

# Enhancing Nigerian Physics Students' Attitude through the Use of Pictorial, Written and Verbal Advance Organizers

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## Abstract

This study investigated the effects of pictorial, written and verbal advance organizers on students' attitude in Nigerian senior secondary school Physics. The study adopted a 4 x 2 factorial design. A total of 180 senior secondary two (SS2) Physics students took part in the study. Students' Attitude Towards Physics Questionnaire (SATPQ) was the instrument used to collect the data with a reliability index of 0.88 using Pearson Product Moment Correlation (PPMC) approach and the data collected were analysis using analysis of covariance and t-test. The results showed that pictorial organizer was the most effective in enhancing students' attitude towards Physics learning. This was then followed by written organizer while verbal organizer was found to be the least effective. The results also showed an insignificant gender difference in the attitude of students towards Physics when taught with pictorial, written and verbal advance organizers. It is recommended that advance organizers should be used in schools to facilitate students' attitude towards Physics.

**Keywords:** Students' Attitude, Pictorial Organizer, Written Organizer, Verbal Organizer, Physics.

## Introduction

Attitude towards Physics as a subject deals with the beliefs, interest, perceptions and aspirations, feelings, habits, persistence and self-concept of students in dealing with the subject. Being an evaluative dimension, it is acquired through learning and can be changed through persuasion using different techniques (Akinbobola, 2008). Yara (2009) defines attitude towards science as interest or feeling towards studying science or the scientific approach assumed by an individual for solving problems, assessing ideas and making decision. Yara (2009) in his findings reports that many students developed negative attitudes to science learning, probably due to the fact that teachers are unable to satisfy their aspiration or goals. Abiakwo (2002) found that the strongest factor affecting students' achievement in physics is the students' attitude.

Jeje and Olagoke (2006) in their study observed that more males have good attitude for science and mathematics and larger percentage of females in the school opted for other subjects apart from mathematics and science. According to Keeves (1992), attitudes towards science are, in general, highly favoured, indicating strong support for science and the learning of science. There is also consistency across countries and age levels within a country, in the average level of attitude towards science by students. Keeves (1992) asserts that attitude towards science are known to decrease as students progress through their schooling years. The implication of Keeves' findings is that attention should be given to science teaching early so as to enable students have favourable disposition towards science later in life.

Parker, Revinue and Fraser (1996) in their findings reveal that in countries where there was an emergent thirst for industrial and technological development, there were very favourable attitudes towards science. However, in countries where a high level of technological and industrial development had been achieved, the findings showed that attitude towards science were more neutral. Generally, boys held more favourable attitude towards science than girls.

In Nigeria, it is widely observed that most of the students in secondary schools have negative attitudes towards the learning of Mathematics and the Sciences (Ubom, 2003). For teaching and learning to be effective, the teacher must be skillful in the selection and utilization of appropriate instructional strategies. One instructional strategy which has the potential to offer opportunity to address the problems of teaching and learning of Physics is the advance organizer learning theory advocated by Ausubel (1962).

The assimilation theory proposes that meaningful learning of the more abstract content could be realized through the use of advance organizers. An advance organizer provides ahead of time some relevant concepts and propositions which subsume and anchor the less inclusive or subordinate concepts in the learning material. When learning abstract subject matter from the textual materials would likely be rote, the assimilation theory becomes the most expedient approach toward achieving meaningful learning (Egbugara, 1988). Since meaningful implies clarity and stability of cognitive structure, and therefore better memory conversation, it follows that materials learnt through the use of advance organizers would be retained better than those of rote learning and this could change their attitude towards Physics, a subject seen by students to be very difficult (Onwioduokit & Akinbobola, 2005). An advance organizer is information that is presented prior to learning and that can be used by the learner to organize and interpret new incoming information. It is a method of bridging and linking old information with something new. Advance organizer is an appropriately relevant inclusive

material introduced in advance and presented at a higher level of abstraction, generality and inclusiveness than the learning material itself and this provides relevant subsuming concepts. Since advance organizer allows the learner to organize the material to be learnt into a familiar structure, new information is filled into an existing framework of categories called “schemas” that contains specific information about a concept. So, when prior knowledge is retrieved, this schema provides a framework on which to attach new knowledge (Bromley, Irwin-Devitis & Modio, 1995). If no prior knowledge is available, advances organizers work best because advance organizer becomes students’ prior knowledge before the new materials are learnt (Akinbobola, 2007).

