EFFECTS OF ADVANCE ORGANIZER ON SENIOR SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN CHEMISTRY IN EKITI STATE, NIGERIA

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ABSTRACT: *This study investigated the effects of advance organizer on senior secondary school students' achievement in Chemistry in Ekiti State, Nigeria. The research designed adopted for this study was non-randomized, non-equivalent pre-test and post-test control group design. The population consisted of all senior secondary class two (SSII) students taking Chemistry in Ikere – Ekiti while sample consisted of 97 senior secondary school two students were drawn from intact classes using purposive sampling technique. The instrument used for the study was Chemistry Achievement Test. The face and content validity as well as reliability of the research instrument were carried out and reliability coefficient of 0.86 was obtained. The results of the data collected from both pre-test and post-test were collated and analysed using statistical tools involving mean and standard deviation, graph t-test and Analysis of Variance (ANOVA) at 0.05 level of significance using). The findings of the study showed that students operate at moderate level performance in Chemistry before their exposure to expository advance organizer. However, the use of expository advance organizer improves the performance of students in Chemistry more than conventional method of instruction. It was therefore recommended that the use of advance organizer should be adopted for the teaching of Chemistry as innovative tools to facilitate effective teaching and learning in secondary schools.*

Key Words: *Advance Organizer, achievement, Chemistry, achievement in Chemistry.*

Introduction

In this era of technological quest and high attainment in modernization, no nation can afford to allow her teeming population to shy away from science education. This is because technological development is hinged on adequate knowledge of sciences. In this regard, students are expected to develop appropriate knowledge and skills in science education, which are necessary for solving problems and improving human life. A nation can be classified as developed or underdeveloped based on her level of scientific and technological development. Any nation that cannot provide standard, effective, and efficient science education to her younger ones is still underdeveloped. For a developing country like ours to join other developed countries of the World, the scientific know-how is embedded in the curriculum has to be attained through the systematic procedure, well developed instructional strategies, and structured skills acquisition processes which are the hallmark of effective science education.

Education, particularly science and technical education is the 'factory' for the production of the needed technologists, technicians, and craftsmen as well as skilled artisans who are required to turn the nation's economy around and usher in the desired technological advancement (Abulude, 2009). However, according to Festus & Ekpete (2012), science and technology are imperative for sustainable global development, but cannot strive ahead without chemistry.

Chemistry is the study of composition, structure, and property of matter including the changes that matter undergoes and the related energy changes that accompany material changes. It occupies a central position amongst the science subjects. The usefulness of chemistry is seen vividly around us in the areas of manufacture of textiles, fertilizers, herbicides, insecticides, and fungicides. It is equally very essential for the management and utilization of natural resources, provision of good health facilities, adequate food supply, and favorable living environment (Omiko, 2017 and Babalola, 2015).

Inclusion of Chemistry as an important prerequisite subject in science in the secondary school calls for the need to teach and evaluate it effectively. Researchers such as Eke (2008); Ameh & Dantani, (2012); Bamidele & Oloyede (2013); Nnoli (2016); Eze & Ezeugo (2018); Eze, Egbo & Onyinye (2018) claimed that any nation aspiring to be scientifically and technologically developed must have an adequate level of chemistry education.

Adesoji (2008) posited that the primary aim of any teacher is to ensure the success of his lesson and by "success" it is meant a process in which the majority of the students understand the essential points of the lesson. The author added that this "success" is invariably tied to the quality of the teacher and in his view; one of the common ways of assessing the quality of teachers is the performance of students in examinations. It is the responsibility of the class teacher to help students attain maximum achievement in their learning tasks. Such responsibility includes the ability to use appropriate instructional strategies in teaching (Sukolatambaya, 2018).

Oloyede & Demide (2000) related the cause of widespread poor performance and negative attitudes towards chemistry by secondary school students in Nigeria to teaching problems. Educational practitioners have generally agreed that teacher-dominated pedagogy where students are placed in a passive role is undesirable and this is still the practice in a majority of classrooms in sub-Sahara Africa in general and Nigeria in particular (Christian & Pepple, 2012). The teaching of chemistry should involve the use of various methods and techniques. These include conventional, discussion, demonstration, and the use of textual and other printed materials. The conventional method is the sole method of teaching chemistry in secondary schools in Nigeria. The general poor achievement of chemistry students in public examinations has been factually documented (Festus & Ekpete, 2012) among others. This poor achievement is a challenge to science educators in general and chemistry educators in particular since finding better ways of enhancing the teaching-learning process is the desire of science educators.

