

Comparing Three Instruments for Assessing Biology Teachers' Effectiveness in the Instructional Process in Edo State, Nigeria

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KEYWORDS Instruments; assessment; biology teachers; effectiveness and instructional process

ABSTRACT The study assessed biology teachers' effectiveness in the instructional process using two instruments and classroom observation, with a view to determining the most objective and appropriate one. The instruments were: Student Assessment of Teacher Effectiveness Instrument (SATEI), Teacher Assessment of Teacher Effectiveness Instrument (TATEI) and classroom observation by the researchers. One hundred and eighty (180) Senior Secondary Class Two (SS2) biology students and six biology teachers selected from six secondary schools in Edo State of Nigeria, were involved in the study. Mean assessment of biology teachers' effectiveness using the instruments were compared through Analysis of Variance (ANOVA). The result of the study showed that there was a strong agreement in the assessment of biology teachers' effectiveness by students and the researchers, indicating high degree of objectivity in their assessments. Besides, biology teachers were biased on their self-assessment of teaching effectiveness.

INTRODUCTION

The quality of education at any level depends largely on the qualification and commitment of the teacher. Thus the national Policy on Education (1998) states that no educational system can rise above the quality of its teachers. In science teaching and learning, the role of the science teacher cannot be over-emphasized. He engages in interactive behaviour with learners, effecting cognitive, affective and psychomotor changes in them. The science teacher is an engineer in the teaching and learning of science as he selects the instructional objectives, contents, method, learning experiences, organizes the experiences and evaluates the outcome of instruction with respect to the stated objectives (Nicholl and Nicholl, 1980). The personality, behaviour and attitude of the science teacher therefore cast too important an impression on the child's mind.

The science teacher can neither be dispensed with, nor can he be totally replaced by the use of modern electronic equipment in teaching. The professional background and commitment of the science teacher determines to some extent the quality of performance of students in all subjects. Confirming this, Druva and Anderson (1983) found that the academic performance of students in science courses positively correlated with successful teaching. Teacher effectiveness therefore could reasonably be assessed by the degree to which he has produced the desired behaviour in his students. Besides, teacher

effectiveness is assessed in terms of teaching experience, knowledge of subject matter, favourable attitude towards teaching and adequate knowledge of teaching methodologies.

Various science educators (Ezeilo, 1988; Ikoku, 1989; Uwadiae, 1997 and Farombi, 1998) have shown that student perform poorly in science subjects. Besides, the results of students in biology, chemistry and physics in the May/June Senior School Certificate Examination for seven consecutive years, 1995 to 2001, as shown in table 1, also corroborate the poor performance of students in science subjects.

The poor performance of students in science subjects has been attributed to:

- (i) poor quality of science teachers whose methods of teaching-excessive teacher talk, coping of notes, rote learning of text books materials-tend to inhibit interest (Resenshine and Furst, 19973);
- (ii) the prevalent expository method of instruction, rather than inquiry, with very little involvement of students in experimentation (Shuaibu, 1979 and Ajeyalemi, 1983) and
- (iii) Lack of laboratory facilities and equipment necessary for practical work (Balogun, 1982).

As teacher's effectiveness could reasonably be assessed by the degree to which he has produced the desired behaviour in his students, this study is designed to assess biology teachers' effectiveness in the instructional process using two instruments and classroom observation with a view to determining the most objective and appropriate one.

Table 1: Performance of students in the May/June WAEC Senior Secondary School Certificate Examination, 1995 – 2001.

Year	Biology			Chemistry			Physics		
	% credit (A_1-C_e)	%pass (P_7-P_8)	%Fail (F_9)	% credit (A_1-C_e)	% pass (P_7-P_8)	% Fail (F_9)	% credit (A_1-C_e)	% pass (P_7-P_8)	%Fail (F_9)
1995	18.90	30.20	50.80	36.70	28.90	34.50	18.90	34.50	46.70
1996	15.90	25.20	58.80	33.50	27.60	39.50	12.80	30.40	56.80
1997	15.80	23.32	60.88	23.57	20.29	56.13	9.35	31.88	58.78
1998	34.92	25.69	39.39	22.30	23.20	54.50	11.50	32.50	56.00
1999	33.10	16.94	49.96	32.22	23.98	43.80	34.22	32.88	41.38
2000	19.31	29.76	50.93	31.89	26.71	42.40	30.06	38.48	31.46
2001	30.30	38.70	61.30	36.26	27.07	36.68	34.46	38.28	27.25
% Average	24.00	27.12	53.15	30.92	25.35	43.79	21.61	34.13	45.48

Source: West African Examination Council 1996 – 2002 Annual Report.

Statement of the Problem

Due to the crucial role of the science teacher in science instruction, and the need to stimulate and sustain students' interest in science, teacher effectiveness has long been a topic of popular and academic interest, particularly in developed countries. Consequently, there is a strong controversy over the use of teacher self-assessment in assessing teaching effectiveness. While some experts: Azu (1987) and Cox (1990), argued in favour of the reasonability of teacher self-assessment, others such as Boekaerts (1991), Rose (1993) and Nwosu (1995) strongly opposed the use, on the ground that teachers are likely to be biased in their self-assessment of teaching effectiveness. The problem of the study therefore is to determine the most appropriate instrument for assessing biology teachers' effectiveness in the instructional process by comparing three instruments: students', biology teachers' and researchers' instruments. The hypothesis tested was: there would be no significant difference in the mean assessments of biology teachers' effectiveness by students, biology teachers and researchers at 0.05 level of significance.

METHOD OF STUDY

Participants: One hundred and eighty (180) seniors secondary class two (SS 2) biology students, 30 per school, and six senior biology teachers, one per school, were selected for the study. Six secondary schools where the principals or their vice were science based in Edo State were used. The students were selected through a systematic random sampling procedure.

