RELATIVE EFFECTIVENESS OF ADVANCE ORGANIZER TEACHING STRATEGY ON LEARNING THE CONCEPT OF ELECTRO CHEMISTRY IN NIGERIA SENIOR SECONDARY SCHOOLS

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Abstract

This study examined the relative efficacy of advance organizer teaching strategy on learning the concept of electrochemistry in the Senior Secondary School Chemistry in Cross River State of Nigeria. Two hypotheses were formulated to guide the study. A total of 60 Senior Secondary two (SS2) chemistry students (25 females and 35 males) were involved in the study out of a population of 110 SS(2) chemistry students. A quasi-experimental pretest –posttest control group design was used for the study. The instruments used in gathering data for the study were chemistry Achievement Test (CAT) and chemistry Retention Test (CRT). All the instruments had a reliability coefficient of 0.65 using Kuder-Richardson formula 21. t- test analysis was used in the analysis of data. From the study, it was observed that advance organizer enhances the performance and retention of the learnt materials in chemistry. Conclusion of the findings led to the recommendation that chemistry teachers should be encouraged to adopt advance organizers teaching strategy in teaching senior secondary school chemistry.

Learning has always been of primary interest to teachers responsible for educating children master the academic basic concepts of various subjects in the school curriculum. It is of even a greater concern to the modern teacher interested in the child's all round growth, and development.

Meaningful learning according to Ausubel (1968) involves the acquisition of new meanings, which are the products of meaningful learning. That is the emergence of new meaning in the learner reflects the completion of a meaningful learning process. Ausubel (1963) and Okebukola (2001) stressed that meaningful learning result when a person consciously and explicitly links new knowledge to relevant concept or propositions they already possessed.

Ausubel al (1968) explained the conditions of meaningful learning. In terms of reception learning, where the content of learning task is presented to learners rather than discovered by learners. The essence of the meaningful learning process is that symbolically expressed ideas are related in a non-arbitrary and substantive (non- verbatim) fashion to what the learner already knows. By substantive and non-arbitrary relatedness, they meant that the ideas are related to some specifically relevant existing aspect of the learner's cognitive structure, such as an image, an already meaningful symbol, a concept or a proposition. They presuppose that the learner manifests a meaningful learning set that is, a disposition to relate the new material non-arbitrarily and substantively to his or her cognitive structure and that the material learned be potentially meaningful to his/her structure of cognitive knowledge on a non-arbitrary and non-verbatim basis. Thus, irrespective of how much

potential meaning may interest a particular learner, if the learner's intention is to memorize it arbitrarily and verbatim, both the learning process and the learning outcome must be rote or meaningless. Conversely, no matter how meaningful the learner's set may be neither the process nor the outcome of learning can possibly be meaningful if the learning task is not potentially meaningful, in so far it is not non-arbitrarily and substantively related to his cognitive structure.

Bergan and Dunn (2000) explained meaningful learning in terms of retention. Retention is the term used to denote the demonstration that learning has been maintained over time. Here retention is measured in terms of temporal interval between stimulus presentation and response emission. Retention may be displayed through recognition or recall. Recall in influenced by the strength of association among concepts that are previously learnt.

One instructional strategy, which probably has the potential to offer opportunity to address the problems of effective teaching and learning of chemistry, is the Advance Organizer learning theory advocated by Ausubel (1968). It can be an appropriate instructional approach to the teaching of concepts in chemistry.

Ausubel (1960) explained that Advance Organizer learning strategy is a pedagogic strategy for implementing the programme principles of progressive differentiation and integrative reconciliation which involves the use of appropriately relevant and inclusive organizers that are maximally stable and discriminable from related conceptual systems in the learner's cognitive structure. It is used to provide a conceptual frame work that students can use to clarify the tasks ahead.

Coffey (2004) described meaningful learning in terms of reception learning, and by reception learning, Coffey means learning where the content of the learning task is presented to, rather than discovered by the learners. Reception learning is said to be different from rote learning, since reception learning can be meaningful, that is it can be associated by the learner with other experiences the learner has had. Meaningful reception learning involves the process of subsumption. Subsumption of information occurs when information enters a student's cognitive structure and interacts with and is subsumed under more inclusive concept already possessed by the student.

In order to describe the importance of classification in learning and retention and the strategy for deliberately manipulating cognitive structure so as to enhance proactive facilitation and to minimize proactive interference, Ausubel (1968) coined the phrase "advance organizer" which involves the use of appropriately relevant and inclusive introductory materials (organizers) that are maximally clear and stable. The advance organizer is a strategy in which the teacher helps students to make connections to learning materials by highlighting the organizational and structural patterns of the new material and indicating how it relates to other materials already learned. The object is to present students with context and conceptual frame works that help students to arrange integrated and retain material, other than specify content and detail. Advance organizers may be presented as written text, as graphic organizer, may utilize audiovisual supports, or may be presented orally. Akinbobola (2004).

