

Effects of Advance Organizer Teaching Strategy on Students' Academic Performance and Retention in Chemistry in Senior Secondary School in Ekiti state, Nigeria

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ABSTRACT: *The study investigated the effects of Advance Organizer teaching strategy on students' academic performance and retention in Chemistry in Senior Secondary School in Ekiti State, Nigeria. The study was a pretest, posttest, control group quasi-experimental design. The sample for this study was 120 SSS II Chemistry students using multistage sampling procedure. The instrument used for this study was Chemistry Performance Test (CPT) and the treatment package used for the study was tagged: Advance Organizer Instructional Package (AOIP). Three null hypotheses were formulated and tested at 0.05 level of significance. The data collected were analyzed using t-test and ANCOVA statistics. The results of the analyses showed that no significant difference existed between the performances of students in experimental and control groups involved in the study at pretest. However, students' achievement in the experimental group at post-test and retention levels was found to be significantly better than that of the control group. This showed that Advance Organizer teaching strategy significantly influenced students' academic performance and retention in Chemistry in senior secondary school. The implications of the results on students' academic performance and retention in Chemistry are discussed. Based on the findings of the study, conclusion and recommendations were made.*

Key Words: *Chemistry students, Advance Organizer, instructional package, Retention, Academic performance.*

Introduction

The purpose of Education is to learn and learning involves acquiring knowledge which should be retained. Retaining the acquired knowledge and using it to perform a task is what is most important about learning. The method of teaching a particular subject can affect achievement and retention ability of students. This is why a teacher must select good teaching strategies that bring out the essence of the lesson.

Chemistry can be defined as one of the branches of Science that deals with the properties of matter and its relationship with energy; and the changes that the matters undergo. Chemistry is one of such subjects or activities whose verifiable evidences are based on scientific proof. Chemistry is one of the subjects that are majorly offered in Senior Secondary Schools in Nigeria, (FGN, 2012). The role of Chemistry in our daily and national life as well as in the industry cannot be overemphasised as many of our day-to-day activities revolve around Chemistry. It is one of the basic requirements for admission into all science- based courses in tertiary institutions like medicine, pharmacy, textile and clothing, agriculture and all fields of engineering.

Despite the key role of chemistry as the central science that forms the basic foundation to many disciplines and in improving the quality of life, research revealed that the poor performance and low enrolment of students in the subject in our secondary schools still remains a matter of serious concern in Ekiti State. Academic performance is defined in terms of examination performance and characterized by performance tests in course work and performance in examinations of students. In relation to educational research, academic performance of a student can be regarded as the observable and measurable behaviour of a student in a particular situation. In chemistry, students' academic performance consists of his scores at any particular time obtained from a teacher- made test.

Retention is defined as the act of absorbing, holding, or continuing to hold or have facts learned (Nneji, 2013). In the context of this work, retention refers to act of absorbing, holding, or continuing to hold or have facts learned in chemistry, it therefore means that students' performance in any given test that is not taken immediately after a course or program of study will depend on the level at which the individual retains the concepts learnt. Students with sound retentive ability will perform better than student with poor retentive ability in such a test. Thus, the low performance of students in chemistry may be as a result of students' poor retentive ability in chemistry. Meaningful learning occurs when learners are able to retain

what they have been taught earlier and when learners' concepts are able to connect them with previous knowledge. For students to do well in chemistry he/she must have good retention memory. According to Bybee (2009), Students' prior conceptions, ideas and experiences which they carry to the class room influence the way they learn new concepts and skills. Research shows that good retention could be done by subsumers. The subsumer here is the Advance Organizer (AO).

Advance organizer is the information that is presented prior to learning which can be used to organize and interpret new incoming information. This study is based on the Ausubellian theory of advance organizers propounded by David Ausubel. The theory of advance organizer focuses on meaningful verbal learning. This theory emphasizes and contributes to the aspects of cognitive learning that encourages rapid learning and retention abilities. This teaching strategy was first introduced and used by Ausubel in 1960. He defines an advance organizer as a cognitive instructional strategy used to promote the learning and retention of new information. In explaining meaningful learning, Ausubel (1960) introduced the concept of a subsumption model as a pedagogic device in which central and highly unifying ideas are stated in terms already familiar to the learner, to which the learner can relate new ideas by subsumption. The introduced subsumers thus become Advance Organizers or anchoring foci for the reception of new material.

