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Effects of Advance Organizer Teaching Strategy on Students' Academic Achievement in Basic Science in Secondary School in Ekiti State, Nigeria

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ABSTRACT
The study examined the effects of Advance Organizer teaching strategy on students' academic achievement in Basic Science in secondary schools in Ado Local Government Area, Ekiti State, Nigeria. The study was a pretest, posttest, control group quasi-experimental design. Purposive and stratified random sampling techniques was used to select a total sample of 160 public JSS I Basic science students (this sample was divided into the experimental and control groups in ratio 1:1; meaning that, 80 students from each group) from four Junior secondary schools in Ado Local Government Area, Ekiti State. Two schools each for Experimental and Control groups. Two null hypotheses were formulated and tested at 0.05 level of significance. The instrument for this study was Basic Science Achievement Test (BSAT) and the treatment package used for the study was tagged: Advance Organizer Instructional Package (AOIP). The data collected were analysed using t-test and ANCOVA statistical analysis packages. The results of the analyses showed that no significant difference existed between the achievements of students in experimental and control groups involved in the study at pretest (this indicated initial academic homogeneity of the groups). However, students' achievement in the experimental group at post-test level was found to be significantly better than that of the control group. This showed that Advance Organizer teaching strategy significantly influenced students' achievement in Basic Science in Junior Secondary School. The implications of the results on students' achievement in Basic science are discussed. Based on the findings of the study, conclusion and appropriate recommendations were made.

KEYWORDS: *Advance Organizer, Teaching Strategies, Academic Achievement and Basic Science.*

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I. INTRODUCTION

The primary purpose of teaching at any level of education is to bring a fundamental change in the learner. To facilitate the process of knowledge transmission, teachers should apply appropriate teaching methods that best suit specific objectives and level exit outcomes. In the traditional epoch, many teaching practitioner widely applied teacher-centered method to impart knowledge to learners comparative to student-centered methods. Until today, questions about the effectiveness of teaching methods on students learning have consistently raised considerable interest in the thematic field of educational research (Oyeniyi, 2019).

Research on teaching and learning constantly endeavor to examine the extent to which different teaching methods enhance growth in student learning (Elvis, 2013). Safdar (2010) affirmed that "how to learn is equally important with what to learn but how to teach (teaching strategy) is more important than what to teach". Teachers make a difference. Some teachers reliably elicit greater gains than others because of differences in how they teach (Tennyson & Volk, 2015).

Teaching methods involve different activities of the teacher and the learners such as questioning, explanation, demonstration or direction. The activities can be referred to as skills or techniques. Thus, teaching methods involve different techniques and methods among which are lectures, cooperative learning, inquiry-oriented learning or inquiry-based methods with mobile devices for learning, self-directed study, computer-assisted testing/assessment (Sung, Chang & Liu, 2015). The use of these techniques vary with different teaching methods and also on many factors such as type of learning objectives, nature of the subject, age of students, number of students in a class among others (Aniaku, 2012). Quite remarkably, regular poor academic performance by the majority students is fundamentally linked to application of ineffective teaching methods by teachers to impact knowledge to learners (Elvis, 2013). Substantial research on the effectiveness of teaching methods indicates that the quality of teaching is often reflected by the achievements of the learners. The success

of a lesson depends on various factors apart from the method of teaching adopted. However the method and strategies used in teaching a lesson is of first-class importance (Fakorede in Owoeye, 2017).

The use of Advance Organizer to ensure effective teaching as well as learning in education was advocated by Ausubel (1960) in his advance organizer learning theory. Ausubel (1960) defined an advance organizer as a cognitive instructional strategy used to promote the learning and retention of new information. According to Mayer (2003) Advance organizers is information that is given prior to teaching any concept, and it helps the students to organize and interpret new information. At the start of the lesson, presentation of the advance organizers can be used in the form of probing questions, story or any other way that may help in connecting the new ideas with the previous concepts or ideas which must be learnt by the students.

