

EFFECTS OF WRITTEN ADVANCE ORGANIZER ON STUDENTS' ACADEMIC ACHIEVEMENT IN SECONDARY SCHOOL PHYSICS

By

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Abstract

This study carried out in Odukpani Local Government Area of Cross River State, was aimed at finding the impact of written advance organizer on students academic achievement in physics. The design for the study was the pre-test, post-test non-equivalent control group. One hundred and sixty five (165) senior secondary II physics students drawn from six secondary schools form the sample. The control group was made up of seventy eight students. Written advance organizer was introduced to the experimental group of eighty seven students one week before the commencement of teaching. Three null hypotheses were formulated as a guide to the study, reliability index of the instrument was 0.88 using the Kuder-Richardson Formula-20. The results of the study showed that there is a significant difference in the academic achievement between the experimental group and the control group, a significant difference in the academic achievement of male and female students in favour of the females. The paper thus concluded that written advance organizer strategy is an effective teaching strategy and recommend its use in physics instruction to enhance achievement.

Science is a process or method of finding out or discovering our world; through the effort made in finding out, new knowledge is acquired and man therefore gain the skill of desiring with increasing accuracy, the things which happen or exist in our environment (Igbojinwaekwu, 2012). According to him, the intrinsic and extrinsic justification for the inclusion of science in the school curricula includes:

- i. Motivation of the citizens to explore the natural world
- ii. Enabling the students to understand the processes of science
- iii. Aiding the students to make empirical judgement
- iv. Improving scientific literacy of a nation
- v. Aiding in economic advancement and
- vi. Exposing science as a vocation. The first three are the intrinsic while the last three are the extrinsic factors.

Physics is one of the most important branches of science which inculcates scientific literacy in the students. It is a science that deals with matter and the energy changes produced by such matter. Physics is at the core of every technological pursuit of a nation. As rightly pointed out by Ogunleye (2001), the technological potentials of a nation can rightly be based on the quality of her physics Education.

In spite of its role in the developmental strides of a nation, the instructional delivery of this subject in our classrooms leaves much to be desired. According to Udo & Ubana (2015), carefully designed and adequately prepared introductory activities can do a great deal to bridge the gap between what had been learnt and what to be learnt. This is why this study is being undertaken to find out the impact of written advance organizer on students academic achievement in physics.

According to Ugwu, Eze and Ugwu (2002) written advance organizer is the learning material presented to the learner prior to the lesson to enable the learner structure the course material and put it in perspective. The concept of written advance organizer is basically the introduction of the learning materials to the learners before the actual teaching and is based on the idea that achievement in learning is facilitated if there is a connection between the new idea or concept and the previous knowledge (Udo, 2011).

Written advance organizer is the type of organizer which is presented to the student in written or prose form. This material is an introductory material which is presented at a higher level of abstraction, generality and inclusiveness than the learning material itself. When these materials are presented to the students prior to the actual lesson presentation it acts as subsumes upon which the new information is anchored. In this way meaningful learning is enhanced. According to Mbotto in Udo (2011), meaningful learning is an attempt by the learners to remember new concept by relating it to previous knowledge. Meaningful learning can only occur when there is an appropriate prior knowledge existing in the cognitive structure of the learner. The problem of the study put in question form is thus: What is the effect of written advance organizer on students' academic achievement in physics?

Purpose of the study

The study is designed to achieve the following specific objectives:

1. To determine the effect of the use of written advance organizer on the mean achievement scores of secondary schools students in physics.
2. To determine the effect of the use of written advance organizer on the mean achievement of male and female students in secondary school physics.
3. Determine the interaction effect of treatment and gender on the mean achievement scores of secondary school students in physics.

Research hypotheses

The following null hypotheses were formulated as a guide to the study. All hypotheses were tested at 0.05 level of significance.

Ho1: There is no statistically significant difference in the mean achievement scores of students taught physics with written advance organizer and those taught without written advance organizer.