Ausubel (1968), suggested that advance organizers might foster meaningful learning by promoting the students, regarding pre-existing super-ordinate concepts that are already in the student's cognitive structure, and by otherwise providing a context of general concept into which the student can incorporate progressively differentiated details. Ausubel claims that by presenting a global representation of the knowledge to be learned, advance organizers might foster "integrative reconciliation" of the sub-domains of knowledge the ability to understand interconnection among the basic concept in the domain.

Novak and Hanesian (2001) explained that these organizers are normally in advance of the learning materials itself and are used to establish a meaningful learning sit. They maintained that advance organizers help the learner to recognize that element of new learning materials can be meaningfully learned by relating them to specifically relevant aspects of existing cognitive structure. The organizer is to bridge the gap between what the learner already knows and what he needs to know before he/she can meaningfully learn the task at hand.

The advent of the internet and hypermedia/multimedia has given rise to a broad range of possible representations, that may be utilized as advance organizers. Coffey and Canas, (2001). Modern advance organizers take the form of text passages, Herron (1994), Kang, (1996). And also in form of graphical representation Gay and Mazur (2003). Another form of advance organizer is the learning Environment organizer (LEO) Coffey, (2000). LEO is an editor /browser based upon concepts which presents a graphical representation of the fundamental concepts in the topic of study.

Most studies affirmed that organizers exert not only a positive statistically significant difference but also a practically important effect on school learning. Barnes, (1999), Coffey and Canas, (2001).

Electrochemistry, in the broadest sense, refers to the study of ionic conductors and the transfer of charges between ionic and electronic conductors. It involves the decomposition of the ionic compound. (Ogban 2000).

Statement of the Problem.

There has been a great shift in emphasis on science teaching and learning all over the world. The concern in recent time is to have science classroom that is student- centered, activity-oriented and focused on understanding rather than rote-learning and simple recall of knowledge Ibeagha (2002).

However, research findings still indicate student's abysmal failure in chemistry (Ivowi 19970, WAEC report 2000). This makes it imperative to search for an approach to teaching of chemistry that aims at understanding rather than memorizing and juggling of facts. Students have difficulties with chemistry and their performance at external examinations has continued to dwindle year by year in Nigeria. This poor performance may be due to non use of appropriate teaching strategy that can enhance teaching and learning of science (chemistry). (Umoren 1998).

This study sought to find out the effects of advance organizers on the achievement of senior secondary school students on the concept of electrochemistry.

Purpose of the Study

The purpose of the study was to achieve the following.

1. To investigate the extent to which the use of advance organizers teaching strategy will enhance the academic achievement of senior secondary school chemistry students on learning the concept of electrochemistry.
2. To examine the extent to which the use of advance organizers teaching strategy will enhance retention among senior secondary school chemistry students.

Hypotheses

The following hypotheses were formulated to guide the study.

1. There is no significant difference between the academic achievement of students taught electrochemistry using advance organizers teaching strategy and those taught using normal lecture /demonstration method only.
2. There is no significant difference among chemistry students exposed to advance organizers with respect to their ability to retain materials taught.

Research Method

A quasi experimental pretest –posttest control group design was used for the study. Purposive sampling technique was used to select schools from the target population. The criteria were.

1. Schools that have graduate teachers for chemistry with at least three years of teaching experience.
2. Schools with well – equipped chemistry laboratory.
3. Schools in which the concept of electrochemistry had not been taught. Four schools met the criteria and random sampling technique through the use of balloting was carried out to select two schools among those that met the criteria. The two schools were randomly assigned to treatment and control groups. Sixty students made up the sample size for the study out of a population of one hundred and ten senior secondary (SS2) chemistry students in Calabar municipal Council of Cross River State. This was made up of 25 females and 35males using intact classes. On the whole, 30 students were in group A and 30 students in group B, with group A having 18 males and 12 females while group B had 20 males and 10 females students.

A researcher designed Chemistry Achievement Test (CAT) and Chemistry Retention Test (CRT) were the instruments used for data collection. A total of fifty (50) multiple choice items were constructed on the concept of electrochemistry. Also Chemistry Retention Test (CRT) contained the same set of (50) multiple choice items but arranged in different order. The instruments were faced and content validated, by chemistry experts.

Reliability of the Chemistry Achievement Test and Chemistry Retention Test were determined using Kuder-Richardson's formula 21. A reliability index of 0.65 was obtained for chemistry achievement test.