In explaining meaningful learning, Ausubel (1960) introduced the concept of a sub-sumption model as a pedagogic device in which central and highly unifying ideas are stated in terms of being familiar to the learner, to which the learner can relate new ideas by sub-sumption. The organizer is introduced in advance of learning itself, and is also presented at a higher level of abstraction (Ausubel, 1960). According to Adebola (2011), advance organizer prepares the learners for the materials they are set to learn. Advance Organizers are the means of strengthening the cognitive structure and enhancing the retention of new information. It provides concept and principles to the students themselves as it helps students to develop intellectual skills to raise reasonable questions, concerning the problems for finding out answers.

Araoye (2009) was of the opinion that students taught using Advance Organizer had higher scores in Biology achievement test than those taught in a conventional way. According to Woolfolk (2001), there are two categories of advance organizer: expository and comparative. Expository 16rganizer functions to provide the learner a conceptual framework for unfamiliar materials, and comparative organizers are used when the knowledge to be acquired is relatively familiar to the learner. In the same way, Novak in Hudson & Fred (2009) noted that an advance organizer is a kind of cognitive bridge, which teachers use to help learners make a link between what they know and what is to be learnt. Advance organizers are therefore frameworks that enable students learn new ideas or information and meaningfully link these ideas to the existing cognitive structure.

There are two broad categories of advance organizers. One of them is Expository organizers' which are used whenever the new material is totally unfamiliar; they emphasize context and link the essence of the new material with some relevant previously acquired concepts. The other one is "Comparative organizers" which are used when the material to be learnt is not entirely new. They are intended to point out ways in which that material resembles and differs from that which is already known (Curzon, 1990). All the advance organizers were presented to learners before actual classroom instruction took place.

Effects of the use of advance organizers on learning Research into the use of advance organizers suggests that they are of considerable value where the learner may not be able to recognize his or her prior knowledge as relevant and where the teacher wishes to focus students' attention on relationships among linked parts of an idea and on connections between parts and the whole (Curzon, 1990). Curzon further points out that Ausubel's own research suggests that the use of advance organizers can enhance the relationship between cognitive structure and new material, thus facilitating teaching and learning. A study by Nyabwa (2005) has demonstrated the effectiveness of using advance organizers in the teaching of mathematics in secondary schools. The use of advance organizers in teaching Biology can make significant contributions by providing appropriate learning opportunities to diverse learners and motivating students to learn both inside and outside the school environment.

Bransford & Anderson cited in Owoeye (2017) that advance organizers are an excellent way to activate and build schema prior to the actual learning of new material by students. 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. In addition, they can efficiently structure their time and the critical points that need to be covered, while simplifying complicated text (Bransford & Anderson in Owoeye, 2017).This enhances 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 thoughts.

Ausubel (1960) defines an advance organizer as a cognitive instructional strategy used to promote the learning and retention of new information. An advance organizer is information that is presented prior to learning that can be used by the learner to organize and interpret new incoming material (Mayer, 2003).

The organizer is introduced in advance of learning itself, and is also presented at a higher level of abstraction (Ausubel, 1960). A few have been conducted on the effects of advance organizers in learning and learners performance (Adebola, 2011). For example, Githua & 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. According to Harg & Willerman in Samuel, Anthony & Zachariah (2013) students can probably be helped by the organization and visual relationships of the advance organizer in a way that oral explanations do not offer. Wachanga & Mwangi (2004) explained that successful teaching and learning of biology depends partly on the correct use of a teaching method whose activities target most learning senses.

Recent brain-based learning research supports the idea of meaningful learning and active processing based on neurophysiological science. Thus, the concept of schema and the use of advance organizers are now considered standard educational practice. It was first introduced by Ausubel, as an application of his meaningful learning and schema theory in the 1960s. Ausubel found out that the use of textual advance organizers was an efficient way to relate new concepts to students' prior knowledge, bridging the gap between the learners' cognitive structure and the materials to be learned, and enhancing learning and retention (Ausubel, 1960). According to Ausubel (2000), an Advance Organizer is a relevant introductory material presented in advance. The organizers help students learn at a higher level of abstraction, generality and inclusiveness than the learning task itself.

