT items consist of 40 objectives (multiple choice type) test questions each with

four alternatives (A-D) answer options. The item took into consideration all the six Bloom's taxonomy of educational objectives through the use of a table of specification to ensure equal distribution of the items over the units. CCAT was also designed to generate information on the demographic data of the students.

### Chemistry Interest Scale (CIS)

The Chemistry Interest Scale (CIS) is a 20 items interest scaled developed by the researcher to determine the interest of students before and after treatment on the concept of chemical combination in chemistry. The items were developed using a four-point scale of very much

like VML, Like- L, Dislike D, very much dislike VMD. The instrument was also designed to generate demographic information on the students. Also, lesson plans were developed for the experimental group.

### Validation of the Instruments

The purpose of the study, the research questions and hypotheses and the initial drafts of the CCAT, CIS and the lesson plans were given to two lecturers and one experienced secondary school teacher for validation. The lecturers were from the Departments of Educational Foundation (Measurement and Evaluation) and Science Education. The validators were requested to vet the achievement tests in terms of suitability

of the items in the CCAT, suitability of the language, relevance of each item, content coverage and any other consideration outside the ones indicated. They were requested to write M (modify), D (delete), R (retain) against items they wish the researcher to modify, delete or retain. Their corrections and suggestions were effected in the final draft of the instrument.

### Reliability of the Instruments

Reliability test for the data collection instruments was carried out to determine the internal consistency of the instrument. The reliability of the CCAT was established using the Kuder-Richardson 20 (KR20) and that of CIS using Cronbach Alpha. [42] posited that Kuder Richardson 20 and Cronbach Alpha methods involved single administration of the instrument and that they could be used to establish the internal consistency of instruments. The Kuder Richardson 20 is good for dichotomously scored data while the Cronbach Alpha technique is excellent for the polytomous data. Copies of

CCAT and CIS were administered to 20 respondents drawn from Onitsha high School, Onitsha. The scores obtained were subjected to KR20 which yielded coefficient of internal consistency of 0.85. The reliability of Chemistry Interest Questions (CIS) was established with Cronbach Alpha method and the coefficient of internal consistency was 0.87. The reliabilities were adjudged to be very high for use in the study. This is in line with the assertion of [43] that if the reliability coefficient yields 0.60 and above, it is high enough for use in educational research purpose.

### Animated-Media Package

Animated-media Package is a package adapted from lectures on chemical combination by [44] and used as an instructional strategy for the experimental group. The animations were developed with the aid of the Microsoft office powerpoint, Adobe flash files (soft files), GIF animated images, Internet downloaded chemical combination instruments. These components embedded into the Microsoft document to form a single animation package. Adobe flash files (soft files) were imported into the power point using computer software named adobe acrobat. GIF animated images

were adapted and modified using computer software called graphic image processing software (GIMP) to suit this work. The modification consisted in removing the unwanted animations or other emphasizes by editing the file and removing unwanted files. Images used in the package were downloaded from [www.flicker.com](http://www.flicker.com); [www.tumblr.com](http://www.tumblr.com); and; Google images. Adobe Flash software was used to independently play all soft files. The animated images downloaded from an internet source and included animated ionic bonding versus covalent bonding instrument, covalent bonding, how atoms bonds. These images were in

form of JPEG, PNG, GIF, BMP. In all the above image forms, only GIF format supports animation. However, computer software called GIMP converted all the images to animated package that can be projected and displayed as motion

images. The animation was downloaded and modified to suit this work. The animation was based on the following content of chemistry: atomic structure; principles of filling in shells, binding forces and chemical combination.

#### Experimental Procedure

The researcher with the aid of two research assistants who were the chemistry teachers in the sampled schools carried out the research. The researcher had meetings with the

research assistants in which the objectives of the study were explained to them. The researcher trained the two research assistant for one week in three contacts for 2 hours per contact.

