

The Effect of Two Programmed Instructional Strategies on Science Students' Performance in Chemistry Lessons in Nigeria

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Abstract: The study investigated the effect of 2 programmed instructional strategies on students' performance in chemistry. The study focused specifically on the effect of Computer Assisted Instruction (CAI) and video-tape Mediated Instruction (VMI) (over the conventional methods) on the teaching of chemistry in Nigerian Secondary Schools. A quasi-experimental design using a pre-test, post-test 3 groups was employed for the study. The sample consisted of 60 Chemistry students randomly selected from public secondary schools in Lagos State, Nigeria. Two Null hypotheses were raised for the study and tested using One-way ANOVA. The study revealed the homogeneity of the three groups through pre-test performance prior to treatment. The study also showed that both the Computer Assisted Instruction (CAI) and Video-tape Mediated Instruction (VMI) have positive effect on students performance than the conventional method of teaching which was employed as control. The use of CAI and VMI was recommended for teaching chemistry in Nigeria secondary schools.

Key words: Programmed instructional strategies, student, chemistry, Nigeria

INTRODUCTION

The development of a nation depends on the level of scientific and technological literacy of such a nation. Hence, a nation regarded as advanced, occupies a leading position in science and technology, characterised by industrialization which is brought about by scientific literacy, exploration and innovation in process and techniques. Ivowi (1998) in his review of the Junior Secondary School in Nigeria, asserted that science programme emphasised the understanding of some basic principles and skills as well as the development of desirable attitudes like honesty, patience and co-operation. The Senior Secondary School, on the other hand, is to prepare students for future activities in the areas of science and technology. Teaching at Senior School level therefore should be activity-oriented and centred on the students. Science at this level should be functional and creative.

Despite the new innovation in science, Owolabi (2003) discovered that the rate at which science students do shift to Arts and Commercial subjects is alarming. So far, efforts to attract prospective students to science appears to be inadequate because students' performance in science is still not satisfactory. The result of students'

performance at the West African School Certificate Examination (WASCE) appears to indicate poor achievement of students in the science subjects.

Agun (1982) noted that poor academic performance in primary and secondary school science subjects in the country has been of great concern to parents, scholars, educators and the government at large. Science teaching in secondary schools has been hamstrung by several factors which include defective teaching of science right from the Junior Secondary School (JSS) level: poorly equipped science laboratory, dearth of qualified science teachers, lack of modern equipments and over crowded classes with students who have little or no interest in science but are in attendance in obedience to the wishes of their parents or guardians. To reduce the rate of high failure and negative attitude of students toward science in our schools, Owolabi (2003) suggested that an individualized approach through laboratory teaching must be emphasised.

The main purpose of classroom instruction is to change the learners' behaviour in the desired direction. Ahiakwo (1991), Adeyegbe (1984) and Nwosu (1993) supported the claims of students low levels of understanding of chemistry contents due to lack of interest. Hence, the importance of modern instructional

strategies to science teaching especially chemistry can not be overemphasized. Agun (1982) defined instructional strategies as all techniques in respect of the state or texture or size by a teacher to transmit knowledge or information to widen students' understanding of concept. Adeosun (1998) observed that instructional strategies are good to widen the scope and understanding of the learner beyond the basic information needs of the course. Such packages will include field and classroom study of real things demonstration of object models, mock up motion picture, project or disrecording graphic portraits maps, etc.

Adesanya (1987) says instructional packages are helps given to the students to ease their rate of assimilation. According to Nvorom (1995), chemistry as a subject requires the use of various instructional packages because their uses have a lot of advantages which include: the provision of background knowledge and common experience on which future learning activities and concept can be based in order to stimulate and motivate students to learn. Instructional strategies could also add depth and meaning to learning and ensure better retention and hence increase students performance in learning science.

Different types of instructional packages needed in the teaching of chemistry includes: the visual, the audio and the audio-visual. According to Browman (1981) educational research indicate that students remember only 10% of what they read, about 20% of what they hear and 50% of what they hear and see. Retention increases, as students get more involved in the learning process. Three instructional devices that appeal to both sight and hearing are now becoming invaluable teaching aids: These are the sound motion picture, television and computer. Today, the importance of television is not so much pronounced like that of video-tape and computer because of its limitations. Although, both video-tapes and video-discs may serve as storage media for interactive video systems, but the latter seems to have more.

Computer is an electronic device that accepts data (input) and performs mathematical and logical operations to give information (output). In addition to its operation, an overview of how computer can be used in chemical research also play a vital role. Tauro reported a study of computer-assisted instruction, involving academically talented high school students. He found that students receiving computer-assisted instruction scored higher in chemistry achievement test and had better attitude toward the course and instruction than the control groups. At the junior high school, Carter (1991) found significant differences in achievement in metric instruction in groups studying. Therefore, instructional strategies and packages play a vital role in teaching science subjects.

Hypotheses: Two null hypotheses were formulated for this study:

H₀₁: There is no significant difference in the pre-test scores of chemistry students.

H₀₂: There is no significant difference in the post-test scores of chemistry students.

MATERIALS AND METHODS

Design: The study employed the quasi-experimental design using a pre-test, post-test, three groups design. The three groups were:

- Computer Assisted Instructions (CAI) group was exposed to learning chemistry through the use of computer instructional packages.
- Video-tape Mediated Instructional (VMI) group was exposed to the same topics in chemistry using video-tape as a medium of instruction.
- The third group called the conventional group, was exposed to the normal lesson approaches. The design of the study is as follows:

Computer Assisted instructional group (G₁) O₁ X O₂
Video-tape mediated instructional group (G₂) O₃ Y O₄
Conventional group (G₃) O₅ - O₆
This third group is hence used as the control group.