Advance Organizers are more abstract in learning materials they precede, and relatable to the existing relevant ideas already present in a cognitive structure. Since researches on Advance Organizer had generated a lot of findings since the 1970s, some criticized that Ausubel's definition for advance organizers was vague. Based on the results of nine experiments, Mayer (2002) made suggestions on the procedures and defined steps for generating advance organizers. He interpreted Advance Organizers as "information that is presented prior to learning and that can be used by the learner to organize and interpret new incoming information" (Mayer, 20003). In order to facilitate learning and retention, Mayer (2003) suggested that advance organizer should:

1. be composed of a short set of verbal or visual information;
2. be presented prior to learning;
3. contain no specific content from the preceding learning task;
4. generate the logical relationships among the elements in the preceding learning task;
5. influence the learners' encoding process, synthezing Ausubel's ideas with more research findings in the 1980, a modified series of procedures for constructing advance organizers were suggested (Hale, 2003).

The procedures for constructing textual organizers include the following:

1. Analyze learning materials to discover and list necessary prerequisite knowledge.
2. Map the cognitive structures of learners. Find out if students know these prerequisite materials.
3. Summarize the major general ideas in the material to be learned.
4. Determine the characteristics of the Advance Organizer.
5. Write some sentences (the Advance Organizers emphasizing the major general ideas and similarities across old and new topics and use them as models.
6. The main subtopics of the lesson should be covered in the same sequence as they are presented in the advance organizer. Estimate the readability of the advance organizer.
7. Check the understandability of the advance organizer.
8. Assess the study time of the advance organizer.
9. Evaluate the validity of the advance organizer.
10. Revise the advance organizer.

According to Tanveer, Farkhunda & Arshad (2015) advance organizers theory supports effective teaching and learning process. It is an appropriate instructional strategy for teaching science concepts. Tanveer et al (2015) also asserted that advance organizers provide support for learning process and presented prior to providing new concept. In this way advance organizer provide framework to student to learn new ideas or information by meaningfully link these ideas to the existing knowledge.

Many researchers continue to test advance organizers in the traditional classroom in different subjects at all levels. More studies have been conducted on a variety of organizers, including textual and graphic organizers. Graphic organizers were conducted in a basal English reading class with an experimental group against a control group (Millet, 2000). This study utilized a pretest, post test design to measure the reading comprehension achievement, and also analyzed a quality and quantity of teacher and students' interaction. The result obtained indicated that in a traditional reader environment, students with graphic organizers performed better in reading comprehension than students with basal reader instruction using the meter analysis techniques. Baiyum and Chen (2007) synthesized fourteen graphic organizer intervention studies for students with learning disabilities. The finding revealed large effects of graphic organizers on learning, indicating that graphic organizers used before and after reading facilitate subsequent learning of students with learning disabilities.

Brunina & Ranning (2003) implemented document analysis, and focus groups strategies to facilitate the effect of graphic organizers in information technology classes. The finding of the study supported the use of advance organizers in the classroom with positive feedback from both students and instructors. Research carried out by Curry and John (2005) revealed that the group receiving the advance organizer had reduced anxiety. Baiyum & Chen (2007) indicated that students of lower learning abilities benefit more from using an advance organizer for online learning.

Owoeye (2017) in the study of effectiveness of problem-solving and advance organizer strategies on Ekiti State senior secondary school students' learning outcomes in Biology found that there is no

significant difference in Biology achievement mean scores of male and female students taught with Advance Organizer strategy.

Teaching Basic Science through Advance Organizer activities may reduce the perceived abstract nature to a vivid reality by exposing the students to the practicality of Basic Science. In the Advance Organizer Basic Science teaching, learning objects are real material objects in the surrounding.

