

Assessment in Primary School Mathematics Classrooms in Nigeria

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Background to the study

Mathematics is the foundation for the economic and technological development of any nation. It has been asserted that without mathematics there cannot be any modern developed Society (Ukeje, 2005). This accounts for the reason why Mathematics is made a compulsory subject at the Primary and Secondary School levels in Nigeria (Federal Republic of Nigeria, 2008). Thus, mathematics is expected to help in accelerating social, economic and technological progress of any Society. But these, in the final analyses, depend on the effective teaching and learning of mathematics in schools. The Primary school level is very important in any educational system because any default at this level would permeate to other levels of the educational system. To realize the objectives of teaching mathematics at any level of the educational system in the Society, there is need to monitor and maintain the quality of the educational processes and products. One major way of monitoring the quality and standards of the teaching and learning of mathematics in schools is through the assessment of the learning outcome of the pupils. The essence of using tests and other evaluation instruments during the instructional process is to guide, direct, and monitor students' learning progress towards the attainment of the course objectives (Alonge, 2004; Kolawole, 2010).

This monitoring of learning achievements in mathematics involves the processes of testing, measurement, assessment and evaluation. A test is set of questions, tasks or problems intended to measure an individual's knowledge, skill, aptitude, intelligence etc. Testing is therefore a systematic procedure of presenting a set of questions, tasks, or problems to testes and expecting them to respond to the items either orally or written, and sometimes by performance within a specified time schedule. Measurement is the assignment of numbers or marks to observed event or response to testing. Assessment is the process of using the results from measurement to take decisions about the object of assessment. Evaluation is a systematic process of determining the extent to which the learners have achieved the stated instructional objectives. Assessment provides the logic and justification for the judgemental stance of evaluation (Anikweze, 2010).

Assessment is an integral part of the teaching learning process and is expected to contribute to students' learning. If assessment does not contribute to the teaching learning process, then it is not necessary to assess the students. Indeed, evaluation is an important aspect of good teaching and learning process because no matter how efficient the teacher, how intelligent the pupils, how adequate the audio-visual equipment, if no provision is made for some evaluation of progress, the teaching may be invalidated. Unfortunately some teachers see assessment as an isolated activity from the teaching and learning processes. Hence, some teachers haphazardly carry out the assessment processes of the pupils without utilising the goals and benefit of assessment in the classroom. Some of the teachers see assessment mainly for the purpose of grading the pupils.

In the Nigerian educational system, Continuous Assessment was introduced in 1982 for the assessment of students at all the levels of the educational system. This replaced the one-shot, or end of course only summative evaluation practiced in the past. Under this system, teachers are to evaluate the learners using written tests, assignments, projects and other assessment instruments during the course and at the end of the term or session. The continuous assessment given during the course accounts for about 30-40 percent, while the end of term assessment accounts for 60-70 percent of a pupil's scores. This gives teachers the opportunity to monitor and assess the learning progression of the pupils in his class.

The continuous assessment is guidance oriented. This requires the skills of teachers in test construction and administration and record keeping. Teachers are expected construct valid and reliable tests which could be used in all schools following established procedures and practices of test construction. In addition to test construction (which is mainly on cognitive aspect of learning), teachers should also be able to measure the learners affective attributes such as attitudes, motives, interest, values and other personal characteristics. The teachers should also be able to provide clues or measures about the physical alertness and patterns of learners' psychomotor attributes. The continuous assessment is said to be comprehensive as it is expected to measure the cognitive, affective and psychomotor domains of learners. This involves a great variety of instruments such as: tests, interviews, questionnaire, assignments, and observations as shown below:

Table1: Test Instruments and Behaviour Domains Assessed

Instrument	Behaviour Domains		
	Cognitive	Affective	Psychomotor
Test/Examination	██████████		
Interview	██████████	██████████	
Questionnaire		██████████	
Anecdotal Records		██████████	
Assignments	██████████	██████████	██████████
Project		██████████	██████████
Observation	██████████	██████████	██████████

This implies that the teacher is expected to give more tests which means more marking and work for the teacher. They need to observe the learners more keenly to access their affective outcomes; therefore more records must be kept by the learners. All these things bore down to more demand, more work, and responsibility for the teachers (Adetula, 2011).