The government and chemistry teachers contribute to this problem because, while the government must provide funds and resources for teaching, teachers have to constantly search for teaching procedures that will provide better results by making learning more meaningful and fairly permanent for their students. For the teacher to achieve this, he must identify students learning problems and design appropriate teaching strategies that are inexpensive, workable, and efficient in attaining instructional objectives (Adesoji & Ibraheem, 2009).

Despite the importance of chemistry and its educational value which is relevant to the need of the individual learner, economic and technological breakthroughs of a nation, and the efforts of researchers to improve on its teaching and learning, the performance of students in the subject is not still encouraging.

In a survey on student's achievement in chemistry, Olorundare (2014) found that the level of achievement is not encouraging and he asserted that student's achievement dwindles every year. This is manifested in the erratic performance of students in chemistry in the West African Senior School Certificate Examination results as presented in Table 1.

Table 1: Analysis of WAEC Results in Chemistry in Ekiti State from 2013-2018

Years	Candidates Registered	A1-C6	%	D7-F9	%
2013	5043	3817	75.7	1093	21.7
2014	5829	3477	59.7	2352	40.3
2015	6072	4580	75.4	1492	24.6
2016	5258	4471	85.0	787	15.0
2017	5258	4894	93.1	364	6.9
2018	5155	3964	76.9	1191	23.1

Source: Ekiti State Ministry of Education, Science, and technology, 2019.

An examination of results presented in Table 1 reveals that the highest achievement in chemistry was in the year 2017 when the percentage credit A1–C6 was 93.1% and in 2018 it dropped down to 76.9%. The lowest was in the year 2014 when the percentage credit A1–C6 went down as low as 59.7% and in 2016 it jacked up to 75.4%. The implication of this is that the performance of students in Chemistry had improved but it was erratic performance, indicating that securing admission into chemistry-related courses like medicine, nursing, agriculture, pharmacy, geology, physical sciences, science education, and engineering in the higher institutions will experience fluctuations.

Also, such poor achievement at the Senior Secondary School Examinations will deplete the enrolment of students who would want to study courses that can lead invocations like health services, pharmaceuticals, petroleum and petrochemical industries, food processing and teaching services among others that are needed for the industrial and economic development of a nation. This poor result calls for

serious concern and this concern has been expressed by parents, teachers, employers of labour and the entire society. A result like this can engender societal ills like disappointment and frustration on the part of the students, anxiety, and apprehension in parents, examination malpractice, and serious implication for technological development.

Students' poor academic achievement in chemistry has been blamed on poor instructional strategies (Lamidi, Oyelekan & Olorundare, 2015); wide range of syllabus (Babalola, 2015); low numerical ability (Fatoke, Ogunlade & Ibidiran, 2013), negative attitude (Bamidele, Adetunji, Awodele & Irinoye, 2013). Equally, a lack of interest has been identified as responsible for the failure (Jegede, 2007).

The finding of Alade & Ogbo (2014) revealed that the cause of widespread poor performance and negative attitudes towards chemistry by secondary school students in Nigeria has largely been attributed to the teaching problem. Several studies have been undertaken on the aspect of the role of the classroom teacher in achieving quality in school (Fatoke, Ogunlade & Ibidiran, 2013; Matthew & Onyejegbu, 2013). Yazachew (2014) pointed out the instructional and management roles of the teacher. Huitt (2005) added planning to it while Akiri & Ugborugbo (2009) identified high failure rates and the poor quality of the students as a reflection of the instructional quality in schools.

Researchers such as (Bamidele, *et al* 2013 & Omiko, 2017) have shown that certain chemistry concepts in the senior secondary school chemistry curriculum have been identified as difficult. Some of these perceived difficult concepts according to them include organic chemistry, mole concept, calculations in electrolysis and volumetric analysis, energetic and redox equilibria, rates of chemical reactions, non-metals, and their compounds among others.