Ho2: There is no statistically significant difference in the mean achievement scores of male and female students taught physics with written advance organizer and those taught without advance organizer.

Ho3: There is no statistically significant interaction effect between the treatment and gender of the students in the mean achievement scores in physics.

Method

The study adopted the quasi-experimental design. This implies that in each of the classes selected, an intact class of the students was used. Specifically the study adopted the pre-test, post-test non-equivalent control group design. The population of the study consisted 532 senior secondary two (SS II) physics students in Odukpani Local Government Area of Cross River State. Odukpani Local Government Area is one of the Local Government Areas in Southern Cross River State. The simple random sampling technique was used to select six schools out of the fourteen (14) secondary schools in the area. Three schools were purposively assigned to the experimental group while the other three were assigned to the control group. In each of the schools selected, an intact class of the students was used. This brought the sample size to one hundred and sixty-five (165) SSII physics students.

The instrument for data collection was the physics achievement test which was a 40 item multiple choice questions drawn from wave motion.

The instrument was face validated by three experts, two in physics education and one in measurement and evaluation. This instrument was trial tested using forty (40) students from a school not used in the study. The scores obtained were analyzed using

Kuder-Richardson formula-20 and a reliability index of 0.88 was obtained which was high enough to consider the instrument reliable.

Pretest was administered on both the experimental and control groups before the actual treatment. The scores obtained were used as covariate in the final analyses. The written advance organizer was introduced to the experimental group one week before the actual treatment. Both groups were taught the concept of wave motion for three weeks. The teaching was carried out by the regular physics teachers in the respective schools with each of them using the structured lesson note prepared by the researcher. After the teaching the post-test was administered on both groups and the results analyzed using the analysis of covariance (ANCOVA) with pretest scores as covariate.

Results

The results of the study are presented below, hypothesis by hypothesis. All hypotheses were tested at 0.05 level of significance.

Ho1: There is no statistically significant difference in the mean achievement scores of students taught physics with written advance organizer and those taught without written advance organizer.

Table 1: Analysis of Covariance Result of the Experimental and control Groups with pretest scores as Covariate

Source of Variation	Sum of Square	Df	Mean Squares	F	Sigf
Corrected model	5083.51	4	1270.87	48.65	0.000
Intercept	1793.50	1	1793.50	68.66	0.000
Pretest	213.24	1	213.24	8.16	0.005
Treatment group	4100.55	1	4100.55	156.98	0.000*
Gender	500.88	1	500.88	19.17	0.000
Treatment group x Gender	424.18	1	424.18	16.23	0.000
Error	3839.82	160	4.00		
Total	642572.00	165			
Corrected Total	8923.34	164			

*Significant at 0.05 alpha level. The analyses in table 1 show that there is a significant difference in the achievement of students between the experimental and the control groups. This implies that written advance organizer significantly influenced students' academic achievement in physics.

Ho2: There is no statistically significant difference in the mean achievement scores of male and female students taught physics with written advance organizer and those taught without advance organizer.

Table 2: Analysis of Covariance (ANCOVA) Result of male and female students taught physics with written advance organizer and those taught without advance organizer

Source of Variation	Sum of Squares	Df	Mean Square	F	Sigf
Corrected model	5083.51	4	1270.87	48.65	0.000
Intercept	1793.50	1	1793.50	68.66	0.000
Pretest	213.24	1	213.24	8.16	0.005
Treatment group	4100.55	1	4100.55	156.98	0.000
Gender	500.88	1	500.88	19.17	0.000*
Treatment group x Gender	424.18	1	424.18	16.23	0.000
Error	3839.82	160	4.00		
Total	642572.00	165			
Corrected Total	8923.34	164			

*Significant at 0.05 alpha level

The results in table 2 showed that there is a significant difference in academic achievement of male and female students taught physics with written advance organizer and those taught without. Hence, the null hypothesis is rejected. This implies that written advance organizer has significant influence on the academic achievement of male and female physics students. However a further analysis has shown that the male students had an adjusted mean of 62.80 while their female counterpart had an adjusted mean of 66.50. This indicates that written advance organizer favours the female students more than their male counterparts.

