IMPROVING QUALITY OF ASSESSMENT OF PHYSICS LEARNING OUTCOMES IN PUBLIC AND PRIVATE SECONDARY SCHOOLS IN PLATEAU STATE THROUGH TRAINING IN TEST CONSTRUCTION

BY
CHRISTIANA AMAECHI UGODULUNWA, Prof. And
GEORGINIA CHINYERE IMO
DEPARTMENT OF EDUCATIONAL FOUNDATIONS
FACULTY OF EDUCATION
UNIVERSITY OF JOS, JOS

Abstract

Quality classroom teaching and learning depend on the quality of evaluation and this in turn depends on quality information gathered through assessment of learning outcomes. Gathering of quality assessment information however, is only possible through the use of quality assessment instruments. The study therefore looked at the quality of teacher-made tests used by physics teachers in private and public schools in Plateau State for assessment of classroom learning outcomes and the extent to which training in test construction can improve their quality. An experimental study involving 26 physics teachers and 492 SSII students as sample was carried out. A pre-experiment questionnaire, physics teachers' pre-and-post tests and a physics achievement test judged to have high content validity with internal consistency reliability coefficient of 0.87 made up the instruments for data collection. Judges' ratings on test content and cognitive objective coverage, reliability scores and mean scores were used to answer the research questions while t-test statistic was used to test the hypothesis. Results show that quality of teachers' tests is poor though tests of private school teachers were of higher quality than those of public schools. Training in test construction improved quality of tests constructed by teachers but did not bridge achievement gaps between students in the two schools. Training and retraining of teachers in test construction is therefore recommended for improved assessment in schools.

Introduction

Classroom learning outcomes are things the teacher hopes to achieve at the end of teaching. They are usually based on the instructional objectives and these guide the teaching and learning process as well as evaluation. Those objectives in the cognitive domain which deal with mastery of concepts, principles, skills and academic achievement in school subjects are grouped into six levels according to their level of complexities starting from the simplest to the most complex. The objectives are usually stated using specific action verbs. These verbs depict what students are expected to do as evidence that learning has taken place. During classroom instruction, activities are carried out at the various levels (Ugodulunwa, 2008). It is only necessary then that teachers need to assess learning outcomes at all levels to ascertain whether or not they

have been achieved. It is therefore the duty of a teacher to ensure that a good assessment procedure is adopted in doing this.

Assessment is a process of information-gathering in order to make value judgment about classroom teaching and learning. Herman and Knuth as cited in Erinosho (2005) perceive assessment as any method used to understand students' current level of knowledge better. Assessment results in schools are mainly used for summative and formative purposes (Obemeata, 2005). Of these two purposes, Falayajo (2004) posits that the greatest value of assessment is realized when the results are available for formative uses. He believes that assessment should be used first and foremost for improving learning. Erinosho (2005) affirms this by saying that classroom assessment is primarily formative, determining content coverage, level of mastery, detecting misconceptions and appropriate teaching method to be adopted. The feedback given to students equally helps them work on their areas of weakness and also improves their study habit. Assessment of learning outcomes is a very important approach to instruction as quality of teaching depends on the quality of evaluation which in turn utilizes information gathered through assessment. Assessment gives teachers the opportunity to be flexible and innovative in their teaching because when low mastery of objectives is discovered, reteaching becomes necessary and this might entail changing of teaching methods and strategies to meet learning needs and strengthen instruction (Ajala, 2005; Ukwuije & Opara, 2013). A good assessment procedure therefore leads to improved learning as according to Joshua and Ikiroma (2013), assessment and learning vary in the same direction.

Since the ultimate goal of assessment is to enhance students' learning, feedback from assessment must be evidence-based. Assessment therefore involves collection of evidence about students' learning (Senior Secondary School Curriculum Guide, 2013). However, Ajala (2005) opines that because the procedure of assessment entails stating instructional objectives and clarifying activities to be accepted as evidence of learning, that there may be discrepancies between what is expected of the learner as evidence of achievement and what the learner has actually acquired. Therefore, the more consistent students' performances are as evidences of achievement of learning objectives, the lesser the discrepancies between the expected and the actual. Since teachers view what is demonstrated by performance as evidence of learning, care must be taken to select clues to illustrate performance described in the instructional objectives. Attention needs to be paid to specific objectives and established criteria used in evaluating students' achievement of each objective (Ukwuije & Opara, 2013). Use of action words that are specific, measurable and achievable in stating the objectives and in assessing the learning outcomes is equally suggested (Ugodulunwa, 2008).