#### Teaching of experimental and control groups

Teaching of the experimental group was conducted by trained research assistants. However, prior to the administration of treatment, pretest was administered to the group to determine their prior knowledge related to chemical combination concepts. Experimental group in this study are groups of students exposed to experimental treatment (teaching using Animated-Media instructional Strategy). The treatment has six distinct stages collapsed into three major stages namely, pre-animated-media; content delivery and post-animated media. Pre-animated-media stage dealt with the provision of an enabling environment for the conduct of animated-media instruction. Here, provision was made for the computer, projector, animated chemical combination software, animated flashcards and the supply of power without interruption throughout the lesson. Sitting arrangement was that there is enough space for projection so that it will not affect the appearance of the image on the screen. As part of pre-animated media state, the teacher ensured that students observed the preparation before the presentation. In addition, objectives of the lesson were clearly stated and explained to the students. The next stage is content delivery or animation stage, where the teacher begins with brief introduction of the lesson to the students. That is, the teacher asked students to narrate their experience on chemistry, what combination, chemical, atom is all about. This is then followed by power

point projection of the developed animated package in the class based on the topic of discussion. Each episode is projected on the screen and students were actively participating in observing, recording, and discussing the presentation. The role of teacher is facilitating and clarification of points unclear to students. Flashcards based on chemical combination concepts projected were also distributed to students as part of the package to enable them interacts with the media and perform activities of animations during the lesson. It should be noted that after each episode, students performed activities based on it and the teacher interacted with students in answering questions and observations raised during projection and activities. The last stage of the lesson was evaluation stage which is a stage of determining whether the stated objectives have been achieved or otherwise. At this stage, the teacher asked students some questions based on the lesson treated with a view to remedying some areas of difficulties observed during the lesson. At the end of each lesson, students had some take home exercise on chemical combination concepts. This exercise lasted for a period of six weeks with two hours fifteen minutes (45 minutes per period) interaction per week. Immediately after the treatment, the test instruments were re-administered on students as a posttest to determine the achievement and interest of students in chemical combination concept. After 4 weeks of posttest, the same CCAT was re-



administered as posttest to determine students' retention ability. The treatment administration can be summarized as follows: Step I: Pre-animation stage (ensure that all relevant materials for animation are adequate and ready to be used). Step II: Introduction (link students' previous knowledge with the lesson to be treated through questioning and activities). Step III: Content Delivery (power point presentation of animated chemical combination concepts). Step IV: Teacher-students' interaction to clarify points. Step V: Activity stage (integrating teaching with various students' activities using other graphic animated-media package). Step VI: Evaluation (this involved application of questioning techniques to determine the attainment of the objectives of the lesson or otherwise). Step VII: Review/Conclusion (highlight and clarify point and areas of difficulties observed during the lesson; allow

#### Teaching the Control Group

The teaching of the control group was also conducted by another research assistant using conventional method. Prior to the actual teaching, pretest was administered to the group to determine their prior knowledge related to chemical combination concepts. In each lesson, objectives were clearly stated to the students and questions were asked in the introductory part to enable students to link their previous knowledge with the lesson to be treated. In the content delivery, the presentation involved verbal communication of

#### Method of Data Collection

In order to generate achievement, retention and interest scores using the CCAT and CIS research instrument, the researcher adopted the pre-test, post-test and post-posttest technique. In the pre-test, the instrument was administered on the participants in their various schools; a conference marking of the scripts was carried out. Each script was vetted and totalled section by section by the researcher.

students to produce their own note through observation during presentation and; ask them to perform some take-home assignments based on the lesson treated). During the experiment, two different treatment patterns were applied by the research assistants (teaching using Animated-Media Strategy and conventional method). Lesson plans for both groups addressed the same instructional objectives based on the same content of chemical combination. However, the experimental plans provided opportunities for small group interaction, activities, and sharing of media resources among the members. Conversely, students in the control group received lectures in the class only. The control group was provided with the conventional routine situation in the classroom while the experimental group was provided with Animated-Media Instructional Strategy as treatment.

chemical combination concepts between the research assistant and the students without integrating any media as in the case of the experimental group. The same content was delivered to the two groups for a period of four weeks after which posttest was administered to determine students' achievement and interest in chemical combination concepts. After a period of four weeks, another test called post posttest was administered to the same group to determine their retention abilities.

Each participant's score in a section of the instrument was entered against his or her serial number. This exercise was repeated after the post-test, post-posttest and the final result sheets completed. Copies of these sheets titled raw scores of student groups (according to school and treatment types) were then handed over to computer analysts for data analyses.