The tests in the school are expected to be diagnostic in nature. But the effectiveness of assessment method in schools falls short of the expectations of many stake holders in the education sector. Some of the major problems affecting the effectiveness of continuous assessment in schools include lack of time, lack storage facilities, lack of knowledge of assessment techniques by the teachers, large class size , and high workload on the part of the teachers. Continuous Assessment is expected to be a formative test. Formative evaluation is expected to lead to actions towards overcoming learning deficiencies; aid in motivating learners and increase retention and transfer of learning (Gronlund & Linn, 1990). Formative testing is designed to identify learners difficulties with a view to providing remediation measures to enhance performance of majority of students (Ajogbeje, 2013). Therefore, if assessment is not effectively carried out in the mathematics class, then the objectives of the lessons cannot be achieved.

In the teacher education training programmes in Nigerian Colleges of Education and Universities, prospective teachers are exposed to courses on measurement and evaluation. They are exposed to the techniques of constructing tests, types of test, validation of tests, calculating reliability coefficients and item analyses. The students on graduation are expected to put these techniques into practice in the classroom assessment of the pupils. But how much of these techniques do teachers practice in the classrooms, and how far do they use the assessment to assist the learners in the teaching learning process?

Teachers form the hub of the educational system including the process of assessment of the pupils in mathematics. If the teachers are not knowledgeable on the techniques and methods of effective assessment, then the objectives of mathematics learning cannot be achieved in our school system. Research report (Dandis, 2013) has indicated that the main forms of assessment that teachers use to evaluate their students in the secondary schools. According to the teachers, they assess:70% of the students work by written exams; 15% of students' attitude toward the subject and towards the members of the educational community; 15% left daily work at home and in class.

To construct good test items, teachers are expected to validate their tests and carry the item analyses. But many primary teachers rely on test items provided by mathematics textbook publishers test items and past examinations(Sharon, 1997). If these are not properly carried out, then the outcome of the test is not useable and the test cannot be reliable. But how much of these do Nigerian primary school teachers carry out in Nigerian schools? In assessing the students, teachers are expected to use the test results to give feedback to the pupils and organise remedial lessons to correct the pupils. But how much of these are carried out by the teachers in our schools? Research results showed that formative evaluation(Viz formative test, feedback, and remediation enhanced the performance of students. The study also showed that formative test with feedback and remediation is more effective than formative test only(Ajogbeje, 2013).

This study is therefore designed to answer the following research questions:

1. How many primary school teachers often use the various assessment instruments in the assessment of pupils in mathematics?
2. From which sources do the teachers generate the mathematics test items in Primary schools?
3. What levels of questions on the Bloom's taxonomy of cognitive domain are often set by teachers in mathematics tests?
4. Do teachers carry out content validity, reliability test and item analyses in mathematics tests?
5. How do teachers use the outcomes of the formative tests in mathematics?
6. What are the problems mathematics teacher faces in assessing pupils in primary school Mathematics?

Research Method

The research design for this study was the survey research design. One hundred and Fifty primary school teachers were sampled from Ebonyi State of Nigeria through purposive sampling technique. The teachers were from the 13 local Government Areas of the state who attended a capacity building workshop organised by the National Mathematical Centre, Abuja in collaboration with the Ebonyi State Universal Basic Education Board from 31st March to 4th April, 2013. There were made up of 108 females and 42 males. In the South Eastern part of Nigeria where the state belongs, there are usually more female teachers than male teachers in primary schools. The main instrument used for the data collection was a Mathematics Assessment Construction Scale (MACS) questionnaire designed to elicit responses from the subjects in the areas of assessment instruments, source of test items, levels of cognitive domain covered by the questions, validation and item analyses. Other areas covered are the use of formative tests and problems of assessing pupils in primary school mathematics. The questionnaire consists of 23 questions on a four point likert scale using never, not often, often and very often. The instrument was reviewed and vetted for face and content validity by three experienced primary school teachers; mathematics educators and two experts in test construction. The split half method was used to establish a reliability coefficient of 0.79. Simple frequency counts and percentages were used to analyse the data and answer the research questions

Research Results

Research Question 1: How many Primary school teachers often use the various Assessment Instruments in the assessment of pupils in Mathematics class?