The Chief Examiner's report on candidates' performance in the West African Examinations Council (WAEC, 2012) noted that many candidates avoided questions involving organic chemistry, and those who attempted the questions recorded very low marks (Bamidele *et al*, 2013). This is why in this study, the concept of hydrocarbons which is a basic bedrock for understanding organic chemistry will be examined. The instructional strategy that would be used in this study is the advance organizer strategy.

Advance organizers are instructional strategies that enable learners' to connect new information to already known material and also construct their ideas (Omondi, Keraro and Anditi, 2018). It is information that is presented before learning and that can be used by the learner to organize and interpret new incoming information. According to TanveerUzZaman, Farkhunda & Arshad (2015), advance organizers place the most general and comprehensive ideas at the beginning of a lesson and progress to more structure and detailed information.

Advance organizer is to explain, integrate, and interrelate the material in the learning task with previously learned material and also help to discriminate new material from previously learned material. If the student never receives or perceives the organizer the strategy is lost.

The theory of Advance Organizer emphasizes that in learning, the meaningful process is essential. Ausubel (1960) postulated that material has to be related to established ideas in the cognitive structure of the learner in terms of ideas, which enable the material to be learned in a logically coherent way. To achieve this, the learner needs access during the learning process to structure ideas that can subsume the new material to be learned and incorporate into the cognitive structure of the learner and provide him with anchors for the new material. This implies that students construct their knowledge in their ways. Consequently, to learn, the learner has to unpack what is taught and then repack it in a way that suits their previous knowledge and learning style.

According to Ausubel (1960), the advance organizer model can be applied to any material which can be organized intellectually. It can be used in every subject area but it was designed for use with verbal material rather than with skills and mastery of problem-solving paradigms. He assumes that the model will be useful in the transfer of material to new problem settings.

It can also serve well in the analysis of expository material in textbooks and other instructional materials were abstractions and information alternate in various patterns. The model is useful to structure extended curriculum sequences or courses and to instruct students systematically in the key ideas of a field. He added that the model can be shaped to teach the skills of effective reception learning. Critical thinking and cognitive reorganization can be explained to learners and they can apply these techniques independently to new learning. He added that the model is never purely expository in interactive situations. Students can raise their questions. The material being organized can take the form of dialogue, be contained in a film, a demonstration, or stories.

Kigo, Okere & Maghanga (2018) identified the following as varieties of advance organizers: Expository, framing, narrative, graphic, skimming, concept webbing or mapping, and comparative, advance

organizers that build schema by providing new information are called expository organizers (Karmes, 2005). Igwe (2002) describes the framing organizer as a teaching strategy where main ideas are differentiated to sub-concepts and are arranged in a matrix in such a way that interrelationship between concepts is shown. The narrative organizer is the anecdote that connects personal experiences or real-world events to the new concept to be presented. Enekwechi (2016) opined that graphic organizers provide a visual representation of facts and concepts and their relationship within an organized frame. The author further added that graphic organizers can exist in many forms like flow charts, story maps, Venn diagrams, sequence chain, tables, and matrix. Examples of graphic organizers like KWLs (ask students to write a list of what student know before the lesson (K), what they want to learn in the lesson (W) and what they learned (L), flow charts and other visual tools can tap into prior knowledge or imply the scope and organization of new content.

The conventional or traditional method on the other hand, is an approach that places no emphasis on students constructing their ideas and it is a method in which the teacher delivers the lesson to students with little or no active participation by the students (Nwagbo & Obiekwe, 2010). In the view of Ibitomi, Adefila & Aina, (2018) conventional method of teaching used by secondary school teachers in teaching chemistry and other science subjects has been identified to be responsible for producing learners who can verbally explain and demonstrate scientific concepts but are not able to translate the knowledge gained from such scientific concepts into usable technology. It is very pertinent therefore to search for an approach for the teaching of chemistry that aims at understanding rather than juggling facts (Oloyede, 2011). TanveerUzZaman, Choudhary & Qamar (2015) revealed that advance organizers serve three purposes: which are to: direct the attention towards the importance of the coming material, highlight ideas and create relationships amongst the ideas and, remind students about important information they already have.

