

## Effects of Study Questions as Advance Organizers on Basic Science and Technology Students' Retention and Interest

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### **Abstract**

*The study determined the effects of study questions as advance organizers on Basic Science and Technology students' retention and interest. Two research questions and two null hypotheses were answered and tested. The non-randomized control group, pre-test, post-test quasi experimental design was used for the study. A sample of 168 Upper Basic 3 students drawn randomly from four schools was used for the study. Subjects in two schools served as experimental group and the other two schools were used as control group. The subjects in experimental group were taught using study questions as advance organizers while those in control group were taught without the use of study questions. The validated Basic Science Retention Test (BSRT) and Basic Science Interest Inventory (BSII) were administered to subjects as pre-test and post-test. The BSRT and BSII were subjected to a reliability test which yielded a Kuder-Richardson formula (KR-21) coefficient of 0.85 and Cronbach alpha of 0.76 respectively. The research questions were answered using mean and standard deviation while analysis of covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The findings revealed that students taught using study questions as advance organizers retained knowledge higher than their counter parts taught without using study questions. Also subjects taught using study questions as advance organizers exhibited higher interest level than their counterparts in the control group. The study therefore, recommended among others that Basic Science and Technology teachers should create students-centered instructional methods such as study questions as advance organizers to produce the desired result it is known to have produced elsewhere.*

**Key Words:** Advance Organizers, Basic Science and Technology, Effect, Interest, Retention and Study Questions.

### **Introduction**

The attainment of the goals of science education is a major concern of education policy makers and one of such goals is the inculcation of scientific literacy (FRN, 2013). Basic Science and Technology as a subject at the foundation level of education is the foundation on which subsequent learning and development of science and technology is built. Basic Science and Technology is aimed at helping learners to acquire scientific knowledge, skills and attitudes that will facilitate the making of informed decision and developmental survival strategies which will enable them to live efficiently in the global community in the present scientific world.

It is in this regard that Odubunim (2006) stated that the sustainable growth and development of any nation is directly proportional to the level and quality of scientific and technological knowhow of her citizens as science and technology remains a veritable tool for national development in areas like agriculture, medicine, engineering among others. Thus, the relevance of Basic Science and Technology learning cannot be over-emphasized considering its imperativeness in this present science based-world where emphasis has been shifted from

products of science to process of science. Meaningful learning could be achieved if Basic Science and Technology teachers adopt appropriate instructional delivery approaches that may enhance the retention of knowledge of the concepts learnt and to help develop the interest of the students in the study material.

It is therefore, the responsibility of the Basic Science and Technology teachers to encourage students to acquire and retain knowledge obtained in schools for future use (Ortese, Yaweh & Akume, 2005). Herron (2014) asserted that meaningful learning is explained in terms of retention. The author further explained that the term used to denote the demonstration that learning has been retained over time may be displayed through recognition or recall.

It is perhaps due to school leavers' inability to recall and apply knowledge gained from the classroom to the workplace that Akpan (2008) reported the lamentation of employers of labour that school leavers were unemployable due to their lack of requisite skills and attitudes needed in work place. Obanaya (2011) reported the finding of a World Bank study which confirmed that employers of labour find some products of Nigerian schools as lacking in work based utility.

Tsoho (2011) declared that retention involves the encoding, storing and retrieval of information by learners. The author is of the opinion that prior introduction to the material/task under study makes for better bonding of new material. When the material finds an anchoring post in the cognitive domain of the learners, the better it is stored and retrieved at a later time. When retrieval is easy, such information can be provided as an answer to question(s) when required. Thus higher achievement and interest gain may be recorded. Odoh (2012) viewed retention as the ability of a learner to communicate to others repeatedly and over time what he/she has learnt and how he/she has arrived at the result. Furthermore such a learner is said to be an active creator his/her own knowledge.