### Method of Data Analysis

The responses of the subjects to CCAT were scored using the marking scheme. Each correct response attracted 2.5 point with maximum score of 100 marks. The Chemistry Interest Questionnaire has 20 items to measure the interest of students on Chemical combination concept of chemistry. The item scales were scored thus: Very much liked VML has 4 points, Liked - L has 3 points, Dislike D has 2 marks, Very much dislike VMD has 1 mark. For students who scored 50 and above in the posttest, retention and post-interest

test, the treatment was said to be effective. For students with the highest gained mean, the treatment is said to be more effective. The research questions were analyzed using mean, while the hypotheses were tested using Analysis of Covariance (ANCOVA). The use of ANCOVA was to control the initial group difference. The decision rule was that the null hypothesis be rejected when p-value is less than 0.05 and not to reject the null hypothesis when p-value is greater than 0.05.

### PRESENTATION AND ANALYSIS OF DATA

Research question 1: What is the effect of animated-media instructional strategy on students' achievement in

chemistry when compared to those taught using conventional method using their pretest and posttest mean scores?

Table 1: Pre-Test and Posttest Mean Achievement Scores of Students taught Chemistry using Animated-media Strategy and Conventional method

Groups	N	Pretest Mean	Posttest Mean	Gained Mean	Decision
Animated-media	77	33.92	75.64	41.71	Effective
Conventional method	45	31.20	48.36	17.16	

Table 1 shows that the group taught chemical combination using animated-media has gained mean score in achievement of 41.71, while those taught using Conventional method had gained mean score of 17.16. With posttest of 75.64, animated-media strategy was effective in enhancing

students' academic achievement in chemistry.

Hypothesis 1: Effect of animated-media instructional strategy on students' achievement in chemistry is not significant when compared to those taught using conventional method using their pretest and posttest mean scores.

Table 2: ANCOVA on Effect of Animated-Media Strategy on Achievement of Students taught chemistry and those taught using Conventional method

Source	SS	df	Mean Square	F	Sig.
Corrected Model	21653.706 <sup>a</sup>	2	10826.853	75.247	.000
Intercept	46733.468	1	46733.468	324.801	.000
Pretest	516.000	1	516.000	3.586	.061
Method	20188.470	1	20188.470	140.311	.000
Error	17122.130	119	143.883		
Total	563366.000	122			
Corrected Total	38775.836	121			

Table 2 shows that there was a significant main effect of the treatment which accounted for 55 percent of the variance in the achievement scores of the students,  $F(1, 121) = 140.311$ ,  $P(0.00) < 0.05$ . Thus, the null hypothesis

was rejected. Therefore, effect of animated-media instructional strategy on students' achievement in chemistry is significant when compared to those taught using conventional method using their pretest and posttest mean scores.

### Summary of Findings

Effect of animated-media instructional strategy on students' achievement in chemistry is significant compared to

those taught using conventional method using their pretest and posttest mean scores.

### Discussion of Findings

Effect of Animated-Media Instructional Strategy on Academic Achievement of Students  
The findings of the study revealed that animated-media strategy positively affected the students' achievement in chemistry, accounting for 55% of the variance in the students' score. Students in the animated-media strategy group scored significantly higher than their counterparts in the conventional method group. This significant difference in the achievements of the animated media group and those in the lecture group can be attributed to the benefits inherent in the use of animated-media strategy. Animated-media strategy reduces the abstract nature of the chemical combination concept taught through the use of animation. The use of animation elucidated the concept and facilitate proper understanding of the concepts through the use of animation, different chemical combination means were broken down to different example with a display of the reaction processes involved in each combination reaction. This gave the students' insight to the reaction in situ, hence, the increase in achievement. When such instructional resources are used to enrich learning experience and environment, students are expected to achieve high. On the other hand, the lack of such rich instructional resources is related to the decline in the availability of teaching resources [44]. The finding of this study lends support to the study of [45] who reported that integrated media such as animation significantly affected students' achievement. The findings of the study also supports the findings of [46] who reported significant difference in the achievement of students taught animation in the form of cartoon and lecture in favour of animation. The findings of the study also in line with that of [47] who reported the significant effect of animation on achievement.

### CONCLUSION

The findings of this study revealed that animated-media instructional strategy positively affected students' achievement in chemistry. This implied that the animated-media strategy is effective for teaching chemistry

concepts. Chemistry teachers should make recourse with animated-media software and develop animated media models to be used in the process of instructional delivery.