Advance organizers are also highly useful in the process of transferring knowledge. Because of the deductive reasoning, students are able to use the rule rather than the example for learning to occur (Luten, Amos & Ackerson, 1980). Advance organizer that serve to present the new information in the form of a story are called narrative organizers. Advance organizer that serve to make appropriate prerequisite knowledge available to the learner by providing new information are called expository organizers. Advance organizers that serve to build external connections with existing knowledge that is relevant to the new information by reminding the learner about prior knowledge are called comparative organizers. The advance organizers strategy operates both substantively and programmatically (Mayer, 2003).

Substantively, it utilizes the basic organizing concepts and principles with the widest explanatory power, inclusiveness, generality and reliability of a given discipline (Coffey, 2000). Programmatically, the advance organizer strategy advocates for those methods of presenting and ordering subject matter that best enhance the clarity, stability and integratedness of the cognitive structure. This means that the basic organizing concepts in a given subject matter have to be identified before presenting in a sequential arrangement of the components units.

In order to make the programming of content of any subject matter discipline more efficient, Carol (1998) identifies two principles concerned which are: the principle of progressive differentiation and the principle of integrative reconciliation. Carol (1998) also states that progressive differentiation in the programming of subject matter is accomplished by using hierarchically series of organizers (in a descending order of inclusiveness), each organizer preceding its corresponding unit of detailed differentiated material. This presupposes that each of the disciplines consists of sets of concepts, which are hierarchically organized. That is, at the “top” of each discipline are members of very broad concepts which include or subsume less inclusive concepts at lower stages of organization.

Organizers are also expressively designed to further the principle of integrative reconciliation. They do this by explicitly pointing out in what ways previously learned related concepts in cognitive structure are either basically similar to or essentially different from new ideas and information in the learning task. Hence, advance organizers explicitly draw upon and mobilize all available concepts in cognitive structure that are relevant for and can play a subsuming role in relation to the new learning material. They also differentiate between the new learning materials and analogous but often conflicting ideas in the learner’s cognitive structure. Advance organizers may be presented as written text, as graphic organizer or may be presented orally (Luten, Amos and Ackerson, 1980).

Researchers have proffered several solutions for changing students’ negative attitude towards Physics. Amongst these are, providing learners with challenges and opportunities to meet the challenges; inculcating in learners the right attitudes needed for optimum performance in Science, Technology and Mathematics; getting the learners aware of career opportunities in Science and Mathematics, and the relevance of the subject to them as individuals (Banu, 1992; Obodo, 1997). The development and use of advance organizers was an attempt towards providing learners with such challenges and opportunities. Using advance organizers could motivate students towards meaningful achievement in Physics (Onwioduokit & Akinbobola, 2005; Akinbobola, 2007), It could change their attitude towards Physics and hence enhance their retention of Physics concepts taught. This study, therefore sought to investigate the effects of pictorial, written and verbal advance organizers on students’ attitude in senior secondary school Physics.

### **Statement of the Problem**

The major aim of Physics teaching is to promote the understanding of the concepts being taught with a view to applying knowledge of such understanding to real life situations. Students have difficulties with Physics, and their performance at external examinations has continued to slide year by year in Nigeria (Akinbobola, 2006). This poor performance has been blamed on inadequate qualified teachers of Physics; inadequacies on the part of the serving Physics teachers; students’ poor attitude towards the subject; an inadequate or lack of use of right teaching facilities and learning materials. Of all the factors that could be responsible for the situation described above, the teacher and method of teaching often come under attack (Akinbobola, 2006). The consistent poor performance in Physics attest to the fact that Physics teaching has not been properly done, hence, the concepts being taught are not properly understood (Afolabi & Akinbobola, 2009; Akinbobola & Afolabi, 2010). This improper Physics teaching has led to a vigorous search for appropriate instructional strategy that would best achieve the aim of Physics teaching, thus improving achievement and enhancing attitude of students towards

Physics. Hence, will there be any change in the attitude of students toward Physics when they are taught with advance organizers? It therefore becomes necessary to find out the effects of advance organizers on students' attitude in senior secondary school Physics in Nigeria.

### **Purpose of the Study**

The purpose of this study is to find out the effects of pictorial, written and verbal advance organizers on the attitude of Senior Secondary School Students in Physics. The study is designed to achieve the following specific objectives:

- (1) To ascertain the effects of advance organizers (pictorial, written and verbal) on students' attitude towards Physics.
- (2) To compare the attitude of male and female students taught with advance organizers (pictorial, written and verbal).

### **Research Hypotheses**

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

**Ho1:** There is no significant difference in the attitude of Physics students taught with pictorial organizer, written organizer, verbal organizer and those not taught with advance organizer.