Ausubel's theory of meaningful learning generated a lot of interest and controversy in cognitive learning. To this end, several studies have been conducted to determine the facilitative effect of the learning model. In the following paragraph several studies concerned with empirical works on advance organizers will be reviewed. Ausubel's study (1960) was the first attempt to inquire into the effect of the advance organizer on learning and retention. In the study conducted, a 2,500 word specially constructed passage on metallurgical properties of plain carbon steel was used as the learning material. This was preceded by an advance organizer which stressed the similarities and differences between metals and alloys, their advantages and limitation, and was approximately 500 words.

The control group had a historical introductory material lacking subsuming concepts relevant to the learning material but was used presumably to enhance student's interest. This control group was necessary so that any obtained difference between the experimental and control group could be attributed to the nature of the experimental introductory passage (advance organizers) rather than to its presence parse. The experimental and control group were made of 120 senior undergraduate students enrolled in educational psychology. The result showed a significant difference at 0.01 confidence levels with a mean of 16.7 and 14.1 and a standard deviation of 5.8 and 5.4 for the experimental and control groups respectively. Ausubel concluded that the result of this experiment supported his hypothesis that advance organizers facilitate learning and retention because they aid the selective mobilization of the most relevant existing concept in the learners' cognitive structure for integrative use as part of the subsuming focus for the learning task.

Novak & Canas (2008) used concept maps in two different psychology courses taught at different levels. In one group, concept maps were used as advance organizers for lectures, and the learner constructed and modified some group maps short text sessions. In the second group, students constructed concept maps of each text chapter as part of the course assessments. It was discovered that students engaged more meaningfully with maps which engaged them in problems and topics. Besides, constructing maps that were evaluated was beneficial.

Uchenna & Okafor (2014) investigated the comparative effectiveness of the expository and concept mapping on academic achievement of slow learners in biology, the results of the study indicated that the group taught with concept mapping instructional strategy performed significantly better than their counterparts taught with the conventional method.

Jack (2014) determined the effects of individual and collaborative concept mapping learning strategy on chemistry students' anxiety and academic achievement. The design of the study was quasi-experimental pre-test – post-test – delayed post-test control group design. The sample of 100 students was drawn from co-educational secondary schools in Taraba North senatorial district. The Chemistry Achievement Test for Students (CATS) and Chemistry Anxiety Scale (CAS) with the reliability of 0.79 and 0.86 respectively were the main instruments, Descriptive Statistics and Analysis of covariance were used to analyze the data collected. The findings revealed that the use of concept mapping had a positive effect on

learning and a significant difference in estimated retention between students who were taught with the traditional method.

In the same vein, Ezeudu (2013) investigated the influence of concept maps on the achievement and retention of senior secondary students in organic chemistry. The study is quasi-experimental of pre-test – posttest nonequivalent control group design. A purposive sampling of 435 was used in selecting from two schools in the Local Government Area. Achievement and Retention Test in Organic Chemistry (ARTOC) was the instrument used for the study. Mean and standard deviation scores were used to answer the research questions while ANCOVA was used to test the hypotheses at 0.05 alpha levels. The study showed that the use of concept mapping as a teaching strategy has a positive effect on learning and also showed a significant difference in estimated retention between students who used the traditional method.

TanVeeruzZaman, Farkhunda & Arshad (2015) investigated the effect of advance organizers strategy on the performance of 9th-grade students. The research design was a true experimental pre-test, post-test. The sample consisted of fifty randomly selected students of 9th grade. Data were analyzed using a t-test at 0.05 significant levels. The results of the study showed that the use of advance organizers strategy had a positive effect on the performance of the experimental group. The use of advance organizers strategy found to help enhance the retention ability of the students. The results of the study lead to the conclusion that advance organizers' strategy is useful to improve the retention ability of science students. They further added that advance organizers serve three purposes such as to direct the attention towards the importance of the coming material, to highlight the ideas and create a relationship amongst the ideas, and to remind the students about important information they already have. They equally stated that advance organizers can be useful devices at the start of a unit, before a discussion, before a question-answer period, before giving a homework assignment, before student reports, before a video, before students read from their school book, before a hand-on activity and before a discussion of science concept based on student's laboratory experiences.