Oludipe (2012) opined that pre-instructional resources in teaching and learning make students to learn more and retain better what they have been taught. This implies that pre-instructional strategy such as study questions if presented to Basic Science and Technology students ahead of the lesson the more students study the questions, the better prepared they come to the class. In this way, meaningful learning might be enhanced, hence better retention of what has been taught and by extension promotes, sustains students' interest and allow students to discover themselves and their abilities.

Ijiga (2008) described study questions as a purpose-setting question to which students are exposed to prior to instruction to facilitate learning. The author noted that questions could be past questions papers, questions set by students and questions pose by teachers during lessons which learners examine or can get knowledge from. The study questions act as instructional stimuli that convey to students the element to be learnt and direction on what and how to do it. Thus study questions used as advance organizers are posed to students prior to the learning session to serve as a guide for students in the study.

Interest among students is inextricably linked to retention, the more interest is shown in a particular subject, the, more time is scheduled to the study of such subject thus such a learner is able to store and retrieve information in a test, score high and achieve the desired objectives of such a programme of study. Interest in an object or activity is aroused as a result of effort to satisfy a felt need (Njoku, 2005). The author added that interest is congruent to need. There is therefore, an assumed link between what the Basic Science and Technology teacher does in the classroom and how learners are motivated to learn.

Sarason (2008) reported that students are no longer interested in school. Once there is no interest in schooling or learning the amount of time scheduled for study may be reduced which in turn may also affect retention. Interest (Renninger, 2006) can be divided into individual

interest and situational interest. The former is more enduring, trait-like and endures over time. It can be considered a disposition that individuals take with them from one context to the next while the latter is more momentary and situation bound. A student's willingness to learn and enthusiasm for discovering knowledge and developing understanding might detect the level of the student's learning (Balym, 2009).

Psychologists over the years have dedicated themselves on finding out how learning takes place because they are intrigued on how the mind acquires knowledge. One of such psychologists is Kurt (1935), who regarded the net effect of forces that are operating simultaneously in the psychological field of any learner as the determinants of his/her responses. Relying on the force field theory implies that it is essential for Basic Science and Technology teachers to structure and re-structure the instructional strategies for the production of varying interest and retention and by extension produce meaningful effect on Basic Science and Technology learning. The outcome of this study might be of benefit to curriculum developers as they might find a useful reference point in their continuous quest for alternative strategies and resources to turn around the fortune of Basic Science and Technology teaching and learning in Nigeria.

The teaching of Basic Science and Technology involves the conventional teacher expository method which may not facilitate meaningful learning and may also make students perceive Basic Science and Technology as abstract and very difficult. Consequently many students develop negative interest towards its study.

To remedy the down trend in Basic Science and Technology students' performance, research studies have increased on the quest for identifying effective teaching/learning strategies that could enhance students' retention and develop their interest in the subject. The Basic Science and Technology teacher is therefore, faced with the challenge of teaching students how to construct meaning from learned materials such that the knowledge gained can be retained over time going by records of poor retention of knowledge and low interest demonstrated by students which are still on the increase. Thus, the need to use study questions as advance organizers to teach Basic Science and Technology at enhancing students' retention and developing their interest has arisen.

The purpose of the study therefore, is to determine the effect of study questions as advance organizers on students' retention of knowledge in Basic Science and Technology and to examine its effect on students' interest in Basic Science and Technology.

### Research Questions

1. What is the difference in the mean retention scores of Basic Science and Technology students taught using study questions as advance organizers and those taught without using study questions.
2. What is the mean interest rating of Basic Science and Technology students taught using study questions as advance organizer and those taught without using study questions.

### Null Hypotheses

**Null Hypothesis 1:** Basic Science and Technology students who are taught using study questions as advance organizers will not differ significantly in their mean retention from those taught without using study questions.

**Null Hypothesis 2:** There is no significant difference in the mean interest ratings of Basic Science and Technology students that are taught using study questions as advance organizers and those taught without using study questions.