**Ho2:** There is no significant difference between the attitude of male and female Physics students taught with:

- (i) Pictorial organizer
- (ii) Written organizer
- (iii) Verbal organizer

### **Research Method**

The design adopted in this study was a 4 x 2 factorial design. The population of this study comprised all the 1164 senior secondary two (SS2) Physics students in the 12 co-educational secondary schools in Ife Central Local Government Area of Osun State, Nigeria. A total of 180 Physics students took part in the study. A random sampling technique through the use of balloting was carried out to select four (4) co-educational secondary schools. The four schools were randomly assigned to experimental and control groups. Three (3) out of four (4) schools were used as experimental group while one (1) school was used as control group.

Students' Attitude Towards Physics Questionnaire (SATPQ) was the instrument used for data collection. The researcher developed this instrument used to measure the attitude of students towards Physics through the use of advance organizers. Two Physics teachers, an educational psychologist and two Physics experts ascertained the validity of the instrument. The questionnaire comprised 25 items on four (4) rating scale responses. The responses, Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) are respectively assigned value point of 4,3,2 and 1 for positive statement and in reverse order for negative statement. The instrument was trial tested to establish its reliability with 50 subjects in a school that was not used for the main study. Cronbach alpha was used to obtain the reliability coefficient of SATPQ and the coefficient of internal consistency of the SATPQ was 0.88.

The pictorial organizer package was developed by the researcher and comprised of various charts, pictures and maps related to the concept of energy in terms of forms of energy, sources of energy, conversions of energy, and applications of energy conversion, which served as subsumer for the learning of heat transfer. Subsumption of information occurs when information enters a students' cognitive structure and interacts with and is subsumed under more inclusive concepts already possessed by the students. This new information about a concept is filled into an existing framework of categories called 'schemas' that contains specific information about a concept. Hence, when prior knowledge is retrieved, this schema provides a framework on which to attach new knowledge. The written organizer package consisted of the same contents with pictorial organizer but was presented in written form. The verbal organizer package was adopted from the written organizer and contained of the same contents but was presented in verbal form.

Pre-attitude questionnaire was administered to the experimental and control groups prior to treatment given (presentation of advance organizers) to the experimental group. The pre-attitude questionnaire contain the same items in the main questionnaire but re-arranged in different order and the results were used as covariate measures in order to statistically equate all groups in the study.

The research assistants (Physics teachers in each school) were trained on how to use the advance organizers and also provided with detailed instructions on the concept of heat energy transfer. The training of the research assistants are in three phases. Firstly, the teachers were brief on the modalities on how to use the advance organizers. Secondly, the researcher taught the lessons using each of the advance organizer that was adopted during the study while the research assistants served as the subjects. Thirdly, the research assistants were asked to teach some students that did not take part in the main study using the advance organizer they will employ during the study. After the administration of the pre-attitude questionnaire, advance organizers were

introduced to the experimental group within the first one week of teaching (three lesson periods). The experimental group 1 was taught with pictorial organizer, group 2 was taught with written organizer while group 3 was taught with verbal organizer. The control group was taught without advance organizers. The experimental and control groups were taught the concept of heat energy transfer using the same content outline for four weeks. The post-attitude questionnaire was administered to the two groups after the teaching of the concept of heat energy transfer.

The data collected were analyzed using t-test, Analysis of Covariance (ANCOVA) using pre-attitude scores as covariate and multiple correlation analysis. All hypotheses were tested at .05 level of significance.

## Results

### Hypothesis One

There is no significant difference in the attitude of Physics students taught with pictorial organizer, written organizer, verbal organizer and those not taught with advance organizer. (see Table 1)

**Table 1: One-way Analysis of Covariance (ANCOVA) of Post-attitude scores of students taught with pictorial organizer, written organizer, verbal organizer and those not taught with advance organizer using pre-attitude scores as covariates.**

Source of Variation	SS	DF	MS	F	Decision at P<.05
Pre-attitude	48.42	1	48.42	0.70	NS
Main effects	11634.66	3	3878.22	56.33	*
Explained	11683.09	4	2920.77	42.43	*
Residual	12047.49	175	68.84		
Total	23730.58	179	132.57		

NS = Not significant at P<.05 alpha level

\* = Significant at P<.05 alpha level

Critical F-value = 3.91

Table 1 shows that the main effect was significant at P<.05. The calculated F-value of 56.33 is greater than the critical F-value of 3.91. Therefore, the null hypothesis stating a non-significant difference in the attitude of Physics students taught with pictorial organizer, written organizer, verbal organizer and those not taught with advance organizer was rejected. Consequent upon the existence of significant difference in main effects, Multiple Classification Analysis (MCA) is considered to determine the specific contribution of the levels of advance organizers to the gain in students' attitude towards the concept taught in Physics as shown in Table 2.