Table 2: Assessment Instruments used by teachers in the Mathematics Class

Instruments	Regularity of the Use of Instruments			
	Never	Not often	Often	Very often
Written Tests	-	-	69(46%)	81(54%)
Assignments	-	3(2%)	51(34%)	96(64%)
Group Work	3(2%)	45(30%)	78(52%)	24(16%)
Project Work	48(32%)	63(42%)	30(20%)	9(6%)
Observation	99(66%)	6(4%)	24(16%)	21(14%)
Oral Examination	78(52%)	63(42%)	9(6%)	-
Peer Group Assessment	96(64%)	42(28%)	12(8%)	-

The table above shows that the percentages of teachers that often and very often use the following assessment instruments: 100% of the teachers often use written tests; 98% of the teachers often use Assignments; 68% of the teachers often use Group work; 30% of the teachers often use Observation; 6% of the teachers often use oral Examination; and 8% of the teachers often use Peer Group Assessment

Research Question 2:

From what sources do teachers obtain their test items for assessing students in Mathematics?

Table 3: Source of Test Items for assessing Students in Mathematics

Source of Items	Regularity Of Usage			
	Never	Not Often	Often	Very Often
Test book Publisher's Questions	3(2%)	36(24%)	51(34%)	60(40%)
Past Questions	48(32%)	51(34%)	36(24%)	12(8%)
Question and Answer Books	54(36%)	51(34%)	39(26%)	6(4%)
Constructed by teacher	6(4%)	30(20%)	33(22%)	81(54%)

The table above shows that: 74% Of the teachers often source their assessment questions from textbook publisher's questions; 32% of the teachers often source their assessment questions from past questions; 30% of the teachers often source their assessment questions from question and answer books; and 76% of the teachers construct their questions

Research Question 3

What levels of questions on the Bloom's taxonomy of cognitive domain are often set by teachers in mathematics tests?

Table 4: Levels of Cognitive Domains covered by Test Instruments

Level of Questions	Regularity of Use of levels of Questions			
	Never	Not often	Often	Very Often
Knowledge	-	-	90(60%)	60(40%)
Comprehension	-	18(12%)	87(58%)	45(30%)
Application	15(10%)	24(16%)	72(48%)	36(24%)
Real life Questions	18(12%)	75(50%)	27(18%)	30(20%)

The table above shows that 100% of the teachers set knowledge level questions; 88% of the teachers set comprehension level questions; 72% of the teachers set application level questions; and 38% of the teachers set real life questions

Research Question 4

Do teachers carry out content validity, reliability item analyses of the test items used in assessing students in Mathematics?

Table 5. Validation Processes of Test Items by Teachers

Validation Processes	Regularity of Validation			
	Never	Not often	Often	Very Often
Content Validity	21(14%)	6(4%)	45(30%)	78(52%)
Reliability Test	81(54%)	63(42%)	3(2%)	3(2%)
Item Difficulty	87(58%)	48(32%)	9(6%)	6(4%)
Item Discrimination	108(72%)	6(4%)	9(6%)	27(18%)
Distracter Index	90(60%)	45(30%)	9(6%)	6(4%)

The table above shows that:82% of the teachers often carry out the content validity of the test instruments; 4% of the teachers often carry out the reliability tests of the test instruments; 10% of the teachers often carry out the analyses of item difficulties; 24% of the teachers often carry out the analyses of item discrimination power; and 10% of the teachers often carry out the analyses of distracter index of the options

Research Question 5

How do teachers use the outcomes of the Formative Assessment tests in Mathematics Class?

Table 6: Use of the Outcomes of Formative Assessment Tests in Mathematics Class

Use of Formative Test	Regularity Of Use			
	Never	Not Often	Often	Very Often
Give Formative Tests	-	-	45(30%)	105(70%)
Give Formative Test and Feedback to students	12(8%)	9(6%)	45(30%)	84(56%)
Give Formative Test, Feedback and Remediation Lesson to Students	3(2%)	69(46%)	39(26%)	39(26%)

The above table shows that 100% of the teachers often give formative tests; 86% of the teachers often give formative tests and give feedback to the pupils; and only 52% of the teachers often give remediation lessons to the pupils in addition to the feedback to the pupils.