Subject: The subjects for the study comprised 60 students randomly selected from 3 public secondary schools. In each school, 20 male and female students were randomly selected, respectively using stratified random sampling method. The 3 public schools were selected using purposive sampling technique. They are all mixed schools with the same facilities but located at different local government Headquarters.

Instrumentation: The instrument used to gather data for this study was a Chemistry Achievement Test (CAT). The instrument consisted of 50 objective test items constructed by the researchers based on the topics in the packages. These include: structure and bonding, quantitative analysis, periodicity and organic chemistry. The instrument was subjected to screening by experts in chemistry to ensure face and content validity procedures. The reliability of the instrument was ascertained using test-retest method. The reliability coefficient of 0.72 was obtained which was adjudged high enough for the study of this type.

Procedure and data analysis: The research was carried out in 3 stages; administration of pre-test, the treatment and post-test. The students in all the three groups were exposed to different treatments. Groups G₁ and G₂ were taught using the 2 specially designed packages; the Computer Assisted Instruction (CAI) and Video-taped Mediated Instruction (VMI) respectively for a period of 8 weeks. The third group (G₃) was exposed to the conventional method, the method in use by the classroom teacher. All the students in the 3 groups attempted the pre-test and post-test before and after the treatment respectively. The performances of the students were analysed using Inferential Statistics. One-way Analysis of Variance (ANOVA) was used to test the 2 hypotheses raised for the study.

RESULTS

Hypothesis 1 was tested using one-way ANOVA (F-statistics) at 0.05 level of significance (Table 1).

The F-calculated value (0.141) is less than F-table value of 3.180 at 0.05 level of significance. Thus, the hypothesis was not rejected. This showed that there was no significant difference in the performance of students in the three groups, it was then concluded that the students selected for the study were homogenous.

Hypothesis 2 was tested using one-way ANOVA (F-statistics) at 0.05 level of significance (Table 2).

In Table 2, the calculated value of F = 51.663 is higher than the table value of 3.180 at 0.05 level of significance. The hypothesis was therefore rejected showing that the performance of the students in the post-test in the three groups differed significantly from each other. A post-hoc analysis on pairs of the three groups with significant differences was carried out using Scheffe's analysis. The result is presented in Scheffe's summary as shown in Table 3.

Table 1: Summary of Analysis of Variance (ANOVA) on students pre-test scores for the three groups

Source of variation	S.S	df	MS	F-cal	F-table
Between group	20.433	2	10.217	0.141	3.180
Within group	4141.750	57	72.662		
Total	4162.83	59			

p>0.05

Table 2: Summary of ANOVA on post-test scores of the three groups

Source of variation	S.S	df	MS	F-cal	F-table
Between	6128.533	2	3064.267	51.663	3.190
Within Group	3380.800	57	59.312		
Total	9509.330	59			

p<0.05

Table 3: Scheffe's summary table for post-test scores

Group		\bar{x}	G ₁	G ₂	G ₃
Computer (CAI)	G ₁	74.60		*	
Video-tape (VMI)	G ₂	68.60			*
Conventional	G ₃	50.80	*		

*Denotes pair of groups significantly difference at 0.05 level

DISCUSSION

The study has revealed that the performance of students in the 3 groups selected for the study were nearly the same. The analysis showed that there was no significant difference in the pre-test mean scores of students in Computer Assisted Instruction (CAI), Video-tape Mediated Instruction (VMI) and conventional groups. Hence, the 3 groups were homogenous since the highest and lowest means do not differ by more than the shortest significant range within the group (Best and Kahn, 1989).

The result of analysis of hypothesis 2 showed that there was a significant difference in the post-test mean scores of the students exposed to Computer Assisted Instruction (CAI), Video-tape Mediated Instruction (VMI) and conventional teaching. The sharp improvement in the students performance noticed in groups G₁ and G₂ (Computer and Video-tape groups) informed the effectiveness of the 2 methods.

The result of the analysis showed that the three groups improved on their performances at the post-test stage, pairs of groups that were found significantly different are: groups G₁ and G₂, G₂ and G₃, also G₁ and G₃. But generally the computer group performed better than the video-tape and conventional groups. Therefore, the treatment exposed to the first 2 groups has a significant impact on students' performance. Calvin (1991) in his study found significant differences in attitude toward computer and chemistry in groups receiving CAI over those who did not receive the CAI. Henson (1998) confirmed that computer can expand the type of instruction received by students, improved on current teaching modes and free teachers to increase their personal attention to students.

The results of this study also confirmed the findings of Moore (1994) asserted that computer is good enough to be used for testing students' mastery of objectives and for diagnosing weakness, recommending remedial work if necessary and indicating when the student is ready to move on to the next step. Computer-assisted instruction occurs as the interaction mode between teachers and students, course material method and computer itself. Computer is hence being embraced as a powerful tool in the teachers' repertoire, in the developing nations, particularly in Nigeria.

CONCLUSION AND RECOMMENDATIONS

The need to improve students' performance in science and possibility of reducing the rate of mass failure in these subjects have led to the consideration of

issues of designing packages for teaching chemistry as a subject in a secondary schools. The practical application of programmed instruction using computer and video-tapes has been confirmed as effective for enhancing performance in chemistry lessons. There were improvements in the performance of students as a result of the use of computer and video-tape instructional packages, compared with students taught using conventional method.

Based on the result, it is recommended that Computer Programmed Instruction should be given priority as a teaching strategy in the teaching of science chemistry in our secondary schools. Since, there were improvements in the performance of students as a result of the use of the 2 packages (Computer and video-tape) over the conventional approach, it is also recommended that these package be incorporated into the chemistry secondary school curriculum and instructional packages as part of the provisions of the National Policy on Education in Nigeria.

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