**Table 2: Multiple Classification Analysis (MCA) of post-attitude scores of students taught with pictorial organizer, written organizer, verbal organizer and those not taught with advance organizer.**

Grand Mean = 61.09	N	Unadjusted	Adjusted for independent variable and covariates
Variable + Category		Dev'n	Eta
<b>ADVANCE ORGANIZERS</b>			0.70
Pictorial Organizer	44	9.55	9.62
Written Organizer	46	5.00	4.99
Verbal Organizer	42	-2.42	-2.47
Without Organizer	48	-11.42	-11.44
Multiple R. = 0.70			
Multiple R. Squared = 0.49			

Table 2 shows a multiple regression index of R = 0.70 with a multiple regression squared index of R<sup>2</sup> = 0.49. This implies that 49% of the total variance in the attitude of students towards Physics is attributable to the influence of advance organizers.

To find the order of effectiveness of advance organizers and direction of significance under investigation, the post-attitude scores were subjected to Scheffe multiple comparison test for a post hoc analysis as shown in Table 3.

**Table 3: Results of Scheffe's post hoc test for multiple comparisons of advance organizers on students' attitude towards Physics.**

Dependent variable: POST-ATTITUDE SCORES						
(I) Advance Organizer	(J) Advance Organizer	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
				Lower Bound Upper Bound		
PO	WO	4.5494*	1.746	.083	-0.3782	9.4770
	VO	11.9697*	1.786	.000	6.9287	17.0107
	WAO	20.9697*	1.728	.000	16.0925	25.8469
WO	PO	-4.5494*	1.746	.083	-9.4770	0.3782
	VO	7.4203*	1.767	.001	2.4331	12.4075
	WAO	16.4203*	1.708	.001	11.5988	21.2418
VO	PO	-11.9697*	1.786	.000	-17.0107	-6.9287
	WO	-7.4203*	1.767	.001	-12.4075	-2.4331
	WAO	9.0000*	1.749	.000	4.0626	13.9374
WAO	PO	-20.9697*	1.728	.000	-25.8469	-16.0925
	WO	-16.4203*	1.708	.000	-21.2418	-11.5988
	VO	-9.0000*	1.749	.000	-13.9374	-4.0626

\* The mean difference is significant at the .05 level

Where: PO = Pictorial Organizer

WO = Written Organizer

VO = Verbal Organizer

WAO = Without Advance Organizer

As shown in Table 3, the mean difference between PO and WO was 4.55; between PO and VO was 11.97; between PO and WAO was 20.97; between WO and VO was 7.42; between WO and WAO was 16.42, and between VO and WAO was 9.00. This implies that pictorial organizer was the most effective in facilitating students' attitude towards Physics. This is seconded by written organizer, followed by verbal organizer while the non advance organizer was seen to be the least effective in facilitating students' attitude towards Physics. The summary of the Scheffe's post hoc test is as shown in Table 4.

**Table 4: Summary of the Scheffe's post hoc analysis of advance organizer on students' attitude towards physics.**

Measures	Comparison of Advance Organizer (Pictorial, Verbal, Written and Without Advance Organizer )	Mean Difference	Decision at .05 alpha level
Advance Organizer	PO VS WO	4.55	PO>WO
	PO VS VO	11.97	PO>VO
	PO VS WAO	20.97	PO>WAO
	WO VS VO	7.42	WO>VO
	WO VS WAO	16.42	WO>WAO
	VO VS WAO	9.00	VO>WAO
	PO VS WO VS VO VS WAO		PO>WO>VO>WAO

### Hypothesis Two

**H<sub>0</sub>2 (i):** There is no significant difference between the attitudes of male and female Physics students taught with pictorial organizer.(see Table 5)

**Table 5: t-test comparison of post-attitude scores of male and female Physics students taught with pictorial organizer**

GENDER	N	$\bar{X}$	SD	DF	t-Calculated	t- Critical	Decision at P<.05
Male	20	70.60	9.02	42	0.03	2.01	NS
Female	24	70.67	8.88				

NS = Not significant at P<.05

The analysis in Table 5 shows that the calculated t-value of 0.03 is less than the critical t-value of 2.01 at P<.05. Therefore, the null hypothesis stating a non-significant difference between the attitude of male and female Physics students taught with pictorial organizer was retained.

**H<sub>0</sub>2 (ii):** There is no significant difference between the attitude of male and female Physics students taught with written organizer (see Table 6.)