**Methodology**

The study adopted the non-randomized control-group, pre-test, post-test, quasi experimental design. The study was conducted in Buruku Local Government Area of Benue State. The population of the study was made up of 1,864 upper Basic 3 students from 74 upper Basic Schools within the study area. A sample of 168 Upper Basic 3 students was drawn from four schools within the study area. The schools were selected through random sampling while intact classes were used for the study. The Basic Science Retention Test (BRST) and the Basic Science Interest Inventory (BSII) which served as pre-test and post-test respectively were used as instruments for the study. Two schools each served as experimental and control groups. Two teachers were employed as research assistants who taught the experimental groups. These were trained on how and when to administer the study questions. The teachers were instructed to teach the control group without using study questions as advance organizers.

The researcher prepared all the lessons plans for control group and experimental groups. The control group was taught using the conventional method while the experimental group was taught using study questions as advance organizers. After 4 weeks of treatment, both groups were administered the BSRT and BSII as post-test. The two groups were given the same test after another 2 weeks as the retention and interest ratings. After each use, the items were reshuffled to minimize familiarity.

**Results**

**Research Question 1:** What is the difference in the mean retention scores of Basic Science students taught using study questions as advance Organizers and those taught without using study questions?

**Table 1: Mean and standard deviation on retention in Basic Science and Technology**

Group	N	Post-test Scores $\bar{X}$	SD	Retention Test-score $\bar{X}$	SD	Mean Retained difference
Experimental	82	23.56	3.99	32.71	5.99	9.15
Control	86	22.67	3.41	24.88	2.82	2.21
Mean diff		0.89		7.83		6.94

Results in Table 1 show that the mean retention score of the experimental group was 32.71 with SD of 5.99 whereas that of the control group was 24.88 with SD of 2.82. The mean difference in mean retention score was 6.94 in favour of the experimental group who were taught using study questions as advance organizers. This implies that those taught using study questions as advance organizers retained higher knowledge of the concepts learnt than those taught without using study

**Null Hypothesis 1:** Basic Science students that are taught using study questions as advance organizers will not differ significantly in their mean retention from those taught without using study questions.

**Table 2:** ANCOVA on students’ retention in Basic Science and Technology

Source	Sum of squares	Df	Mean square	F	Sig
Corrected model	5553.16	4	1388.29	372.21	.000
Intercept	17.40	1	17.40	4.67	.320
Pre-test	2981.29	1	2981.29	799.31	.000
Method	1889.44	1	1889.44	506.57	.000
Error	607.96	163	3.73		
Total	14454.00	168			
Corrected total	6161.12	167			

Table 2 show that  $F(1 \alpha 167) = 506.57$  with  $p=.000$  since  $p=.000 < 0.05$ . This shows a significant difference in mean retention scores between students taught using study questions and those taught without using study questions. It therefore means that Basic Science and Technology students taught using study questions as advance organizers retained knowledge higher than their counter parts taught without using study questions.

**Research Question 2:** There is no significant difference in the mean interest ratings of Basic Science and Technology students that are taught using study question as advance organizers and those taught without using study questions.

**Table 3:** Mean and standard deviation on interest ratings of students in Basic Science and Technology

Group	N	Pre-interest X	SD	Post-interest X	SD	Mean Gain
Experimental	82	2.80	0.15	3.19	0.14	0.39
Control	86	2.65	0.28	2.99	.27	0.34
Mean diff		0.15		0.20		0.05

Results in Table 3 show the interest ratings of experimental group (who used study questions as advance organizers) in Pre-interest to be 2.80 with SD of 0.15 while that of control group (without the use of study questions) was 2.65 with SD of 0.28. The mean difference in the pre-interest rate of both groups was 0.15 signifying homogeneity. At Post-interest the experimental group taught using study questions had a mean interest rate of 3.19 with SD of 0.14 which was higher than that of the control group of 2.99 with SD of 0.27. Thus, 0.20 was the mean difference in favour of the experimental group. The mean gain for the experimental group was 0.39 and that of the control group was 0.34 while the mean difference was 0.05 in favour of the experimental group.