From the foregoing, quality instruments need to be used in measuring students' performance in order to reduce discrepancy between the expected and accepted evidences of learning. Teacher-made tests are one of the instruments commonly utilized in the assessment of classroom learning outcomes (Ajala, 2005). Although different tools like classwork, homework, assignments, quiz, observation technique can be utilized

(Erinosho, 2005), the results generated from tests/examinations are put into more use in decision-making in schools than results from others. This is because a test is a more formal tool for gathering information about students' learning (Mertler, 2003). Teacher-made tests are therefore the assessment instrument of focus in this study. They are prepared to meet prescribed instructional objectives and so are more useful to the classroom teacher than generalized achievement tests. Among other things, Ebel and Smith as cited in Ajala (2005) suggest that during planning and organizing of tests, the questions should be selected to assess learning outcomes stated in the objectives, allow students to demonstrate competencies learnt during instruction and questions must sample all important aspects of topic in the subject. Tests should also produce consistent results. All these border on issues of content validity, reliability and coverage of cognitive objectives (balance) in testing. Accordingly, in order to improve quality of classroom assessment of learning outcomes, teachers need to be taught to produce tests that meet these standards.

Observation has shown that students in private schools perform better than those in public schools in external examinations. This Oyetunde, (1988) attributes to higher teaching standard, better facilities and the fact that most parents of students in private schools are literate, are of high socio-economic status and so can afford textbooks for their children. Imo (2012) however is of the opinion that whereas teachers in public schools lack proper monitoring and a good number of them are not quite committed to their duties, private school teachers are closely monitored and so show greater commitment to their work. Given that good teaching results to better learning according to Aina (2009), could it be that the quality of tests used by the teachers in private schools is better than those of public schools thus providing better quality assessment information that enhances teaching and learning? The researcher therefore investigated and compared the quality of tests used by teachers in these two main types of schools in Plateau State, Nigeria. The study also investigated the possibility of improving the quality of teachers' tests through training in test construction. These were carried out in physics at the secondary school level as it is believed that physics is at the heart of science and technology.

For years now, students have been performing poorly in external examinations in many subjects including physics. If this continues, with time, it will be difficult to get a good number of students enrolling for courses in science and technology in tertiary institutions given that a credit pass in physics is a prerequisite for such enrolment. There is need therefore for physics teachers to be enabled to discover students' learning difficulties in the subject in good time so as to remedy them. As a result of this, use of quality teach-made tests for assessment of classroom learning outcomes in physics becomes imperative in order to enhance the learning of the subject.

The following questions and hypothesis were formulated to guide the study:

What is the quality of physics tests prepared by Private and Public School Physics teachers in terms of content coverage, internal consistency reliability and coverage of cognitive objectives?

To what extent does exposure to training in test construction improve the quality of Private and Public school Physics teachers' tests in terms of content coverage, internal consistency reliability and coverage of cognitive objectives?

There is no significant difference between physics achievement mean scores of students in Private and Public Schools taught by teachers exposed to training in test construction.

Method

The study is experimental in nature and utilized the pretest-posttest control group design at the training stage and intact group (Posttest only) of students for the assessment of students' achievement in physics. The population of the study was made up of all the SSII Physics teachers in all the Coeducational Private and Public Secondary Schools in Plateau State who hold at least a first degree in physics and their students. The sample for the study was made up of 26 physics teachers and 429 SSII students taught by the teachers in the experimental group. Due to unavailability of a sampling frame for the population of teachers, cluster sampling technique which can be used in such cases was employed in sampling teachers. Two Educational zones out of the three in Plateau State were randomly selected and then one Inspectorate Area was randomly selected from each of the 2 zones. All the 26 teachers in the selected clusters who fit into the defined population of the study were involved in the study. Intact groups of students taught by the teachers in the experimental group were equally involved.