Bransford, (2004) and Anderson (2004) agree with Ausubel that advance organizers are an excellent way to activate and build schema prior to the actual learning of new material by students. They also explained that time structure will enhance the development of higher order thinking in their students by helping them to relate concepts previously learned to the new material and enabling them to quickly organize their thought. Based on the initial response to the material presented in the organizer, teachers can modify their lesson plans and materials to better fit the prior knowledge of their students. Learners construct knowledge by making connections between new information and their existing conceptual network. For example, Githua and Nyabwa (2007) found out that students taught using advance organizers had significantly higher scores in mathematics achievement test than those taught in the conventional way. Also, studies carried out by Ajaja (2006), and Ojeifo (2000) revealed that the use of advance organizers by students had facilitating effects on the students learning and retention of the concepts they were taught. However other researchers (Salmon, 2000) in separate researches found out that the use of organizers did not have any facilitative effect on students achievement and retention of the concepts they were taught. These researches show that there are still conflicting results of findings in the use of organizers.

A primary process in learning is subsumption in which new material is related to old and relevant ideas in the existing cognitive structures (Adebola, 2011). The organizer is introduced in advance of learning itself, and is also presented at a higher level of abstraction. A few studies have been conducted on the effects of advance organizers on learning and learners performance. According to Adebola, (2011), Students learn best when they possess an integrated package of skills and beliefs that support learning. The records from the West Africa Senior School Certificate Examination (WASSCE), results for year 2010 to 2016 shows a persistent low and erratic performance of students in Chemistry according to WAEC chief examiners report (2016).

Table 1: The Senior Secondary school certificate results in chemistry from 2010-2016.

| Year | Candidate | No of passes | % passes |
|------|-----------|--------------|----------|
| 2010 | 624442 | 19912 | 31.89 |
| 2011 | 66604 | 20021 | 30.16 |
| 2012 | 90488 | 39289 | 43.42 |
| 2013 | 143839 | 73329 | 50.98 |
| 2014 | 105133 | 40970 | 38.97 |
| 2015 | 103211 | 41635 | 40.34 |
| 2016 | 112442 | 48923 | 43.51 |

Sources: (WAEC chief examiner's report, 2016)

Table 1 above shows that percentage passes for the years 2010, 2011 were 31.89% and 30.16% respectively. It also shows that the percentage pass only reached average in 2013 out of the seven years under consideration. Considering this table, we can conclude that there is low and erratic performance in Chemistry in secondary schools. The analysis of WAEC results of chemistry students in Ekiti State from Ekiti State Ministry of Education, Science and Technology, Ado Ekiti also showed that between 2013 and 2018, there was an erratic performance of students in chemistry.

The teaching of chemistry involves the use of various methods and techniques. This includes lecture, discussion, demonstration, experimental, inquiry among others. From the experience of the researcher, the lecture method also known as chalk and talk method is the most popular conventional method of teaching chemistry in our secondary schools in Ekiti State. Therefore in the present study, teaching of Chemistry was done using the Advance Organizer in order to find out if there will be any effect on students' performance and retention in Chemistry in Ekiti State.

Statement of the Problem

The problem of science teachers trying to get students to clearly understand scientific concepts and for the concepts to get retained in their memory has bothered most science educators. The researcher observed that there is a persistent low and erratic performance of students in Chemistry in Ekiti State in recent years. This informed the use of advance organizer for teaching chemistry besides conventional classroom learning but the researcher noted that there are still contrary findings as regards the use of advance organizer. Hence the researcher sought to find out if the use of advance organizer will have any significant effect on Secondary School students' performance and retention in Chemistry in Ekiti state, Nigeria.

Purpose of the Study

The main purpose of this study is to investigate the effect of using advance Organizer on students' academic performance and Retention in Chemistry in senior secondary school in Ekiti state, Nigeria.

Research Questions

The following research questions were raised to guide the study:

1. Will there be difference in the performance of students in chemistry that are taught using advance organizer and those taught using conventional method?
2. Will there be difference in the students' retention in the learning of Chemistry when taught using advance organizer and when taught using conventional method?

Research Hypotheses

The following null hypotheses were formulated to guide the study and were tested at 0.05 level of significance.

1. There is no significant difference in the performance mean scores of students who are taught using Advance Organizer and those who are taught using Conventional Teaching Method
2. There is no significant difference in retention ability of students exposed to advanced organizer and those exposed to the conventional method.