Basic science formerly known as Integrated Science is the first form of science a child comes across at the secondary school level. Basic Science is considered the bedrock of all science subjects at the Senior Secondary School (SSS) level. The subject prepares students at the upper basic level for the study of core science subjects (biology, chemistry and physics) at the Senior Secondary School (SSS) level (Oludipe, 2012). According to Trustee of Princeton University cited in Oyeniyi (2019), Basic Science is a revolutionary new introductory science curriculum developed at Princeton intended for students considering a career in science. Basic Science emphasizes scientific literacy and research oriented learning (Gunseli & Guzin, 2017). The subject encourages exploration of student's immediate environment. As a result, Basic Science teachers continue to learn along with their students.

The teaching of Basic Science is therefore, based on the philosophy of active learner participation in the process whereby, students are encouraged to learn by constructing their own knowledge based on what they already understand as they make connection between new information and old information, guided or facilitated by the teacher (Piaget) as quoted by (Anna, 2015).

Under this philosophy, students are encouraged and let to discover concepts and generalizations based on their experiments. In the study of Akomolafe as quoted by Anna (2015), rightly pointed out that, when children learn science using the process of activity approaches, they improve their ability to apply intellectual skills to solve problems, improve their language development, become more creative, master science content better and develop positive attitude towards Science and Scientists.

There are various objectives of Basic Science as identified by Bilesanmi-Awoderu & Oludipe (2012). The reasons for which Nigeria government started Basic Science teaching in Nigerian upper basic level include:

i Provides of students at the upper basic level, a sound basis for continuing science education in single science subject.

Ii Enhancement of scientific literacy of the citizenry.

Iii It allows students to understanding of students' environment in its totality rather than in fragments.

Iv Having a general view of the world of science.

V The processes of science serve as unifying factors for the various science subjects.

The importance of Basic Science in everyday life can never be over emphasized. It serves as the bedrock which provides the required training in scientific skills to meet the growing needs of the society. It is the fundamental knowledge acquired through Basic Science at the upper basic level that leads to the transformation of the world through dramatic advances in almost all fields including Medicine, Engineering, Electronics and Aeronautics among others (Guyana, 2018).

The application of scientific knowledge acquired through Basic Science, as reported by Guyana (2018) has helped many countries like China and India to transform from poor feudal type economies to become economic and industrial power houses and in several ways compete effectively with developed countries. Basic Science is of great importance because early experiences in science help students to develop problem-solving skills that empower students to participate in an increasingly scientific and technological world (Guyana, 2018).

Basic Science is the type of science which provides unique training of students in observation, reasoning and experiment in the different branches of science; it also helps students to develop a logical mind (Prakash, 2012). Basic Science enables students to be systematic and enables them to form an objective judgment. Basic Science, if taught according to its philosophy, equips students with the necessary introductory scientific and technological knowledge and skills necessary to build a progressive society. This forms the bedrock on which scientific and technological studies rest (Ochu & Haruna, 2014).

Gender issues are currently the main focus of discussion and research all over the world, Nigeria inclusive. The question of gender is a matter of grave concern especially among academics and policy formulators. Intellectuals are worried about the role of male and female in the psychological, political, social, economic, religious, scientific and technological development of nations (Ujiro, 2015). Meanwhile concerns about academic achievement with respect to males and females have generated a considerable interest in the field of educational testing over the years. Differences in academic achievement of the two genders are likely to contribute disparities in the allocation of cognitive roles in the world of work.

Oludipe (2012) quoted Erinosho that what has remained the main focus of great concern in the field of science education are the biases and misconceptions about women and science, i.e. science is a male enterprise. Many researches according to Oludipe (2012) had been carried out on gender issues in science education. Abdullahi, Mlozi & Nzalayaimisi (2015) quoted Bilesanmi-Awoderu that many researchers have provided

reports that there are no longer distinguishing differences in the cognitive, affective and psychomotor skill achievements of students in respect of gender.

In Nigeria, in spite of the enormous role that Basic Science plays in providing a solid foundation for the mastering of basic concepts in science and technology for national development, and the efforts of government and other stakeholders in improving science education, results in Basic Science in most certified examination bodies like the results of examination conducted by National Examinations Council (NECO) and Ekiti State Ministry of Education, Science and Technology have not been satisfactory. The broad aim and expectations of any teaching and learning programme is productivity and positive-evaluated end-product (achievement).