Four instruments were used for data collection. A four-item pre-experiment questionnaire (PEQ) eliciting teacher's name, school, qualification and area of specialization was used to locate qualified teachers for the study. Samples of physics teachers' tests before (PTP1) and after the experiment (PTP2) as well as a 53-item research-made physics achievement test (PAT) with 50 objective and 3 essay items. PAT was the only instrument that needed validation. Its content coverage was judged adequate by two physics experts in Jos using National Physics Curriculum and a template from the Faculty of Education, University of Jos. These experts, who are Physics Panel Chief Examiners for West African Examination Council, also teach the subject at the secondary school level. The average internal consistency reliability coefficient of the instrument using Kuder-Richardson (KR21) formula and Cronbach Alpha method was calculated to be 0.87. The item Difficulty and Discrimination Indices for PAT ranged from 0.30-0.70 and 0.40-0.78 respectively. The average inter-rater reliability coefficients for the assessment of PTP1 and PTP2 using coefficient of concordance were 0.91 and 0.95 respectively.

The researchers and 3 research assistants visited all the Senior Secondary Schools in the selected clusters with PEQ to identify qualified teachers for the study. Copies of the selected physics teachers' previous tests (PTP1) and students' scores on the tests were collected. The selected teachers were randomly assigned to experimental and control groups and later the teachers in the experimental group were exposed to training in test construction for 5 days. The training addressed issues on content validity in testing, reliability and balance (coverage of levels of cognitive objectives) as well as compliance

to item-writing rules. At the end of the training, both teachers in experimental and control groups were given assignment to construct 20-item objective tests on given topics, administer the tests to their students and submit copies of the tests and scores on them to the researcher (PTP2). Teachers were then given 4 weeks to teach and assess their students on given topics. This was to enable the trained teachers use the acquired skill in assessing their students to promote learning of the topics. At the end of the period, PAT was administered to the students and scored by the researchers.

The content coverage of PTP1 and PTP2 were assessed by the 2 physics experts. Coverage of cognitive objectives was assessed by 2 measurement experts from University of Jos using action verbs for assessing the various levels of the cognitive domain. A three-point scale of "adequate", "fairly adequate" and "inadequate" was used by the Judges. The internal reliability coefficients of the tests were calculated by the researcher using Kuder-Richardson KR21 formula.

Tables of Judges' ratings on the content and cognitive objective coverage of physics tests constructed by Private and Public school teachers, reliability scores and gain scores were used to answer the research questions while t-test statistic was used to test the hypothesis.

Results

Table 1: Quality of Physics Test Prepared by Private and Public School Teachers

Teacher	Sch-type	Content Cov.	Cog. Obj.Cov.	Rel.Coef
A	Private	Inadequate	Inadequate	0.43
B	Private	F/adequate	Inadequate	0.46
C	Private	F/adequate	Inadequate	0.57
D	Private	Inadequate	Inadequate	0.33
H	Private	Inadequate	F/adequate	0.45
M	Private	Inadequate	F/adequate	0.38
O	Private	F/adequate	Inadequate	0.42
Q	Private	Inadequate	Inadequate	0.53
S	Private	Inadequate	Inadequate	0.34
T	Private	Inadequate	F/adequate	0.41
U	Private	F/adequate	F/adequate	0.62
V	Private	Inadequate	Inadequate	0.57
W	Private	Inadequate	F/adequate	0.21
X	Private	Inadequate	F/adequate	0.32
Y	Private	F/adequate	Inadequate	0.48
Z	Private	F/adequate	Inadequate	0.47
AA	Private	F/adequate	Inadequate	0.60
AB	Private	Inadequate	Inadequate	0.42
AG	Private	F/adequate	Inadequate	0.54
Mean Reliability Score				**0.45**
E	Public	Inadequate	Inadequate	0.48
G	Public	Inadequate	Inadequate	0.34

J	Public	F/adequate	F/adequate	0.54
L	Public	Inadequate	Inadequate	0.46
P	Public	Inadequate	Inadequate	0.36
R	Public	F/adequate	Inadequate	0.56
AF	Public	Inadequate	F/adequate	0.28
Mean Reliability Score				**0.43**

Note: Sch-type- school type, F/adequate- fairly adequate, Cov.- coverage, Cog.Obj.Cov.- cognitive objective coverage, Rel. Coef-reliability coefficient

Table 1 shows that the content coverage of Private school teachers' tests is higher than those of Public School teachers with 57.9% and 71.4% of the tests for the two groups respectively rated inadequate. For coverage of cognitive objectives, 68.4% of Private School teachers' tests was rated inadequate while that of Public school teachers was 71.4%. This shows that the Private School teachers' tests are still better in terms of coverage of cognitive objectives.

