



Effects of Advance Organizers on Upper Basic Science Students' Achievement and Retention in Giade Local Government, Bauchi State, Nigeria

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ABSTRACT

This study attempts to find out the effectiveness of advance organizer model of teaching on students' achievement and retention in basic science at an upper basic level. The study employed a quasi-experimental design. The sample for the study was 110 upper-basic II students. A simple random sampling technique was used to select two upper-basic schools in Giade Local Government Area, Bauchi State, Nigeria. The experimental group was taught using an advance organizer model of teaching, while the control group was taught using the traditional teaching method. Basic Science Achievement Test (BSAT) was used as an instrument for data collection. The reliability of BSAT was determined using the Kuder-Richardson formula 21 (K-R21) and the reliability coefficient obtained was 0.76. The hypotheses were tested at a 0.05 level of significance using a t-test. The findings of the study revealed students in the experimental group had achievement and retention significantly more than their counterparts in the control group. Also, gender has no effect on students' achievement and retention when advance organizer model was used as a medium of instruction. Based on these findings, it was recommended that Basic science teachers should adopt the use advance organizer model of teaching in the teaching of Basic science.

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INTRODUCTION

The 21st century presents the global community with challenges of significant advancement in science and technology. As a result attention has been focused on improving the teaching and learning of science and technology all over the world, because provision of effective science and technology education remains the only essential way for every country to meet up with these challenges and to attain social and economic development. This fact is mention in the National Policy on Education (FRN, 2014) and by United Nations Educational, Scientific and Cultural Organization (UNESCO) (2017) that science and technology education should provide the learners with the adequate

knowledge and skills that would ensure efficient sustainability in world of scientific and technological advancement. The National Policy on Education also emphasizes the teaching and learning of science and technology as a gateway for equipping the learners with needed knowledge, competencies, attitude, and skills on science and technology. This would enable the learners to conduct themselves in line with the global acceptable standards.

Basic science was previously called integrated science and it is a first form of pure science students come across at upper basic level of education in Nigeria. Agu and Samuel (2018 a) maintains that, for a student to study science oriented subjects (Biology, Physics and



Chemistry) at the senior secondary school successfully, that student had to be well groomed in Basic science at the upper basic school. This implies that Basic science is a requirement and foundation for learning science related subjects and its curriculum is purely science. In view of this, the subject received great attention in the basic education curriculum. With all the roles Basic science play in grooming future scientifically literate Nigerians, Osokoya (2013) claims that there exist ineffectiveness in the teaching and learning of the subject as majority of the teachers employed inappropriate teaching strategies that results to students' poor achievement and retention. This problem of students' poor achievement and retention in Basic science might be as a result of the teaching strategies employed by Basic science teachers do not encourage the learners to participate actively and apply their creative minds during the instruction as a result the learners find it difficult to understand, dig deeper, retain, and meaningfully apply what was learned to the solution of problems in real life situation. Ogbeba and Agernor (2016) points out such ineffective teaching strategies prevent the learners from participating actively during science lessons and impair learners' ability to achieve and retain what was learned. This view is supported by Enekwechi (2016) who writes that application of effective teaching strategies that allow the learners to actively participate during instruction would likely result to meaningful learning instead of rote learning. Similarly, UNESCO (2017) offers that, learners' achievement and retention in Science, Technology, Engineering and Mathematics (STEM) subjects can be enhanced through effective application of instructional strategies that actively engage the learners. This persistent problem of Basic science students' poor achievement and retention is strongly affecting the Nigeria's quest for producing indigenous scientifically literates and it may be tackled by effective application of advance organizer model of teaching.

Advance organizer model of teaching is based on theory of meaningful verbal learning formulated by David Ausubel on the principle that learning takes place by the assimilation of new concept into the concepts already exists in the

learners' cognitive structure. Ausubel (1960) described advance organizers as relevant introductory information that is presented to the learners prior to a new classroom instruction so as to facilitate assimilation of the new material. Ausubel (2000) concludes that advance organizers are bridges that help the learners to link their prior knowledge with the new classroom instruction which results to meaningful instructional process. Therefore, advance organizers are bridges that provide the learners with new information or ideas and meaningfully link such ideas to their existing knowledge. According to Nazimuddin (2015) advance organizer model of teaching is designed to strengthen learner's cognitive structures and primary concern to provide teachers with means of organizing and conveying large amounts of information to the learners as meaningfully and efficiently as possible. In the same vein, Kapri (2017) asserts that in advance organizer model teacher's role is to retain the control of the intellectual structure, organize and present what is to be learned systematically prior to and during the instructional processes and provide tasks to the learner to integrate and synthesize what has been learned. The learner's primary role is to master and retain the ideas and information. The advance organizers provide concepts and principles directly to the learners and they are classified into two major categories which are presented to learners prior to instruction namely; comparative and expository organizers. Curzon (1990) as cited in Awodun (2016) offers that comparative organizers are applied where the material to be learned is related and differs to some degree from what already existed in learners' cognitive structure. This alerts the learners that the topic they are to learn is not completely new, it resembles something that already exists in their cognitive structure, while expository organizers are applied when the new learning concepts are completely unfamiliar to the learners. They link those new concepts with some relevant previously learned concepts.