Awofala & Nneji (2012) carried out a study on the effect of framing and team assisted individualized instructional strategies on students' achievement in mathematics. The study showed that students subjected to framing advance organizer performed significantly better than those subjected to team assisted individualized instructional strategy.

The teaching of hydrocarbons is chosen in the present study because of chief examiner's reports in WASSCE of 2013, 2015, and 2017 that revealed a low percentage in the number of those that attempted questions related to organic chemistry as reported by Omiko (2017). Another reason for selecting hydrocarbon is based on the fact that the researcher is saddled with the responsibility of teaching the freshers introductory organic chemistry at both N.C.E. and undergraduate levels, It is hoped that the expository advance organizer developed would be useful in imparting knowledge to the students.

Students' scoring academic ability level has been discovered as important factors influencing students' achievement in science. Many studies have been carried out to determine how the differences in scoring level and academic ability can affect student knowledge of science concepts. Yusuf & Afolabi (2010) investigated the effects of computer-assisted instructional package on secondary school students' performance in Biology, it was discovered that students' scoring ability influence their performance in biology. However, the low ability group of students gained most followed by the high ability group. The study of Lamidi, Oyelekan, and Olorundare (2015) on effects of mastery learning instructional strategy on senior secondary school students' achievement in mole concepts showed that there is a significant covariance in the achievement between scoring level and group.

Statement of the Problem

Despite all the curricular innovation and other efforts aimed at promoting science teaching in schools, not a great success has been achieved in chemistry and consequently, the problem of students 'poor achievement in chemistry in Nigerian secondary schools continues to linger. This could probably be due to the methods of teaching and the materials available for teaching; teacher questioning style and students' participation in chemistry lessons.

For effective chemistry teaching, some studies have recommended discovery, mastery learning, guided inquiry, concept formation, concept attainment and problem-solving methods (Festus & Ekpete, 2012; Lamidi, *et al*. (2015); and Khan, Hussain, Ali, Majoka & Ramzan, 2011). The use of advance organizers as an instructional strategy has been widely acknowledged to teach abstract concepts in sciences and has demonstrated the capability to bridge the gap between the known and the unknown, creating meaningful learning and enhances students' academic achievement (Omondi, Keraro & Anditi, 2018).

Therefore, it is expected that the use of the Advance Organizer model could assist the learner in retaining and reproducing a large amount of information in Chemistry. It is against this background that the researchers are interested in expository advance organizer strategy to handle the teaching of hydrocarbons in chemistry to determine its effects on secondary school students' academic achievement. Although few studies have been undertaken to develop instructional materials based on different teaching models for the teaching of chemistry, there is rare evidence of teaching chemistry in a senior secondary school based on the expository advance organizer. To bridge this gap and to present the effort being made to rectify the ugly situation of erratic performance in Chemistry, an attempt will be made in the present study to also explore whether or not the strategy has interactive effects on the moderating variable such as students' score level.

Research Hypotheses

The following hypotheses were formulated and were tested in this study:

Ho_1: There is no significant difference between the academic achievements of students in chemistry when taught with expository advance organizers and those taught with the conventional method.

Ho_2: There is no significant difference in the academic achievement of students when taught hydrocarbons using expository advance organizers based on score level.

Research Method

The study is a quasi-experimental type which adopted non-randomized, non-equivalent pre-test and post-test control group design. Quasi-experimental was adopted to determine whether an intervention treatment (expository advance organizer) will reveal the intended effect on the student's performance. The design involves two major components: independent and dependent variables. The independent variables are an expository advance organizer and conventional method while the dependent variable of the study will be students' achievement in chemistry.

The population of the study comprised of all senior secondary class two (SSII) students offering chemistry in Ikere-Ekiti, Ekiti State, Nigeria. The sample for the study comprised 97 senior secondary schools two drawn from intact classes of two co-educational senior schools in the study area.

The preference for involving only SSII students is because:

i. The students would be expected to have been exposed to considerable knowledge of chemistry in their Senior Secondary School (SSI).

ii. The topic "introduction to organic chemistry" to be taught are offered at Senior Secondary School II (SSS II) according to the new senior secondary school curriculum (NERDC, 2009, NPE, 2013).