Instruments: Two instruments: Students Assessment of Teacher Effectiveness Instrument

(SATEI) and Teachers Assessment of Teacher Effectiveness Instrument (TATEI) were designed and employed in the study by the researchers. The TATEI was developed as a self-assessment instrument for biology teachers. The items on both instruments were similar and generated to test the ability of biology teachers in their use of questions and practical activities in the laboratory during instruction as follows: recall facts and principles; apply facts and principles to problem solving situation; form hypothesis or encourage speculation; design experimental procedure; make direct observation; interpret recorded data; make inference from recorded or observed data; understand the purpose of an experiment; demonstrate to students on how to handle laboratory apparatus carefully; use teaching aids to facilitate students understanding of some difficult and abstract concepts in biology; involve students in practical activities in all practical oriented topics, group the students for effective class control and management of each practical activity; assign specific activities to students according to their various grouping during practical and practice each activity before the students are called upon to perform on their own. The instruments consisted of four points rating scale: very good (4); good (3); fair (2); and poor (1).

The content validity of the instruments was ensured by presenting them to experts in science education, measurement and evaluation and three senior biology teachers in schools not involved in the main study. These experts agreed that the items were appropriate for assessing biology teachers' effectiveness in the use of questions and practical activities in the laboratory. The reliabilities of the instruments were obtained in a test-retest method at four weeks interval; and they were 0.84 and 0.73 for SATEI and TATEI respectively.

Procedure: The students and biology teachers were administered the SATEI and TATEI respectively. The TATEI items were later transformed into a checklist/rating scale of four points for observation and assessment of biology teachers' effectiveness in the classroom. This checklist was employed by the researchers and the principals or vice principals of each school who assisted them (researchers) observed and assessed biology teachers' effectiveness in the use of questions and practical activities. The mean assessment by researchers and their assistants from observation of biology teachers was used as the final observation score for each biology teacher. Mean assessments of biology teachers' effectiveness by students and teachers themselves were obtained as shown in Table 2.

To determine if there was any significant difference among the means, Analysis of variance (ANOVA) was carried out as shown in Table 3. Post Hoc Analysis using Tukey's Honestly Significant Difference (HSD) test was used to determine the direction of superiority of means as shown in Table 4.

RESULTS

From the table 2, the three groups: students,

teachers and the researchers, assessed biology teachers effective in the use of questions and practical activities during instruction with total mean scores of 52, 68 and 50 respectively. The table also showed a sharp agreement in the assessment of biology teachers' effectiveness by students and researchers.

From table 3, the calculated F-value of 10.6 is greater than the table F-value of 1.65 at 0.05 level of probability. This indicates a significant difference among the mean assessment of biology teachers' effectiveness by students, teachers and researchers. The Null hypothesis is therefore rejected.

From the table 4, mean two which is teachers' self-assessment is superior to others.

DISCUSSION

The result of the study showed that biology teachers' self-assessment of teaching effectiveness was superior to students' assessment and the researchers' observation method. Besides, there was a strong agreement in the assessment of biology teachers' effectiveness by students and the researchers indicating a high degree of objectivity in their assessments. Based on the great difference between the self-assessment by

Table 2: Mean assessment of biology teachers' effectiveness by students, teachers and researchers according to schools.

S. No.	Names of Schools	Assessment by students	Assessment by teachers	Assessment by researchers
1	Adolo College, Benin City	57	61	51
2	Aduwawa Secondary School, Benin City	52	67	49
3	Ambrose Alli University Secondary School, Ekpoma	62	72	55
4	Emaudo Secondary School Ekpoma	53	71	54
5	Auchi Comprehensive College, Auchi	42	66	40
6	Momodou College Agbede	46	68	48
Total Means		52	68	50

Table 3: Comparison of mean assessment of biology teachers' effectiveness by students, teachers and Researchers: Summary of ANOVA.

Sources of variations	Sum of Square (SS)	Degree of Freedom (dr)	Mean Square (MS)	Calculated F- value	Table F- value
Among (Treatment)	915.6	2	457.8	10.6	1.56
Within (Error)	518	12	43.2		

Table 4: Multiple comparison of means: Tukey's Honestly Significant Difference (HSD) test

	Student' assessment $X_1 = 52$	Teachers' assessment $X_2 = 68$	Researchers' assessment $X_3 = 50$
Students' Assessment $X_1 = 52$	-	16*	2
Teachers' Assessment $X_2 = 68$	16*	-	18*
Researchers' Assessment $X_3 = 50$	2	18	-

Studentised Mean = 11.1 * = Significant

biology teachers and the assessments done by students and the researchers, the researchers placed more premium on the assessments done by students themselves. In other words, the researchers believed that biology teachers were not objective enough in their self-assessment of teaching effectiveness in the use of questions and practical activities. The result of this study is in agreement with Boekaerts (1991) and Rose (1993) who strongly opposed the use of teacher self evaluation in the assessment of teaching effectiveness; and Nwosu (1995) who found that chemistry teachers were biased in their self assessments of teaching effectiveness. The result of the study however, is incongruous with Azu (1987) and Cox (1990) who argued in favour of the reasonability of teacher self-evaluation.

CONCLUSION

Based on the results of the study, SATEI and classroom observation records by the researchers appeared to be more reliable for assessing biology teachers' effectiveness than TATEI. Researchers in science education should therefore avoid the use of teacher self-evaluation method in assessing biology teachers' effectiveness. The result of this study cannot be generalized to other states in the country, further study involving other states has to be carried out. Besides, this kind of study should be replicated in other science subjects to enable correlation of teaching-learning behaviour among science teachers.

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