In a need to ensure the utilization of result-oriented strategies in science classroom, Semerci and Batdi (2015) suggests that the use of constructivist-based instructional strategies such as Ausubelian advance organizer model of



teaching which enables the learners to actively participate in teaching and learning processes through collaborating with teacher that yields capabilities, such as independent-learning, social interaction, healthy competition and self-evaluation among the learners and results to improvement in learners' academic achievement and retention. Mallick and Amandeep (2014) offers that advance organizers enhance learners' achievement and retention of new knowledge. Their purpose is to help the learners to explain, integrate, inter-relate and differentiate the new learning concept with the previously learned concepts. Atomatofa (2013) points out that effective application of advance organizer model of teaching during classroom instruction has improved students' achievement and retention far better than traditional teaching method. Similarly, Tanveer-Uz-Zaman et al., (2015) maintains that advance organizer model of teaching had a positive effect on the achievement and retention ability of the learners.

Gender stereotype is common in most of the activities of an average Nigerian, more commonly in northern part of the country (Uche et al., 2016). There is issue of gender imbalance in learning of STEM subjects, because in Nigeria these subjects are mostly seen as male centered. That is the reason why Jirgba et al., (2018) points out that the existing difference in male and female students' achievement and retention in science subjects has been a disturbing issue to science educators. This view is supported by the findings of Ogunleye and Adepoju (2011); Tangas et al., (2015); Agu and Samuel (2018 b) who reported that there exist significant difference between male and female students' achievement in science subjects. In the same vein, Udo and Ubana (2013); Chibabi et al., (2018) found that male students' retained the learned science concepts better than their female counterparts. However, on contrary findings Awodun (2016); Omondi et al. (2018) found that gender has no effect on learners' achievement in science subjects when advance organizer model of teaching was used. Similarly, in separate researches Chukwu (2011); Ogbaba and Agernor (2016) reported that there exists no significant difference in male and female students' retention of learned science concepts. In view of all that

has been mentioned so far, one may suppose that there is controversial issue of gender imbalance in learning science subjects that requires further investigation. This makes it necessary for educational psychologists to come up with promising instructional strategies to enhance the teaching and learning of science subjects for achieving gender equity in science education for sustainable development. Therefore, effective application of an appropriate instructional strategy could arouse learners' achievement and retention irrespective of gender.

The purpose of the study is to determine the effectiveness of advance organizer model of teaching on upper basic students' achievement and retention in basic science. The specific objectives are to:

1. To examine the difference in students' achievement mean scores in experimental and control groups.
2. To examine the difference in male and female students' achievement mean scores in experimental group.
3. To examine the difference in students' retention mean scores in experimental and control groups.
4. To examine the differences in male and female students' retention mean scores in experimental group.

Research Hypotheses

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

- HO₁** There is no statistically significant differences in students' achievement mean scores in experimental and control groups.
- HO₂** There is no statistically significant difference between male and female students' achievement mean scores in experimental group.
- HO₃** There is no statistically significant differences in students' retention mean scores in experimental and control groups.
- HO₄** There is no statistically significant differences between male and female



students' retention mean scores in experimental group.

METHODOLOGY

The study employed a pre-test, post-test, control group quasi-experimental design. The sample for the study was 110 upper basic II students from two randomly selected upper basic schools in Giade Local Government Area, Bauchi State. Two intact classes were also selected at random one from each of the two selected upper basic schools; one class was experimental group and other control group. Experimental group was taught using advance organizer model of teaching while, the control group was taught using traditional teaching method. Pre-test was administered to both the experimental and control groups before the experiment, the groups were taught for the period of 4 weeks then post-

test was administered and test of retention was administered to both groups 2 weeks after the post-test. Experimental group was given the advanced organizers for each lesson two days before the lesson. Basic Science Achievement Test (BSAT) was the instrument used for data collection from the subjects. The reliability of BSAT was determined using Kuder-Richardson formula 21 (K-R21) and the reliability coefficient obtained was 0.76. Data for the study were analyzed using mean and standard deviation (SD) to answer the research questions and t-test to test the four null hypotheses at 0.05 level of significance.

RESULTS

Hypothesis 1: There is no statistically significant differences in students' achievement mean scores of experimental and control groups.

Table 1: Independent T-test Analysis of Post-test Achievement Mean Scores of Experimental and Control Groups

Group	N	Mean	SD	t-value	df	p-value	Decision
Experimental	54	15.22	3.84	5.444	108	0.000	Rejected
Control	56	11.48	3.35				

Results in Table 1 above presented that when the post-test achievement mean scores of the experimental and control groups were compared statistically a $df = 108$, $t = 5.444$, $p < 0.05$ was obtained. The result from the table revealed that there was significant difference the post-test achievement means scores of experimental and control groups in Basic Science with mean score of 15.22 and S. D of 3.84 for experimental group and mean score of 11.48 and

S. D of 3.35 for control group. The p-value of 0.000 is less than the alpha value of 0.05. Therefore, the null hypothesis which states that there was no statistically significant differences in students' achievement mean scores of experimental and control groups was rejected.