The Instructional Study Package (ISP) was used for experimental control group and, the instrument: Chemistry Achievement Test on the topic hydrocarbons (CAT) was also used for the study. The instrument (CAT) is a researcher-made test used for data gathering and comprised of two sections (A and B). The bio-data of the respondents (students) made up section A, while section B consisted of fifty multiple-choice objective items based on the topics i.e. hydrocarbons were collated and used for both pre-test and post-test during data collection. The CAT was given to three experienced secondary school chemistry teachers who have been teaching the subject in the last ten years in three secondary schools in Ikere. Each question consisted of four options labeled (A – D) in which one is the correct option. Aside from data gathering, the content of the CAT was also used as the pre-test and post-test to ascertain students' prior knowledge before the treatment and their performance after the treatment. Lesson notes were developed and used for lesson presentation for the treatment and control group. The lesson presentation of the treatment group will be conducted using an expository advance organizer.

To ensure face and content validity of the instrument, CAT (Fifty multiple choice objective questions) were given to three experienced secondary school chemistry teachers who have been teaching the subject for the past ten years; chemistry experts. The ratings and assessment of these validators were used in fashioning out the final instruments for the study along with the approval of the researcher's supervisor. The expository advance organizer lesson note was also validated by experts in test and measurement.

Also, the content validity of (CAT) was established using a table of specification in which questions will be distributed to align with three Bloom's taxonomy lower-order cognitive skills namely knowledge, comprehension, and application. Thereafter, (CAT) was trial-tested by administering it on students' in an intact class in a school in Ikere which is not part of the sample but within the population scope of the study. The scores gathered were analyzed using Kuder-Richardson 21 (KR-21) to establish its reliability at 0.05,

Alpha level of significance. The reliability coefficient of 0.86 was obtained which was considered reliable enough for the study.

The researcher sought the students' consent to participate in the study through an informed consent form signed by their parents. The chemistry teachers' of the sampled schools were also given a consent form to solicit their involvement as research assistants during the experiment. The selected students were allowed to participate voluntarily in the study in conformity with the ethical practices of research. The names of the participating schools as well as the identity of the respondents or students were not disclosed at any point in this study. The researcher treated students' contributions with optimum discretion for the study alone. The total period for the research was three (3) weeks. The research assistants assisted the researcher in the aspects of administering the pre-test, post-test, and treatment to the experimental group and teaching the control group. The researcher visited the schools before treatment to train the chemistry teacher who used an expository advance organizer for the experimental group.

The teaching of hydrocarbons in both the experimental and control groups took place during the periods scheduled for chemistry lessons and it was not exceeded the time frame scheduled for the topic on the school scheme of work to avoid disrupting normal school routine. The chemistry teachers that were involved as a research assistant taught the control group using conventional instructional strategy and the experimental group using advance organizer lesson note respectively for double lesson periods.

The two groups labeled groups A and B. Group A was assigned an experimental group while group B was the control group. Group A was exposed to an expository advance organizer while group B which is the control was exposed to the conventional method.

The research procedure was in two stages; the pre-treatment stage and the treatment stage (two weeks), and the post-treatment stage (one week), making a total of three weeks for the study.

(i) The researcher trained the teacher to be used for group A on how to administer the treatment. The teachers of the two groups were provided with the topics and the lesson notes each required for the teaching of the topics. The researcher went through the lesson notes with the teachers to ensure compliance with the objectives and the mode of presentation of the lessons. During the first period of the first week the pre-test (CAT) will be administered on the students.

(ii) Thereafter, as from the second period in the first week the two groups A and B were exposed to its respective treatment expository advance organizer and conventional method respectively.

(iii) During the post-treatment stage in the third week; the content of CAT was reshuffled and administered to the respondents as a post-test to determine the students' performance.

The data obtained from the four research questions raised were subjected to frequency count, mean and standard deviation. Also, inferential statistics were employed to test for hypotheses. Hypotheses 1 was tested using the t-test, while one way ANCOVA was used to test hypotheses 2 at the 0.05 level of significance. The data collected for this study were analyzed using the Statistical Package for Social Sciences (SPSS) software version 25.