### REFERENCES

1. Ababio, O. Y. (2010). *New school chemistry for senior secondary schools*. Onitsha: Africana Feb Publishers PLC.
2. Abdulkarim, B. (2010). An assessment of facilities for teaching practical chemistry in senior secondary schools in Zaria Education Zone. *Journal of Science and Mathematics Education, 1(1)*, 89-97.
3. Abdulkarim, B. (2010). The perception of chemistry as a subject among secondary school students in Zaria Metropolis. *Journal of Educational Research and Development, 5(1)*, 99-103.
4. Abdullahi, M. (2009). *Basic concepts in education*. Kano; Pmats Commercial Press
5. Aderogba, K. A. (2011). Laboratories and sustainable teaching and learning about senior secondary school (SSS) chemistry in Nigeria. *Journal of Educational and Social Research, 2(4)*, 112-119.
6. Aderogba, K. A. (2012). Improving teaching and learning aids in classes of chemistry in Ogun state (Nigeria) Senior

- Secondary School (SSS). *International Journal of Research in Education*. 3(2), 250 - 255.
7. Aggarwal, J. C. (2008). *Essentials of educational psychology*. Delhi. VKAS publishing house.
  8. Aksoy, G. (2012). The Effects of animation technique on the 7th grade science and technology course. *Creative Education*, 3, 304 - 308.
  9. Aksoy, G. (2013). Effect of computer animation technique on students' comprehension of the —solar system and beyond unit in the science and technology course. *Mevlana International Journal of Education*, (1), 40 - 46.
  10. Aminu, S. (2011). *Impact of animated-media strategy on achievement, retention and interest among secondary school geography students in weather concepts; katsina state, Nigeria*. Unpublished thesis, Ahmadu Bello University, Zaria.
  11. Aremu, A, & Abiodun, S. (2010). Computer animation and academic achievement of Nigerian senior secondary schools students in Biology. *Journal of Educational Technology*, 6(2), 23-31.
  12. Atadoga, M. M. ,& Onaolapo, M.A.O. (2008). *A handbook on science teaching method*, Zaria: Shola Press.
  13. Atadoga, M. M.,& Lakpini, M.A (2013). *A comparison of numeracy achievement of primary school pupils taught using whole class and varied classroom organization instructions*. Proceedings of Multicultural African Conference, Held at Faculty of Education, Ahmadu Bello University, Zaria .
  14. Ayotola, A., & Abiodun, S. (2010). Computer animation and the academic achievement of Nigerian Senior secondary school students in Biology. *Journal of the Research Center for Educational Technology*, 6(2), 148-161.
  15. Bichi, S. (2009). *Effects of problem solving strategy and enriched curriculum on students' achievement in evolution concepts among secondary school students*. Unpublished Doctoral Dissertation Faculty of Education, Ahmadu Bello University, Zaria.
  16. Busari, A. T. (2009). Field study in chemistry, an inevitable tool for acquiring observatory and analytical skills. *Informational Journal of Research in Education*. 6(1&2), 23-29.
  17. Dwyer, F.,& Dwyer, C. (2003). *Effect of animation in facilitating knowledge acquisition*. Paper presented at the meeting of Pennsylvania educational research association, Hershey, PA.
  18. Esra, O.K. (2013). Effects of cartoons on students' achievement and attitude in Biology teaching (endocrine system). *Kastamonu Educational Journal*, 21(3), 933-944.
  19. Federal Republic of Nigeria (2013). *National policy on education*; Abuja, Federal Ministry of Information.
  20. Gambari, A.I., Falode, C.O., & Adegbenro, D.A. (2014). Effectiveness of computer animation and geometrical instructional model on mathematics achievement and retention among junior secondary school students. *European Journal of Science and Mathematics Education*, 2(2),127-146.
  21. Giginna, L. I. (2013). *Effect of animation instructional strategy on students' achievement, interest and retention in chemical bonding*. Unpublished dissertation, University of Nigeria, Nsukka,
  22. Hidi, S., Renninger, K. A., & Krapp, A. (2004). Interest, a