Hence the need for Advance Organizer teaching strategy as it will enhance their performances because they encourage interaction among them, allows students to observe, think, reason, investigate and make conclusion on their own about what they see themselves.

II. RESEARCH HYPOTHESES

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

1. There is no significant difference in the achievement mean scores of students taught using Advance Organizer teaching strategy and conventional teaching method after the treatment.
2. There is no significant difference in the achievement mean scores of male and female students taught in each of Advance Organizer teaching strategy and conventional methods.

III. METHODOLOGY

The research design adopted in the study was a pretest, posttest, control group quasi-experimental. Purposive and stratified random sampling techniques was used to select a total sample of 160 public Junior secondary one (JSS I) Basic science students (this sample was divided into the experimental and control groups in ratio 1:1; meaning 80 students from each group) from four Junior secondary schools in Ado Local Government Area, Ekiti State, Nigeria. Two schools each for experimental and control groups respectively.

The treatment package used for the study was tagged: Advance Organizer Instructional Package (AOIP).The instrument used to collect relevant data from the subjects was Basic Science Achievement Test (BSAT). The reliability of the instrument was determined through the split-half method with the reliability coefficient of 0.82.

The administration of the instrument was in three stages: the pre-treatment stage (two weeks), the treatment stage (four weeks) and the post-treatment stage (two weeks). Eight weeks altogether were used for the whole study. The experimental group was taught using Advance Organizer teaching strategy while the control group was taught using the conventional method of teaching.

Two null hypotheses were tested at 0.05 level of significance. The data collected were analysed using t-test and ANCOVA statistical analysis packages.

IV. RESULTS AND DISCUSSION

Hypothesis 1

There is no significant difference in the achievement mean scores of students taught using Advance Organizer teaching strategy and conventional teaching method.

Table 1 : t-test analysis of achievement mean scores of students taught using Advance Organizer teaching strategy and students taught using conventional method.

GROUP	N	Mean	SD	Df	t_{cal}	t_{tab}	Result
Experimental	80	22.15	9.24				
Control	80	16.73	7.46	158	4.072	1.980	*

P < 0.05 (Result Significant at 0.05 level). * = Significant.

As shown in table 1, when the mean scores (posttest) of students taught using Advance Organizer teaching strategy and students taught using conventional method were statistically compared, a *t-value* (t_{cal} = 4.072) with P < 0.05 alpha level was obtained, which was significant at 0.05 level. This implies that there exists significant difference between the Advance Organizer teaching strategy and conventional method of teaching achievement mean scores after the treatment in favour of students taught using Advance Organizer teaching strategy. Consequently, the null hypothesis which states that there is no significant difference in the achievement mean scores of students taught using Advance Organizer teaching strategy and conventional teaching method was rejected. As such, the conventional method of instruction can be said to be less effective compared with Advance Organizer teaching strategy.

Hypothesis 2

There is no significant difference in the achievement mean scores of male and female students taught in each of Advance Organizer teaching strategy and conventional method.

In order to test the hypothesis, scores relating to Basic science achievement scores of male and female students taught using Advance Organizer teaching strategy and conventional methods were computed and analyzed using Analysis of Covariance (ANCOVA) statistics at 0.05 level of significance. The result is presented in Table 2.

Table 2: ANCOVA showing Basic Science Achievement scores of Advance Organizer teaching strategy and conventional methods by gender

Source	*SS*	*df*	*MS*	F_{cal}	F_{tab}
Corrected Model	1273.221	4	263.422	42.282	2.52
pretest Achievement	3.148	1	3.148	.342	2.92
Sex	.572	1	.572	.068	2.92
Group	826.188	1	826.188	221.221	2.92
Sex * Group	3.314	1	3.314	.313	2.92
Error	782.316	155	6.431		
Corrected Total	2614.312	159			
Total	91241.000	160			

P > 0.05 (Result Significant at 0.05 level). * = Significant.