Ho3: There is no statistically significant interaction effect between the treatment and gender of the students in the mean achievement scores in physics.

Table 3: Analysis of Covariance (ANCOVA) of the Interaction between treatment and gender

Source of Variation	Sum of Squares	Df	Mean Square	F	Sigf
Corrected model	5083.51	4	1270.87	48.65	0.000
Intercept	1793.50	1	1793.50	68.66	0.000
Pretest	213.24	1	213.24	8.16	0.005
Treatment group	4100.55	1	4100.55	156.98	0.000

Gender	500.88	1	500.88	19.17	0.000
Treatment group x Gender	424.18	1	424.18	16.23	0.000*
Error	3839.82	160	4.00		
Total	642572.00	165			
Corrected Total	8923.34	164			

*Significant at 0.05 alpha level

In table 3, the analysis showed significant interaction effect between treatment used and gender of students. Thus the null hypothesis is rejected. This means that the facilitating effect of written advance organizer on students' achievement scores is not the same at all levels of gender. However the post hoc analyses on the interaction effect of the post-test score showed that the female students had an adjusted mean of 73.66 while their male counterpart had an adjusted mean of 66.43. This indicates further that the interaction effect between treatment and gender favours the female students more than their male counterparts.

Discussion of results

From the results, it was found out that there exist a significant difference between the academic achievements of students taught with written advance organizer and those taught without. The result showed that the experimental group had a higher adjusted mean than the control group. Thus, the use of written advance organizer facilitates the learning of the physics concept (wave motion) than the non use. The success of the experimental group may be attributed to the anchoring effects that advance organizer has on learning. This result is consistent with that of Coffey and Canal (2001) and Onwioduokit and Akinbobila (2005) who obtained significant difference in achievement between the experimental and control groups. This result is however in contrast with that of Nwachukwu (2002) that showed no significant difference between the experimental and control groups after being exposed to advance organizer.

The result of the study also showed a significant difference between the mean achievement scores of male and female physics students. The result also showed that the female had a higher adjusted mean than the males. This implies that the written advance organizer favours the females than the males. This result confirms that of Anagbogu and Ezeliora (2007) that obtained a result that showed that the female performed better than the males in a performance test after treatment. The result is however in contrast with that of Onwioduokit and Akinbibola (2005) and Akinbibola (2007) that found no significant difference between the academic achievements of male and female students after treatment. The implication of this result is that if an appropriate method is adopted in the teaching of physics, the female students have the chance of performing better than

their male counterpart. Thus the girl's low academic achievement in the sciences may not be as a result of physiological factors but mainly the environment in which the girl child finds herself.

On the effect of interaction between treatment and gender, the result showed a statistically significant effect between treatment and gender. However, the interaction was higher in the females than in the males. This was because they had a higher adjusted mean than the male counterparts. This result is however in contrast with that of Agommuoh and Nzewi (2003) that showed no significant interaction effect between gender and treatment (teaching method).

Conclusion/Recommendations

Based on the findings of this study it could be concluded that written advance organizer strategy is an effective strategy for meaningful learning to occur. This is because physics students taught with written advance organizer achieved higher than those taught without. It is also evident from this study that the use of written advance organizer could improve the female students' achievement in physics. This is evident by the fact that the female students achieved significantly higher than their male counterparts. It is thus, recommended that, for better achievements in physics, teachers of physics should be encouraged to adopt appropriate advance organizers in conjunction with other appropriately selected teaching methods. The variety of teaching methods will thus help to increase the students' understanding of the subject. In this way higher achievements could be ensured and the abstract nature of the subject reduced. It is also further recommended that adequate workshops should be organized for the servicing physics teachers on the use and efficiency of advance organizers.

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