- motivational variable that combines affective and cognitive functioning. In D. Y. Dai & R. J. Sternberg (Eds.), *Motivation, emotion, and cognition: Integrative perspectives on intellectual functioning and development* (pp. 89-115). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
23. Ivowi, U. M. O. (2005). *Secondary science education Nigeria*. Paper Presented at the UNESCO Workshop on Planning Secondary Science Education. Magaliesburg, South Africa.
  24. Iwena, O.A (2010). *Essential chemistry for senior secondary schools*. Ogun: Tonad Publishers Limited.
  25. Joshi, S.R (2008). *Teaching of science*. New Delhi. A.P.H Publishers Corporation.
  26. Kearsley, G. (2002). *Exploration the use of animation in learning and instruction: The Theory into Practice Database* (Online).
  27. Krapp, A. (2005). Basic needs and the development of interest and intrinsic motivational orientations. *Learning Instruction, 15*, 381-95.
  28. Kumar, K. L. (2008). *Educational technology a practical textbook for students, teachers professional and trainers*. New Delhi: New Age International Publishers.
  29. Lawal, T. E. (2007). —Think and Do! activity and its effect on the performance of pupils in primary science in selected primary schools in Zaria Municipality, Nigeria. *Journal of Science and Mathematics Education, University of Cape Coast, 3(1)*, 87-92
  30. Mahmud, A. (2010). An investigation to the effect of discovery as a methods of instruction on the academic in genetics among colleges of education. *Journal of Educational Research and Development, 5(1)*, 82-88.
  31. Maikano, S. (2007). *Effects of outdoor and indoor laboratory experience on secondary school students' academic achievement and retention in ecology in Kaduna State*. An Unpublished M.ed Thesis. Department of Education, Ahmadu Bello University, Zaria.
  32. Mangal, S. K (2010). *Essentials of educational psychology*. New Delhi. PHI Learning Private Limited.
  33. Mayer, R. E. & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist, 38(1)*, 43-52.
  34. Mayer, R. E. (2001). *Multimedia learning*. New York: Cambridge University Press.
  35. Mayer, R.E., & Moreno, R. (2005). Animation as an aid to multimedia learning. *Educational Psychology Review, 14*, 87-99.
  36. Moreno, R. (2007). Optimizing learning from animations by minimizing cognitive Load: cognitive and affective consequences of signaling and segmentation methods. *Applied Cognitive Psychology, 21*, 765-781.
  37. National Examination Council (2013). *Regulations and syllabuses for senior secondary certificate examination (SSCE) for candidates in Nigeria*. Minna.
  38. Neuman, D., & Hood, M. (2011). Evaluating computer-based simulations, multimedia and animations that help integrate blended learning with lectures in 119 first years statistic. *Australian Journal of Educational Technology, 27(2)*, 34-41
  39. Nigerian Educational Research & Development Council (2008). *Chemistry curriculum for senior secondary schools 1-3*. Federal Government Press, Lagos.

40. Nsofor, C. C. (2010). *Effects of improvised instructional media on Niger state secondary school students' achievement in selected biology concepts*. An Unpublished Ph.DDissertation, Federal University Technology, Minna.
41. Nsofor, C., & Ala, N. (2013). *Effects of computer aided instructional package on biology students' achievement in genetic concepts in Katagum Educational Zone, Bauchi State, Nigeria*. Proceedings of Multicultural African Conference, Held at Faculty of Education, Ahmadu Bello University, Zaria Between 11th - 15th June, 2013
42. Nworgu, B. G. (2015). *Educational research: Basic issues and methodology*. Ibadan: wisdom Publisher Limited.
43. Nwoye, B G. (2009). *Educational measurement and evaluation: Theory and practice*. Nsukka: Hallma Publishers.
44. Obeka, S. S (2010). Effect of inquiry and demonstration methods on students achievements and retention in some environmental education concepts of education. *Journal of Studies in Science and Mathematics Educatio*, 1(1), 52-58.
45. Obeka, S.S.(2011). *Panacea of science education research*. Zaria: Ahmadu Bello University Press Limited, Kaduna State, Nigeria.
46. Ogundokun M.O & Adeyemo D.A.(2010). Emotional intelligence and academic achievement: The moderating effect of age, Intrinsic and extrinsic motivation. *The African symposium*, 10(2), 127-141.
47. Okam C.C (2009). *Methods of teaching the science*. An unpublished paper presentation at the occasion of academic staff orientation of Umaru Musa Yar'adua University Katsina.