Pretest was administered to the two groups (experimental and control groups) for one hour. Treatment was given to the experimental and control groups for three weeks. The experimental group was taught the concept of electrochemistry using advance organizer teaching strategy followed by lecture/demonstration method while the control group was taught the same concept using the lecture/demonstration method only, for the same period of time. Posttest was administered to the two

groups (experimental and control group) after the treatment for one hour. Also after one week a retention test was administered. The data collected were analyzed using t-test. All hypotheses were tested at 0.05 level of significance.

Results.

The result in this study are presented according to the hypothesis.

Table 1 T-Test Comparison of Pretest Mean Scores of Experimental and Control Groups.

Group	N	X—	SD	DF	t-calculated	t-critical	Decision at P < .05
Advance organizer (experimental)	30	6.87	6.70	58	1.75	2.00	NS
Control	30	4.40	4.21				

NS = No 1 Significant at P < .05

From the result, the calculated t-value 1.75 is less than the critical t-value 2.00 indicating that there is no significant difference between the performance of the two groups in the pretest. This means that the two groups are not significantly different in their depth of knowledge on the topic chosen.

Hypothesis one (HO_1).

There is no significant difference in the academic achievement of students taught electrochemistry using advance organizers teaching strategy and those taught using normal lecture/demonstration method only.

Table 2. T-Test Comparison of Posttest Mean Scores on Achievements of Students Taught With Advance Organizers and those Without Advance Organizers.

Group	N	X—	SD	DF	t-calculated	t-critical	Decision at P < .05
Advance organizer (experimental)	30	65.57	8.27	58	3.67	2.00	*
control	30	58.13	7.47				

*= Significant at P < .05

Analysis in table 2 shows that the calculated t-value 3.67 is greater than the critical t-value, 2.00. It implies that there was a significant difference in the achievement of chemistry students taught electrochemistry using advance organizer teaching strategy and those taught without the advance organizer. That means that advance organizer produced a positive significant effect on the learning of electrochemistry.

Hypothesis two (HO_2).

There is no significant difference among chemistry students exposed to advance organizer with respect to their ability to retain materials taught.

Table 3. T-test Comparison of Retention Scores on Achievement of Students Taught With Advance Organizers and Those without Advance Organizers.

Group	N	$\bar{X}$	SD	DF	t-calculated	t-critical	Decision at P < .05
Advance organizer (experimental)	30	60.70	7.25	58	3.35	2.00	*
control	4.40	4.21					

* = Significant at P < .05

Data in table 3 shows that the retention ability main effect is significant at P<.05. The calculated t-value 3.35 is greater than the critical t-value 2.00. This implies that chemistry students taught with advance organizer differ significantly in their ability to retain materials taught than those taught without the advance organizers.

Discussion.

Testing of hypothesis one revealed that a significant difference was found to exist between the performances of students taught the concept electrochemistry using advance organizer teaching strategy and those taught with the lecture/demonstration method only. The data in table 2 indicates that students taught the concept of electrochemistry using advance organizer teaching strategy performed significantly better than those taught without the strategy.

This might be due to the fact that advance organizers provided ideational anchorage and enhanced meaningful learning and thus, improved the performance of the students. Thus, advance organizers provide concrete basis for conceptual thinking and so facilitate better and proper understanding of chemistry concepts. This was consistent with the findings of Herron (2001) and Kang (1999). They observed that advance organizers enhance students achievement and facilitate meaningful learning.

Testing of hypothesis two revealed that a significant difference was found to exist between students exposed to advance organizers with respect to their ability to retain materials taught. This may be due to the fact that advance organizers provide a useful learning set of which the learners related the new material arbitrarily and substantively to his cognitive structure. Since the learning set is meaningful, it modifies the learner's cognitive structure, thereby facilitating the learning and retention of the concept.

Thus, the organizer is based on the premise that logically meaningful material becomes incorporated most readily and stably in the cognitive structure of the learner in so far as it is subsumed under specifically relevant ideas. The study is in line with the findings of Adejumo (2002) Coffey and Canas (2001). Results indicated that advance organizers facilitated meaningful learning and retention of chemistry concepts. This might been due to the stability and clarity of the anchoring ideas that the organizer provided in the cognitive structure.

Implication of the Study.

This study has provided useful insight into the use of advance organizer teaching strategy in teaching the concept of electrochemistry in senior secondary school chemistry. Students can benefit from the strategy and improve their learning and retention of chemistry concepts.

Conclusion

On the basis of the findings the following conclusions were drawn.

1. There exist significant difference between the achievement of students taught the concept electrochemistry using advance organizer teaching strategy and those taught using lecture/demonstration method only.
2. There sexists significant difference among chemistry students taught using advance organizer teaching strategy with respect to their ability to retain materials taught.

Recommendations

Based on the result of the study, the following recommendation were made.

1. Chemistry teachers should explore the use of advance organizers in teaching various concepts at senior secondary school level.
2. Textbook authors should adopt the advance organizers strategy in presenting materials in their books.

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