**Null Hypothesis 2:** There is no significant difference in the mean interest ratings of Basic Science and Technology students that were taught using study questions as advance organizers and those taught without study questions.

**Table 4:** ANCOVA on students' interest in Basic Science and Technology

Source	Sum of squares	Df	Mean square	F	Sig
Corrected model	7.93	4	1.98	253.53	.000
Intercept	610	1	.610	78.07	.000
Pre-Interest	6.29	1	6.29	803.97	.000
Method	.13	1	.134	17.16	.000
Error	1.27	163	.008		
Total	1613.16	168			
Corrected total	9.20	167			

The summary of analysis of covariance in Table 4 show that the calculated p value is significant as  $F(1, 167) = 17.16$  hence  $p = .0000 < 0.05$ . Consequently the null hypothesis 2 was rejected. This show that Basic Science and Technology students who were taught using study questions as advance organizers exhibited higher level of interest as opposed to their counterparts who were taught without the use of study questions.

### Discussion of Findings

The study investigated the effect of study questions as advance organizers on Basic Science and Technology students' retention and interest. The findings reveal that the mean retention scores of Basic Science and Technology students taught using study questions is higher than their counterparts taught without using study questions. This concurs that of Oloyede (2011), Adetunji, Bamidele and Awodele (2013) who found out that various forms of advance organizers used in their respective studies significantly enhanced retention. Furthermore, the significant higher mean retention scores of Basic Science and Technology students taught using advance organizers than that of the control group is in line with Obomanu and Barineka (2010) who found out that teaching Basic Science and Technology using study questions as advance organizers enhance students' retentive abilities. The use of advance organizers in this study therefore, enabled students to be active cognitively and hence higher retention. This agrees with Solomon (2012) finding on retention which showed that active involvement of students enhances their understanding of new situation. In this study, study questions as advance organizers enhanced students' retention of the Basic Science and Technology concepts learnt. The significant effect that the study questions as advance organizers yielded on students' retention in this study may likely be attributed to the fact that study questions provided anchorage for the knowledge gain.

On interest, the findings reveal that the mean retention rating responses of Basic Science and Technology students taught using study questions is higher than their counterparts taught without using study questions. This is in agreement with Narmmadha and Chamundeswari (2013) who observed that students' interest towards Chemistry has a direct effect on their retentive capabilities in the subject. The significant enhancement of students' interest using study questions may be as the result of the creation of the engaging environment where students were able discover and own what they have learnt. This is in consonance with Stipek (2009) and Wigfield (2012) who separately declared that curricular intervention aimed at enhancing students' interest are likely to impact students' retention. Another impact made by the use of study questions as advance organizers may be attributed to proper study habits students demonstrated by thoroughly studying the questions which in turn may have translated to their thorough study of concepts than taught during the course of the experiment. Similarly the success recorded could be also attributed to the fact that study questions prepared students for

the subsequent lessons which may serve as impetus for students' interest and ability to retain the knowledge which they acquired during lesson. Another driving force may be the adequate time (2 days) availed to study questions prior to each lesson unlike the study by Ijiga (2008) where study questions were administered only 5-10 minutes prior to lesson.

### Conclusion

Based on the findings of the study, it was concluded that, the use of study questions as advance organizers enhances students' retention and interest in Basic Science and Technology. Thus, the use of study questions should be encouraged in teaching Basic Science and Technology for the actualization of the goal of science teaching for self-reliance.

### Recommendations

Going by the conclusion, the following recommendations were made:

1. Teacher training institutions should incorporate the use of study questions as advance organizers as part of Basic Science and Technology teacher education curriculum.
2. Policy makers should use the findings of this study as basis for taking informed decisions on instructional methods (study questions as advance organizers) to be adopted in teaching Basic Science and Technology as opposed to the dependence on the conventional methods since it is found to enhance retention of knowledge and develop positive interest of students in the subjects

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