The mean reliability coefficient for tests constructed by Private School teachers was calculated to be 0.45 and slightly higher than that of Public School teachers which was 0.43. Though the test quality was generally low, the tests constructed by Private School teachers can be rated better in quality than those of Public School teachers.

Table 2: Quality of Physics Tests Prepared by Private and Public School Teachers in Experimental Group before Training in Test Construction (PTP1)

Teacher	Sch-type	Content Cov.	Cog. Obj. Cov.	Rel. coef
B	Private	F/adequate	Inadequate	0.46
C	Private	F/adequate	Inadequate	0.57
M	Private	Inadequate	F/adequate	0.38
Q	Private	Inadequate	Inadequate	0.53
S	Private	Inadequate	Inadequate	0.34
T	Private	Inadequate	F/adequate	0.41
W	Private	Inadequate	F/adequate	0.21
Z	Private	F/adequate	Inadequate	0.47
AA	Private	F/adequate	Inadequate	0.60
Reliability Mean Score				**0.44**
G	Public	Inadequate	Inadequate	0.34
L	Public	Inadequate	Inadequate	0.46
P	Public	Inadequate	Inadequate	0.36
AF	Public	Inadequate	F/adequate	0.28
Reliability Mean Score				**0.36**

Note: Sch-type- school type, F/adequate- fairly adequate, Cov.- coverage, Cog.Obj.Cov.- cognitive objective coverage, Rel. coef- reliability coefficient.

Table 3:Quality of Physics Tests Prepared by Private and Public School Teachers in

Experimental Group After Training in Test Construction (PTP2)

Teacher	Sch-type	Content Cov.	Cog.Obj.Cov.	Rel.	GainScore
B	Private	F/adequate	F/adequate	0.68	0.22
C	Private	Adequate	F/adequate	0.86	0.29
M	Private	F/adequate	F/adequate	0.70	0.32
Q	Private	F/adequate	F/adequate	0.78	0.25
S	Private	F/adequate	F/adequate	0.66	0.32
T	Private	Adequate	Adequate	0.88	0.47
W	Private	Adequate	Adequate	0.60	0.39
Z	Private	F/adequate	F/adequate	0.58	0.11
AA	Private	Adequate	F/adequate	0.80	0.20
Reliability Mean Score					**0.73**
Reliability Mean Gain Score					**0.29**
G	Public	Adequate	Adequate	0.82	0.48
L	Public	Adequate	F/adequate	0.64	0.18
P	Public	F/adequate	F/adequate	0.65	0.29
AF	Public	F/adequate	F/adequate	0.62	0.34
Reliability Mean Score					**0.68**
Reliability Mean Gain Score					**0.32**

Note: Sch-type- school type, F/adequate- fairly adequate, Cov.- coverage, Cog.Obj.Cov.- cognitive objective coverage, Rel.coef-reliability coefficient.

Training of teachers in test construction was found to be effective in improving the quality of teachers' tests in the three areas under consideration but the focus of the study is on the extent of improvement experienced by Private and Public School teachers in the experimental group.

Tables 2 and 3 show that 77.8% of Private School teachers' tests and 100% of Public School teachers' tests improved in content coverage. The level of improvement in content coverage was more for the Public School teachers. However, the Private School teachers improved more in cognitive coverage than the Public School teachers as indicated by percentage improvement of 88.9% and 75% respectively for the two groups. The mean reliability gain score for the Public School teachers' tests was 0.32 while that of Private School teachers was 0.29 thus the Public School teachers improved more in the area of test reliability.

Table 4: t-test Comparison of Physics Achievement Mean Scores of Private and Public School

Students Taught by Teachers Exposed to Training in Test Construction

Groups	n	$\bar{x}$	S.D	df	tcal	tcrit (α=0.05)
Private Schools	332	35.30	7.48	427	19.46	1.96
Public Schools	97	22.80	5.78			

$p<.05$

Table 4 shows that tcal □ tcrit, also mean of Physics achievement scores for Private and Public schools were 35.30 and 22.80 respectively, the hypothesis was therefore rejected. The Private school students mean score was significantly higher than that of public school students.