Significance of the study

The study is significant to provide teachers with information on how to redirect their teaching of unfamiliar or new scientific concepts to science students by using teaching methods along with advance organizers that will facilitate and enhance the students' understanding and retention of scientific concepts. The study is also meant to create awareness to science teachers that the use of advance organizer teaching strategy will help prevent students from rote memorization. The use of advanced organizers will be of help to the students in acquisition of the scientific concepts the teacher wants them to learn.

Delimitation of the Study

The study was delimited to the use of advance organizers in teaching mole concept topic in Chemistry. The study covered only the State-controlled schools in Ekiti State and was delimited to Senior Secondary School Two, (SSSII) Chemistry students and gender was incorporated. The study was also delimited to effects of advance organizers on the Students' Performance and Retention in Chemistry in Ekiti State.

RESEARCH METHOD:

The study adopted quasi - experimental pre - test, post - test control group design. This is represented as follows:

Experimental Group (E): O_1 X O_2 O_{R1}

Control Group (C): O_3 X_C O_4 O_{R2}

Where:

O_1, O_3 = observations before treatment (pre-test),

O_2, O_4 = Observations after treatment (post-test)

| | | |
|------------------|---|----------------------------------|
| O_{R1}, O_{R2} | = | Observations (retention) |
| X | = | Treatment (advance organizer) |
| X_c | = | Treatment (conventional method). |

Population: The population for the study comprised of 19,603 Senior Secondary Schools Two (SSS II) students in 189 public Secondary Schools in the three Senatorial Districts across the sixteen (16) Local Government Areas (LGAs) of Ekiti State, Nigeria as at the time of this study (Source: Ekiti State Ministry of Education, Science and Technology, 2018). The population involved both male and female students. The schools that were chosen were those that have presented students for the Senior Schools Certificate Examination/ West Africa Examination Council (SSCE/WAEC) or National Examination Council (NECO) for the past five years.

Sample and Sampling Technique: The sample for this study was about 120 SSSII Chemistry students. The sample was selected using multistage sampling procedure. The first stage involved the selection of one LGA from each of the three Senatorial Districts in Ekiti State through simple random sampling technique. The second stage involved the selection of one LGA from the three LGAs earlier selected through simple random sampling technique. The third stage was the selection of two schools from each of the selected LGAs using purposive sampling technique. Intact class was used in each of the schools selected for selection of students.

Research Instrument: The instrument used for this study was Chemistry Performance Test (CPT). CPT was used to measure students' performance in the Mole Concept. The instrument consist of 20 items of multiple choice objectives with four options from the past Senior Secondary School Two (SSS II) unified examinations of the State. The CPT used as pre-test and post-test was also used as retention test but scrambled. The students were not pre-informed about the retention test taken three weeks after post-test.

Validity of the instrument: Face and content validity were ensured by experts in Tests and Measurement, two experienced Chemistry teachers who are WAEC and NECO examiners.

Reliability of the instrument: The reliability of each of the instrument was determined through test re-test method. This was done by administering the CPT on 20 students from SSS II Chemistry class from a school different from the schools used for the study. Within an interval of three weeks, the test was rearranged and re-administered on the students. The scores obtained from the separate responses was correlated using Kuder-Richardson 21 formula.

Experimental Procedure: The experimental procedures were in three stages: the pre-treatment stage (one week), the treatment stage (four weeks) and post treatment stage (three weeks), making a total of eight weeks for the study. *At the pre-treatment stage*, permission was obtained from the authority of each of the schools that was used for the study. The researcher discussed the purpose of the study with the Chemistry teachers in the schools that were used as research assistants. The research assistants were trained on the roles they were expected to play in the course of the study. The pre-test was administered at this stage. *At the treatment stage* which lasted for four weeks, the experimental and control groups were exposed to treatment. At the post-treatment stage, the post-test was administered to students in both the experimental and the control groups. The content of the CPT used in pre-test was reshuffled and used as the post-test and retention test to find out their level of performance in Chemistry. Data collected was analyzed using descriptive statistics of frequency count, mean and standard deviation to answer the research questions. T-test statistics was used to test hypotheses. Each hypothesis was tested at 0.05 level of significance.