**Table 6: t-test comparison of post-attitude scores of male and female Physics students taught with written organizer**

GENDER	N	$\bar{X}$	SD	DF	t-Calculated	t- Critical	Decision at P<.05
Male	22	65.09	9.00	44	0.71	2.01	NS
Female	24	67.00	9.16				

NS = Not significant at P<.05

The analysis in Table 6 shows that the calculated t-value of 0.71, is less than the critical t-value of 2.01 at P<.05. Therefore, the null hypothesis stating a non-significant difference between the attitude of male and female Physics students taught with written organizer was retained.

**H<sub>0</sub>2 (iii):** There is no significant difference between the attitude of male and female Physics students taught with verbal organizer (see Table 7).

**Table 7: t-test comparison of post-attitude scores of male and female Physics students taught with verbal organizer.**

GENDER	N	$\bar{X}$	SD	DF	t-Calculated	t- Critical	Decision at P<.05
Male	23	59.03	7.97	40	0.54	2.01	NS
Female	19	57.90	8.88				

NS = Not significant at P<.05

The analysis in Table 7 shows that the calculated t-value of 0.54 is less than the critical t-value of 2.01 at P<.05. Therefore, the null hypothesis stating a non-significant difference between the attitude of male and female Physics students taught with verbal organizer was retained.

## Discussion

The results of hypothesis one showed that there was a significant difference in the attitude of Physics students taught with pictorial organizer, written organizer, verbal organizer and those not taught with advance organizer. Multiple Classification Analysis (MCA) showed that 49% of the total variance in attitude of students towards Physics is attributable to the influence of advance organizers as shown in Table 2. The post hoc analysis as shown in Table 3 showed that pictorial organizer was the most effective in facilitating students' attitude towards Physics. This is seconded by written organizer, followed by verbal organizer while the non-advance organizer was seen to be the least effective in facilitating students' attitude towards Physics. This might be due to the fact that if the attitude of students towards a school subject such as Physics is negative, there is bound to be a corresponding negative performance in the subject unless a strategy capable of stimulating interest and developing positive attitude is adopted in teaching the subject. Physics students developed positive attitude towards the subjects through the use of advance organizers, study the subject, enjoy it and get satisfaction from knowing the subject. This study is in line with the findings of Onwioduokit and Akinbobola (2005) and Akinbobola (2007) that advance organizer enhances students' performance in Physics. Its presence awakened the interest of students and helped them to develop positive attitude towards the subject. Advance organizers make students to understand and retain more of what they have been taught, therefore making them to achieve better in various concepts in Physics. In essence, it makes learning faster and can even serve as a motivation factor for the students to develop positive attitude towards the subject. This is also in agreement with Akinbobola (2008) that a good instructional strategy could enhance students' attitude towards the subject.

The result of hypothesis two showed that there was no significant difference in the attitude of male and female Physics students taught with pictorial organizer, written organizer and verbal organizer. Results indicated that there was no significant difference between the males and the females in terms of attitudinal change. In other words, advance organizers caused both the males and the females in the same way to change their attitude more towards Physics learning. The non-significant difference in the attitude of male and female Physics students is in line with the findings of Nsofor (2001) and Akinbobola (2008). They observed that both males and females could do well in science if exposed to similar learning conditions. This research study is in support of Aworanti and Abimbola (1997) that gender of students was not a major factor in their achievement and attitude in science.

## Conclusion

In the light of the findings of this study, the researcher concludes that advance organizers brought about attitudinal change in students towards Physics learning. Attitude of students towards Physics is enhanced by the

use of advance organizers. The results also showed that pictorial organizer was the most effective in enhancing students' attitude towards Physics learning. This was then followed by written organizer while verbal organizer was found to be the least in enhancing students' attitude towards Physics learning. Also, advance organizers caused both males and females to change their attitude in the same way. There was no significant difference in attitude by gender. Hence, advance organizer enhances concrete learning, deductive reasoning, critical thinking and understanding rather than in rote learning and memorization.

### Recommendations

Consequent upon the findings of this study, it is hereby recommended that:

- (a) Physics teachers should make effective use of advance organizers in facilitating the attitude of their students towards Physics.
- (b) Teachers and parents should do everything to encourage both males and females towards better attitude and achievement in Physics, by providing them with motivating and stimulating environment which is rich in instructional strategy like advance organizers for learning.
- (c) Publishers, Federal and States' ministry of education should organize seminars and workshops for Physics teachers to acquaint them with the use of advance organizers in teaching various Physics topics.
- (d) In order to enhance students' attitude towards Physics, teachers should provide the students, first, with the most general and inclusive ideas of the discipline and then these are progressively differentiated in terms of details and specificity. Disorderly or unorganized presentation of ideas of concepts would lead to learning by rote rather than meaningful learning.

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