Table 2 showed that the computed F-value (F_{cal} = 0.313 < F_{tab} = 2.92) with a P-value (P> 0.05 alpha level) obtained from the analysis of the difference in Basic science achievement mean scores of male and female students taught using Advance Organizer teaching strategy and conventional methods. The null hypothesis, therefore, was not rejected. This implies that there is no significant difference in Basic science achievement mean scores of male and female students taught using Advance Organizer teaching strategy and conventional methods.

V. DISCUSSION

Research Hypothesis one intend to find out the effects of Advance Organizer teaching strategy and conventional method of teaching on the performance of Basic science students in junior secondary schools in Ekiti State. It was discovered that students' taught using outdoor teaching strategy had significantly higher academic achievement than their counterpart taught using conventional method. This result is not entirely surprising as it confirms the assumptions that students' taught using Advance Organizer teaching strategy (experimental) performed significantly better than those taught using the conventional teaching method. This was confirmed by their calculated mean academic performance in Basic science which was 22.15 and 16.73 by experimental and control group students' respectively. This outcome agreed with findings of Adebola (2011) that advance organizer prepares the learners for the materials they are set to learn; and that of Githua & Nyabwa (2007) in the study found out that students taught using advance organizers had significantly higher scores in mathematics achievement test than those taught in the conventional way. The outcome also agreed with the findings of Oyeniyi (2019) while looking at the effects of Advance Organizer teaching strategies on students' learning outcomes in secondary school Basic Science in Ekiti State found out that there is significant difference between pre-test and post-test mean score of students exposed to outdoor activities: that Advance Organizer teaching strategy was effective in the teaching of Basic Science in Ekiti State, Nigeria.

Research Hypothesis two seek to find out the difference in the achievement mean scores of male and female students taught in each of Advance Organizer teaching strategy and conventional method. The findings revealed that: there was no significant difference in the academic achievement of male and female students in Basic science in each of the experimental and control groups before and after the treatment. In other words, the achievement of male and female students exposed to Advance Organizer teaching strategy did not differ significantly as female students were found to have similar achievement in Basic science as their male counterparts in the Advance Organizer teaching strategy and conventional methods of teaching in this study.

The implication of this result is that gender was not a significant predictor of students' achievement in Basic science. This finding agreed with the findings of Abdullahi, Mlozi & Nzalayaimisi (2015) quoted Bilesanmi-Awoderu that many researchers have provided reports that there are no longer distinguishing differences in the cognitive, affective and psychomotor skill achievements of students in respect of gender. The findings also agreed to the findings of Owoeye (2017) in the study of effectiveness of problem-solving and advance organizer strategies on Ekiti State senior secondary school students' learning outcomes in Biology that there is no significant difference in Biology achievement mean scores of male and female students taught with Advance Organizer strategy

VI. CONCLUSION

This study focused on the effects of Advance Organizer teaching strategy on Students' academic Achievement in Basic Science in Junior Secondary Schools, Ekiti State, Nigeria.

Based on the findings of this study, it can be concluded that Advance Organizer teaching strategy is more potent in stimulating students' achievement in Basic science in secondary schools than the conventional method. It can also be concluded that the effect of teaching method on Junior Secondary School Basic Science was also found not to vary with gender of students. This simply implies that performance of students taught using different teaching methods is not in any manner affected by their gender.

VII. RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made:

1. Since the commonly used conventional method of instruction has been empirically discovered in this study to be less effective than Advance Organizer teaching strategy in improving Junior Secondary School students' academic performance in Basic Science, the conventional method presently in use by Basic science teachers should be improved upon or modified or replaced (as the case may be) with Advance Organizer teaching strategy and other activity-based teaching method.
2. Basic science teachers should be encouraged to adopt Advance Organizer teaching strategy as this will expose the students to doing by themselves which is the foundation for tomorrow's scientists thereby leading to the development of our dear country, Nigeria since the needed man-power would have know the developmental rudiments right from their secondary school days.
3. State and Federal Government should equip all schools with necessary facilities for the application of Advance Organizer teaching strategy.

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