Results

Below is a presentation of the results of findings in this study. The results shows both the descriptive statistics that determined the answers to the research questions as well as the inferential statistics that gave room for testing of the various hypotheses:

Table 2 : Pretest, Posttest and Retention Descriptive Data for both Groups

| Groups | Retention means | Post-test mean | Pre-test mean | Tests diff. | Retention diff. |
|---------------|-----------------|----------------|---------------|-------------|-----------------|
| A.O group | 17.58 | 16.00 | 8.43 | 7.57 | 1.58 |
| No-A.O. group | 12.80 | 14.33 | 8.20 | 6.13 | -1.53 |

The table shows that there are differences in posttest and pretest means of the subjects in both groups with the advanced organizer group having the higher means in pretest, posttest and retention test. The pretest scores of subjects in the two groups were 8.20 for the No-organizer group and 8.45 for the advanced organizer group. The advanced organizer group had the higher mean difference of posttest and pretest (7.57); and also had the higher mean difference in retention and posttest (1.58).

Research question 1: Will there be difference in the performance of students in chemistry that are taught using advance organizer and those taught using conventional method?

From the table one above, it is seen that there are differences of posttest means in the performance of students in mole concept of Chemistry when exposed to advanced-organizers and No-organizer with posttest means of 16.00 and 14.33 respectively. The advanced-organizer group had the higher mean while the No-organizer group had the lower mean.

Research question 2: Will there be difference in the students' retention in the learning of Chemistry when taught using advance organizer and when taught using conventional method?

Data in table one reveals that there are differences of retention among subjects exposed to advanced-organizers and No-organizer with the advanced organizer group having the higher mean (17.58), while the No-organizer had the lower mean (12.80).

Analysis of hypotheses 1 and 2 using the t-test as seen in the table below will show if the differences between the groups in terms of performance and retention of the mole concepts in Chemistry are significant or not.

Table 3 Showing the t-test analysis of subjects in any two groups.

| Groups | N | X | SD | df | t-cal | t-table | REMARKS | |
|--------|-----|----|-------|------|-------|---------|---------|-------------|
| (Ho1) | AO | 40 | 16.00 | 3.79 | 78 | 2.11 | 1.96 | Significant |
| | NO | 40 | 14.33 | 3.27 | | | | Reject Ho1 |
| | AOR | 40 | 17.58 | 2.69 | 78 | 7.30 | 1.96 | Significant |
| | NOR | 40 | 12.80 | 3.15 | | | | Reject Ho2 |

Where; (AO & NO -Advanced & No-organizer groups in performance test; AOR & NOR – Advanced and No-Organizer groups in Retention test)

Hypothesis testing 1: There is no significant difference between the performance mean scores of students in chemistry exposed to Advance Organizer and those who are not exposed to Advance Organizer. From table above, the t-test calculated values for the performance of students in mole concept in Chemistry between the advanced-organizer (AO) group and the No-organizer (NO) group gave a value of 2.11 which is greater than the t-table value of 1.96. Thus the Hypothesis one is rejected meaning there is a significant difference in performance of students in Chemistry when exposed to advanced-organizers and those not exposed to organizers with the organizer group performing better than the No-organizer group.

Hypothesis testing 2: There is no significant difference in retention ability of students exposed to advanced organizer and those not exposed to Advance Organizer. From table above, the t-table value is 1.96 while the t-calculated values for the retention of mole concept in chemistry when exposed to advanced organizers and those not exposed to organizers is 7.30. This value is greater than the table value and therefore shows that there is a significant difference between students in the two groups in terms of retention with the advanced organizer group with a mean of 17.58 performing better than those in the control group with a mean of 12.80. This means hypothesis two is rejected. This means that there is a significant difference in the retention of students in Chemistry in mole concept of those exposed to advanced organizers and those not exposed to advanced organizer with the advanced organizer group performing better.

Discussions

The purpose of this research was to find out if the students taught lessons on Mole Concept did better when given organizers before the lesson than their counterparts not given any organizers in both performance and retention test. It also found out that those given advanced organizers did better than those not given organizers in both performance and retention of the concepts taught. Results of this study agree with studies carried out by Adebola (2011), Ajaja (2006), Lin and Chen (2006) among others. In the separate studies carried out by these researchers they found out that the use of advanced organizers by students had facilitating effects on the students learning and retention of the concepts they were taught. The students learning were thereby enhanced.

Conclusion

In conclusion the researcher recommends that students should be given advanced-organizers in addition to good instructional methods and texts. Advanced organizers should be given before the lessons to the students by the teachers since these are found to often have at least small facilitative effects for learners

in most learning situations especially when it involves entire new learning. Also recommended is that, the government and those in educational affairs should encourage teachers who teach science concepts by providing them with materials or items that can serve as advanced organizers for students to learn science concepts better. When advanced organizers are used the students attain and retain science concepts better.

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