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Effects of Direct Observational Assessment Technique on Students' Interest and Achievement in Secondary School Practical Chemistry.

Ugwu, Anthonia, *Ph.D.*
Department of Science Education
University of Uyo, Uyo. Akwa Ibom State, Nigeria.
E-mail: toniaclare@gmail.com
Tel: +2348061295335

Abstract

This study was designed to determine the effects of direct observational assessment technique on senior secondary three (SSIII) chemistry students' interest and achievement in practical chemistry. The study adopted a quasi – experimental pre-test post–test non – equivalent control group design. A sample size of 92 SSIII chemistry students from two secondary schools was drawn from the study area – Uyo municipality of Akwa Ibom State of Nigeria. The two schools were randomly assigned to experimental and control groups. The treatment group was assessed using direct observational assessment technique while the control group was assessed using the

conventional assessment technique (pencil and paper). The instruments used for data collection were practical chemistry achievement test (PCAT) adopted from past WAEC questions and Chemistry Practical Activities Interest Scale (CPAIS) adapted from Njoku (2003) with a reliability coefficient of 0.98. Analysis of covariance was employed to test the two hypotheses at 0.05 level of significance. The result of the study showed that direct observational assessment technique improved the interest and achievement of the students assessed by direct observational assessment technique but not conventional paper and pencil assessment technique. It was recommended among other things that examination bodies like WAEC and NECO should employ this assessment technique in assessing practical work.

Introduction

Assessment technique is a strong determinant in teaching – learning process. Assessment according to Ojokuku (2008) remains the most important and appropriate technique that can be used to determine whether learning has taken place or not. Akusoba, (1999), and Omoifo & Oluruntegbe, (1999) submitted that modes of assessment adopted by teachers influence the ways in which learning takes place. Giddings & Fraser (cited in Ugwu, 2009) made it categorically clear that mode of assessment adopted by teachers' influences teachers' teaching style, students' learning style and attitude towards practical work. Consequently, appropriate assessment strategy has to be employed in assessing students performance especially in assessing practical work in science if meaningful objectives of the lesson are to be achieved, hence the choice of direct observational assessment technique as the focal interest of this study.

Another important determinant of achievement in teaching – learning process is interest. It is a component of attitude that measures the degree of a person's likeness for a person, something or even an event. According to Njoku (2003), students' interest significantly correlates with their academic achievement in school subjects and as

such has significant influence on their learning outcomes. Interest determines the zeal with which students study and solve their academic problems. It, therefore, becomes pertinent for teachers to explore and find avenues/ways of arousing students' interest in teaching-learning process so as to help them achieve high in different school subjects especially science practical that acquaints them with scientific and technological skills.

Practical Chemistry and Students' Academic Performance

Chemistry is a practical – oriented subject that occupies a prominent place in school science curriculum. It is an experimental science that needs a high level of practical work for its understanding, development and application (Ugwu 2007). Its practical activities do not only enhance performance but acquaint students with science process skills which are the intellectual skills needed to practice and understand science and which also aids creativity development among learners. This can only be achieved if appropriate teaching strategies with corresponding assessment technique and instruments are employed.

Unfortunately, it has been observed that students' performance in practical chemistry in Nigeria has been very poor despite all the efforts to help them achieve high in the subject (Ezeano, 2002), Fasakin, (2003) and Udochukwu, (2008). In addition to the poor performance, Ezeliora (1999) and Njoku, (2003) submitted that students' interest in practical chemistry is equally poor. Efforts to ameliorate these problems have been on improvement on the teaching strategies and resources for the teaching of the practical activities. Since it has been established that modes of assessment adopted by teachers influence the teachers' teaching style, students' learning style and attitude towards practical work, (Giddings & Fraser in Ugwu 2009), It becomes worthwhile to explore the effects of assessment techniques on students' interest and achievement in practical chemistry. Practical chemistry till today is assessed even in external examinations like West African Examination Council (WAEC) and

National Examination Council (NECO) with traditional paper and pencil assessment technique which according to Reece & Walker (2006) is unreliable and not achieving the intended results. According to them, they assess only the end products neglecting the processes involved in achieving the results. Consequently, the instruments that have been used for sometimes in the assessment of practical work have become more widely accepted for other tasks and based on direct observation.

Direct Observational Assessment Technique

Direct observation is an assessment technique where you watch the completion of a task and assess the process, (how the work is done) and the product, (what has been done) (Reece & Walker, 2006). In other words, direct observational assessment technique refers to on-the-spot assessment and scoring of both the processes and products of a task that involves watching the completion of the task, assessing both how the task is done and what has been done as well. Direct observation assessment technique makes use of observation schedule that is designed for identifying and scoring the processes that the students are expected to undergo, the skills they are expected to exhibit and acquire as the activities go on and finally the answers (products) obtained. Here, students are awarded marks at different stages of the practical activities as they carry out the processes involved and exhibit the appropriate skills in carrying out the activities and in manipulating the equipment/apparatuses and also at the getting of correct product(s). Students are made to understand that their marks are spread out into processes involved and products obtained as well and not just on the products obtained as it is with the traditional paper and pencil assessment technique. This assessment technique thus encourages the students to carry out the activities and learn the processes involved as they get marks for processes involved and not only on the products. It is against this background that this study intended to find out the effects of direct observational assessment techniques on students' interest and achievement in practical chemistry.