Hypothesis 2: There is no statistically significant difference between male and female students' achievement mean scores in experimental group.

Table 2: Independent T-test Analysis of Achievement Mean Scores of Male and Female Students of Experimental Group

Gender	N	Mean	SD	t-value	Df	p-value	Decision
Male	31	15.23	3.55	0.008	52	0.994	Accepted
Female	23	15.22	4.29				

Results in table 2 above shows that when the post-test achievement mean scores of male and female students in experimental group were compared statistically a $df = 52$, $t = 0.008$, p

> 0.05 was obtained. The result from the table revealed that there was no statistically significant difference between male and female students' achievement mean scores in experimental group



with mean score of 15.23 and S. D of 3.55 for male and mean score of 15.22 and S. D of 4.29 for female. The p-value of 0.994 is greater than the alpha value of 0.05. Therefore, the null hypothesis which states that there was no statistically significant differences between male

and female students' achievement mean scores in experimental group was accepted.

Hypothesis 3: There is no statistically significant differences in students' retention mean scores in experimental and control groups.

Table 3: Independent T-test Analysis of Students' Retention Mean Scores in Experimental and Control Groups

Group	N	Mean	SD	t-value	df	p-value	Decision
Experimental	54	15.63	3.97	6.426	108	0.000	Rejected
Control	56	11.05	3.49				

Results in Table 3 above highlights that when the retention mean scores of the experimental and control groups were compared statistically a $df = 108$, $t = 6.426$, $p < 0.05$ was obtained. The result from the table revealed that there was statistically significant difference between the retention mean scores of experimental and control groups with mean score of 15.63 and S. D of 3.97 for experimental group and mean score of 11.05 and S. D of 3.49 for

control group. The p-value of 0.000 is less than the alpha value of 0.05. Therefore, the null hypothesis which states that in students' retention mean scores in experimental and control groups was rejected.

Hypothesis 4: There is no statistically significant differences between male and female students' retention mean scores in experimental group.

Table 4: Independent T-test Analysis of Retention Mean Scores of Male and Female Students of Experimental Group

Gender	N	Mean	SD	t-value	df	p-value	Decision
Male	31	15.77	3.50	0.308	52	0.759	Accepted
Female	23	15.43	4.61				

Results in table 4 above shows that when the retention mean scores of male and female students in experimental group were compared statistically a $df = 52$, $t = 0.308$, $p > 0.05$ was obtained. The result from the table revealed that there was no statistically significant difference between male and female students' retention mean scores in experimental group with mean score of 15.77 and S. D of 3.50 for male and mean score of 15.43 and S. D of 4.61 for female. The p-value of 0.759 is greater than the alpha value of 0.05. Therefore, the null hypothesis which states no statistically significant differences between male and female students' retention mean scores in experimental group was accepted.

DISCUSSION

The findings of this study revealed that the use of advance organizer model as a medium of instruction has a significant effect on students' achievement and retention in Basic Science. The students taught using advance organizer model achieved and retained what was learned significantly than those taught using traditional teaching method. Therefore, it can be deduced that the high achievement and retention score of experimental group is as a result of their exposure to advance organizer model of teaching which provided them enough prior knowledge on learning task at hand that resulted to students' active participation during the teaching and learning. This finding is in agreement with that of Atomatofa (2013), Wachanga et al. (2013),



Mallick and Amandeep (2014) and Tanveer-Uz-Zaman et al. (2015) who on their separate studies found that advance organizer model of teaching is effective in enhancing students' academic achievement and retention.

The study also revealed that was no significant difference between the achievement and retention mean scores of male and female students in the experimental group in Basic Science. Therefore, gender has no effect on students' achievement and retention when advance organizer model was used as a medium of instruction. This implies that advance organizer model of teaching is a gender-friendly instructional strategy that can be used to minimize the gender-achievement-gap in Basic Science. This finding is in accord with that of Awodun (2016), Ogbaba and Agernor (2016) and Omondi et al. (2018) who in their separate studies on advance organizer model of teaching found no significant difference in the achievement and retention of male and female students.

CONCLUSION

Based on the findings of this study, it can be concluded that the use of advance organizer model in teaching Basic science is more effective than traditional teaching method in enhancing upper basic students' achievement and retention. Therefore, advance organizer model be used to address the challenge of upper basic students' poor achievement and retention in Basic science. Also it can be concluded that when advance organizer model of teaching is used gender has no effect on learners' achievement and retention in Basic science. Therefore, advance organizer model could be used to address the problem of gender imbalance in learning Basic science and science subjects in general.

RECOMMENDATION

The present study indicated that advance organizer model of teaching was effective in understanding of Basic science for it is effective in achieving and retaining the learned concepts irrespective of gender. This presents the need for Basic science teachers to adopt the use of advance organizer model in their

instructional process to encourage meaningful learning among the learners.

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