Results and Discussion

Hypotheses Testing

Hypothesis 1: There is no significant difference between the academic achievement of students in chemistry when taught with expository advance organizers and those taught with the conventional method.

Table 2: t-test Analysis of academic achievements of students taught Chemistry with expository advance organizer and those taught with the conventional method

Treatment	N	Mean	Std. D	df	t	p-value
Experimental	58	67.14	7.099	95	10.342	.000
Control	39	48.87	10.309			

Table 2 shows that the performance of students in the experimental and control groups significantly differ (df =96, t=10.342, p<0.05). Since the p-value of 0.000 was <0.05 level of significance, the null hypothesis was rejected. The table further indicated that students in the experimental group with 67.14 mean scores perform better than their counterparts in the control group with a 48.87 mean score. Therefore, there is a significant difference between the academic achievement of students in chemistry when taught with expository advance organizers and those taught with the conventional method.

Hypothesis 2: There is no significant difference in the academic achievement of students when taught hydrocarbons using expository advance organizers based on score level.

Table 3: Analysis of Covariance (ANCOVA) of difference in the academic achievement of students when taught hydrocarbons using expository advance organizer based on score level

Source	SS	df	MS	F	Sig.
Corrected Model	2016.755[a]	4	504.189	28.007	.000
Intercept	50167.499	1	50167.499	2786.723	.000
Treatment	592.141	1	592.141	32.892	.000
Score Level	54.147	2	27.073	1.504	.228
Treatment * Score Level	43.306	1	43.306	2.406	.124
Error	1656.214	92	18.002		
Total	90374.000	97			
Corrected Total	3672.969	96			

Table 3 shows that (F=2.406, p=0.124) at 0.05 level) of significance. The null hypothesis was not rejected. This implies that the interaction effect of treatment and score level was not statistically significant. Similarly, the main effect of the score level was not statistically significant (F=1.504, p=.228). However, the main effect of treatment was statistically significant (F=32.892, p<0.05). Therefore, there was no significant difference in the academic achievement of students when taught hydrocarbons using expository advance organizer based on score level.

Discussion of Findings

Based on the results of the findings, it was discovered in Table 2 that there is a significant difference between the academic achievement of students in chemistry when taught with expository advance organizer and those taught with the conventional method. This shows that the uses of expository advance organizers have a significant contribution to the understanding and performance of students in Chemistry. This finding is consistent with Wachanga et al (2013) who found that students taught a mole concept using the advance organizer teaching approach achieved better in Chemistry than those taught through regular teaching methods. Torres, Espana, and Orleans (2014) in corroboration of this finding discovered that the Chemistry students subjected to graphic advance organizer performed significantly better than those subjected to the traditional method of teaching with adjusted mean scores of 47.45 and 39.11 respectively.

The study found out in Table 3 that there was no significant difference in the academic achievement of students when taught hydrocarbons using expository advance organizer based on score level. This implies that with the use of expository advance organizer, the initial ability of students was not a condition for better understanding and performance in Chemistry. In consonance with this finding, Onijamowo (2010) discovered that the scoring level of students does not influence the number of misconceptions and alternative conceptions students hold, added that high scorers held the least number of misconceptions and alternative conceptions. Meanwhile on the contrary, Lamidi, Oyelekan, and Olorundare (2015) found in their study a significant covariance between scoring level and treatment.

Conclusion

Based on the outcome of this study, it is concluded that students operate at moderate level performance in Chemistry before their exposure to the expository advance organizer. However, the use of expository advance organizers improves the performance of students in Chemistry more than the conventional method of instruction. Despite that the low scorer gained most followed by medium scorer when exposed to the expository advance organizer, student performance was not conditioned by the score level.

Recommendations

Based on the findings and conclusion from the study, the following recommendations were made:

1. The use of advance organizer should be adopted for the teaching of Chemistry as innovative tools to facilitate effective teaching and learning in secondary schools.
2. Regular seminars and workshops should be organized for Chemistry teachers in other to broaden their knowledge on the effective method of using advance organizer instructional strategies in Chemistry classrooms and laboratory.

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