Statement of the Problem

The overall students' poor interest and achievement in practical chemistry in Nigeria has become a source of concern to chemistry educators in Nigeria. Identified problems of students' poor performance in practical chemistry examination from WAEC Chief Examiner's report of 2005 and 2006 are indicative of the fact that this aspect of chemistry is not properly taught. This led to the choosing of effective methods of teaching chemistry practical as the theme for STAN chemistry workshops in the year 2007. This notwithstanding, students still perform poorly in practical chemistry.

Following the submission of Gidding & Fraser (cited in Ugwu 2009), that assessment of practical work influences not only the teachers' teaching style but the students' learning style and attitude towards practical work as well, it seems that the paper and pencil assessment technique in use could be contributory to this ugly situation. It assesses only the products and not the processes involved in getting the product.

Chemistry is an experimental subject that needs assessment technique that can identify, assess and score both the processes and products of practical work thereby compelling them to acquire the skills and attain the objectives of practical work. This study, therefore, is designed to find out the effects of direct observational assessment technique on students' interest and achievement in practical chemistry.

Research Questions

1. What is the effect of direct observational assessment technique on students' mean interest score in practical chemistry?
2. What is the effect of direct observational assessment technique on students' mean achievement score in practical chemistry?

Hypotheses

HO_1 : There is no significant effect between the mean interest scores of students assessed with direct observational assessment technique and those assessed with paper and pencil assessment techniques.

HO_2: There is no statistical significant effect between the mean achievement scores of students assessed with direct observational assessment technique and those assessed with paper and pencil assessment technique.

Method

A quasi – experimental pretest – post- test control group design was used in this study. The data reported in this paper were obtained from an exercise which investigated the effects of direct observational assessment technique on students' interest and achievement in practical chemistry. The study was conducted in selected senior secondary schools in Uyo metropolis of Akwa Ibom state in Nigeria. The performance of the students is here reported.

Sample and Sampling Techniques

Ninety two (92) SS III chemistry students were drawn from two secondary schools in the study area as the sample size. The two groups were randomly assigned to experimental and control groups. The experimental group consisted of 43 students against 49 students for the control group.

The two instruments used for data collection were Practical chemistry Achievement Test (PCAT) and Chemistry Practical Activities Interest Scale (CPAIS)

The Practical Chemistry Achievement Test (PCAT) was adopted from West African Examination Council (WAEC) while chemistry practical activities interest scale (CPAIS) was adapted from Njoku,(2003). The CPAIS has a reliability coefficient of 0.98. The PCAT has 3 questions on qualitative analysis aspect of the Practical Chemistry covering processes and products of practical activities

involved in identification of constituents of ions in a mixture of salts. This identification involved processes like

- Identification / recognition of gases, colours, precipitates etc.
- Separation of mixtures
- Experimentation and manipulation of equipment / apparatus
- Carrying out observation on reactions
- Measurement of quantities
- Controlling of variables
- Confirmation and interpretation of results

Treatment / Procedure

Before the commencement of the treatment both (CPAIS) and (PCAT) were administered to both groups as pre–interest and pre-test respectively. After the pre–interest and pre–test, the regular chemistry teachers started the experiment by teaching them, giving them some exercises to do at the end of each lesson and assessing them.

The two groups were taught the same content using the same lesson plan with the same instructional objectives and instructional strategy. The difference was in assessment technique where Quantitative Analysis Observational Schedule (QAOS) was used for the experimental group that was assessed on-the-spot by direct observation while the control group was assessed with conventional paper and pencil assessment technique.

The experiment lasted for 4 weeks and each week, some exercises were given to the students to do after the lesson. Each group was assessed and feedback given to the students each time based on the assessment technique/instrument used. At the end of the experiment both post–interest and post-test were administered to the students and data collected. Data were analyzed qualitatively using mean, standard deviation and analysis of co- variance.

The results of the data analysis are presented in tables below in line with research questions and hypotheses.

Research Question 1: *What is the effect of direct observational assessment technique on students' mean interest scores in practical chemistry?*

The result presented in table 1 shows that the mean pre-interest and post-interest scores with their standard deviation scores for the experimental group are 38.86, 51.70, 8.579 and 5.271 respectively. However, the pre-interest and post-interest mean scores with the standard deviation scores for the control group are 31.71, 43.27, 6.429 and 8.827 respectively. Table 1 also shows that the mean interest gain of the experimental group is 12.84 as against the mean interest gain of 11.56 of the control group indicating the superiority of the experimental group over the control group in fostering interest in the students.

HO_1: There is no statistical significant difference in the mean interest scores of students assessed with direct observational assessment technique and those assessed with paper and pencil assessment technique.