Discussion

The findings of the study show that the quality of tests prepared by private and public school physics teachers is poor with low coverage of content and cognitive objectives as well as low reliability. The consequence of using such tests for classroom assessment of learning outcomes according to Ajala (2005) is that there will be discrepancies between what is measured as evidence of students' learning and what is actually learnt. The students' true level of mastery of instructional objectives is thus not revealed to the teacher as well as their areas of difficulties and misconceptions. As a result of these, proper remedial activities are not planned and executed to enhance learning. However, the quality of test prepared by private school teachers is slightly better than those of public school teachers. This might be a confirmation of the opinion of Imo (2012) that private school teachers are closely monitored and have greater commitment to work than public school teachers.

The findings also show that the quality of tests prepared by both private and public school teachers improved greatly after exposing the teachers to training in test construction. While the quality of Public School teachers' tests improved more in content and reliability, the tests of Private School teachers improved more in coverage of cognitive objectives. This shows that training is a veritable tool for improving quality of classroom assessment and with good assessment procedure according to Joshua and Ikiroma (2013), classroom learning gets enhanced.

Again, the findings reveal that although training of private and public school teachers in test construction improved the quality of their tests, however, it did not bring about a bridging of the achievement gap between the students in the two schools. Private school students achieved higher than the Public school students. It appears the difference in achievement levels in the two schools may not be solely as a result of the quality of classroom assessment done in the schools. Other things that make for difference in school quality like availability of textbooks and teaching facilities, good teaching method and so on as suggested by Oyetunde (1988) may be responsible. Availability of literate parents who may carry out academic follow up activities at home for their children/wards may also contribute to higher achievement of private school students.

Conclusion

The study has shown that the quality of teacher-made tests used for classroom assessment of learning outcomes in physics in both Private and Public schools is poor and needs to be upgraded. Training of teachers in test construction has proved to be effective in doing this. When higher quality tests are used in classroom assessment, classroom learning is enhanced as quality information is gathered through assessment to

drive instruction. However, training of Private and Public school teachers in test construction did not bridge achievement gap between the students from the two schools.

Recommendations

1. To enhance classroom learning, use of quality tools for classroom assessment of learning outcomes is needed so both Private and Public Physics school teachers need training and retraining in test construction.
2. Quality assurance of tools for classroom assessment of learning outcomes in physics should be given adequate attention.
3. Ways of bridging achievement gaps in physics between Private and Public school students need to be sought for.

References

Aina, O. (2009). *Assessment and contemporary issues in education.* Ile-ife: ObafemiAwolowo University Press Ltd

Ajala, J.A. (2005). Evaluation of students' classroom performance.In A.E. Emeke& C.V. Abe, (Eds.), *Evaluation in theory and practice* (pp11-27).Ibadan: PEN Services.

Erinosho, S.Y. (2005). Accountability based assessment for improved academic performance.

In A.E. Emeke & C.V. Abe (Eds.), *Evaluation in theory and Practice* (pp29-42).

Ibadan: PEN Services.

Falayajo, W. (2004).Methods of evaluation. In O. A. Afemikhe& J.G. Adewale (Eds.),

I*ssues in educational measurement and evaluation in Nigeria* (pp309-318).

Ibadan: Educational Research and Study Group.

Imo, G.C. (2012). Effects of training in test construction on quality of teacher-made tests and students' physics achievements in secondary schools in Plateau State. Unpublished Ph.D thesis, University of Jos, Nigeria.

Joshua, M.T. & Ikiroma, B. (2013). Impact of teacher guided assessment among secondary schools students in a large class. *Nigerian Journal of Educational Research and Evaluation (NAERE),* 12, (2), 1-8.

Mertler, C.A. (2003). *Classroom assessment–A practical guide for educators.* Los Angelis: Pyrczak Publishing.

Obemeata, J.O. (2005). Measurement and evaluation in education.In A.E. Emeke& C.V. Abe (Eds.), *Evaluation in theory and Practice (pp43-51).* Ibadan: PEN Services.

Oyetunde, T.O. (1988). Reading performance and processing strategies of selected secondary school students in Plateau State of Nigeria. Unpublished Ph.D thesis, University of Jos, Nigeria.

Senior Secondary School Curriculum Guide, (2013). The future is now: from vision to realization.

Retrieved July 29,2014 from www. cd1.edb.hkedcity.net/cd/cns/ss

Ugodulunwa, C.A. (2008). *Fundamentals of educational measurement and evaluation.* Jos: Fab Educational Books.

Ukwuije, R. P. I & Opara, I. M. (2013). School-based assessment: Implication for educational transformation. *Nigerian Journal of Educational Research and Evaluation (NAERE),12(2),* 9-18.