Table 2 shows that F (23.007) is significant at .000 for the technique at 1 and 91 degrees of freedom (Df). This is because 0.000 is less than 0.05 significant level earlier set for the hypothesis. Hence, the hypothesis is not accepted. There is, therefore, a significant difference between the mean interest scores of students assessed with direct observational assessment technique and those assessed with paper and pencil assessment techniques.

Research Question 2: *What is the effect of direct observational assessment techniques on students' mean achievement scores in practical chemistry?*

Table 3 shows that the experimental mean achievement pre-test and post-test scores are 42.88 and 58.60 respectively with standard deviation scores of 7.199 and 5.729 respectively; While that of the

control group are 36.41 and 50.12 with standard deviation scores of 8.722 and 7.052 respectively. As shown in table 3, the mean achievement gain for the treatment group is 15.72 as against 13.71 of the control group indicating the superiority of the treatment group over the control group in students' achievement in practical chemistry.

HO_2 There is no significant difference between the mean achievement scores of students assessed with direct observational assessment technique and those assessed with paper and pencil assessment technique.

Table 4 shows that F (25.616) is significant at 0.000 for the technique at 1 and 91 degrees of freedom (Df). This is because .000 is less that 0.05 significant level earlier set for the hypothesis. Hence, the hypothesis is not accepted. There is, therefore, a significant difference between the mean achievement scores of students assessed with direct observational assessment technique and those assessed with paper and pencil assessment technique.

Discussion of Findings

The discussion is based on the results of the analysis of the 2 hypotheses posed for the study

Students Interest in Practical Chemistry

The findings on table 2 revealed that there is a significant difference between the mean interest scores of students assessed by direct observational assessment technique and those assessed by paper and pencil assessment technique. This finding agrees with the submission of Reece & Walker (2006) who submitted that direct observation had become more widely accepted for the assessment of practical work. It also agrees with Giddings & Fraser (cited in Ugwu 2009), that assessment of practical work influences the teachers' teaching style, students' learning style and attitude towards practical work. The significant difference could be attributed to the use of the widely accepted direct observation for practical work which has influenced the students learning style and attitude towards practical work.

Students Achievement in Practical Chemistry

The finding on table 4 revealed that students assessed by direct observational assessment technique achieved higher than those assessed by paper and pencil technique. The finding is in agreement with Omoifo & Oloruntegbe (1999) who submitted that assessment of science process skills are better done using both paper and pencil and on – the – spot assessment technique rather than paper and pencil assessment technique only. The high achievement with observational assessment technique could be attributed to its ability to assess both the processes and products thereby compelling the students to acquire and master the skills involved in the activities.

Conclusion

From the findings of the study, it was concluded that direct observational assessment technique has positive effect on students' interest and achievement in practical chemistry.

Recommendations

1. Scientific and technological skills can only be acquired through practical work; therefore, practical chemistry should be assessed with techniques that can assess both the processes and products like direct observation for the acquisition of these skills.
2. Chemistry and other science subject teachers should try to develop and validate assessment instruments that can assess and, score the skills in practical work and use.
3. Examining bodies and science teachers should be encouraged to use direct observational assessment technique for the assessment of practical work in science.

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Table 1: Mean Interest Scores, Standard Deviations and Mean gain scores of experimental and control groups

Groups		Pre-Interest		Post-Interest		
	N	Mean	Standard Deviation	Mean	Standard deviation	Mean Interest Gain
Treatment	43	38.86	8.579	51.70	5.271	12.84
Control	49	31.71	6.429	43.27	8.827	11.56
Mean Difference		7.15		2.43		

Table 2: summary of one – way Analysis of covariance on experimental and control group on students' interest

Source	Sum of squares	df	Mean square	f	Significance f
Corrected model	1631.679	2	815.839	14.808	.000
Intercept	8470.967	1	8470.967	153.754	.000
Pre interest	3.223	1	3.223	.059	.809
Technique	1267.537	1	1267.537	23.007	.000
Error	4903.398	89	55.094		
Total	211553.000	92			
Corrected Total	6535.076	91			

Table 3: Mean Achievement Scores, Standard Deviations and Mean gain scores of experimental and control groups

Groups		Pre test		Post test		
	N	Mean	Standard Deviation	Mean	Standard deviation	Mean Interest Gain
Treatment	43	42.88	7.199	58.60	5.729	15.72
Control	49	36.41	8.722	50.12	7.052	13.71
Mean Difference		6.47		8.48		

Table 4: summary of one – way Analysis of covariance on experimental and control group on students' achievement

Source	Sum of squares	df	Mean square	f	Significance f
Corrected model	1485.478	2	742.739	14.874	.000
Intercept	10644.643	1	10644.643	213.162	.000
Pre test	.021	1	.021	.000	.984
Technique	1279.189	1	1279.189	25.616	.000
Error	4444.381	89	49.937		
Total	277343.000	92			
Corrected Total	5929.859	91			