Research Question 6

What are the Problems of Assessment in Mathematics at the Primary School Level?

The problems identified by teachers are: Some of them include: Absenteeism, lateness and truancy of pupils from school; Lack of interest by pupils; Lack of materials for organising tests; Lack of time to organise tests and do corrections for pupils; Lack of preparation by the pupils for assessment; Lack of knowledge about assessment techniques by some teachers; Poor attitude of teachers to assessment due to poor condition of service, Lack of infrastructure such as tables and chairs for the students to take tests; Large class size; and Lack of textbooks and stationeries by the students.

Discussion of Results

The results of the study indicate that 100 percent of the teachers use written tests and majority of them use written assignments and group works to assess the pupils in mathematics. This supports the research findings by Dnadis (2013) Assignment and group work in this context are in form of written tasks given to students to carry out after the lesson periods. Written test are usually easier and more convenient for the teachers and pupils. Hence, many teachers rely on written tests. Also, written tests make it possible to capacity of individual learners. With the continuous assessment practiced in Nigeria, assignments and group work form part of the continuous

assessment marks. In fact, teachers are expected to use the class tests, end of term examinations, assignments and group work to assess and grade the pupils in mathematics. It is not common for teachers in Nigeria use observation, oral examination and peer group assessment to assess and grade pupils in mathematics. Some of the problems militating against the use of these assessment instruments are large class size, time factor and lack of teachers' knowledge of how to use these instruments. Thus the assessment in primary school mathematics is directed only towards the description of pupils' mastery of mathematics concepts and not towards the goals of mathematics in the society. Thus assessment based on written test is not valid and comprehensive as it does not measure all that it is expected to measure to achieve the goals of mathematics education

This study revealed that over 74% of the teachers source their assessment questions from publishers' test books. This is simply because the teachers and pupils use the recommended textbooks. Most times the teachers prepare their lesson notes from the textbooks, give assignments from them are most likely to draw their items from the textbooks. It is just easier and convenient for the teachers. This supports the report by Sharon(1997). Very few of the teachers source their test items from past questions and question and answer books. This is rather surprising as it is believed that many teachers usually copy questions from past questions and past questions and answer books. At the primary school level, there are many past question and answer books especially for common entrance examination purposes. Some teachers usually expose their pupils to past questions while preparing them for entrance examinations.

About 74% of the teachers indicated that they construct the test items by themselves without copying from any source. This is actually a good development. But do the teachers actually construct the test items following the principles of test construction? This is likely not to be. This calls for proper training and guidance for the teachers.

The result of this study shows that majority of the teachers often times set test items covering knowledge, comprehension and applications. But only few of them indicated that they set questions on real life problems. This supports the findings by Sharon, Charlene and Denniss(1997). It is highly recommended that mathematics should be related to the world in which pupils live. Pupils should be able to use mathematics knowledge to solve real life societal problems. This will make them to appreciate mathematics more and be attracted to its study.

The results of this study indicate that many teachers carry out the content validity of the test items at least to cover many of the topics covered with the pupils. But only very few of them often carry out the reliability test, item difficulty index, item discrimination power and distracter index. For any test instrument that these item analyses are not carried out, then the test cannot be valid, reliable and useable. Many teachers do not carry out item analyses of their test instruments due to lack of knowledge of the techniques, time factor and high workload resulting from the large class size. Many of them just copy questions without these item analyses. This calls for proper training and retraining of the teachers on validation, reliability and item analyses.

This study revealed that majority of the teachers give formative tests and feedback of the test results to the pupils. This is in line with the continuous assessment practiced in Nigeria. It is usual for teachers to give tests, mark the scripts and give feedback to the pupils on their performances. This study has also revealed that only about 48% of the teachers do not give remediation lessons to the pupils to correct them on their areas of weaknesses. Formative tests should not stop at giving feedback but should extend to remediation lessons to the pupils. Generally assessment for learning should not only measure the process of learning and learning outcomes, it is also expected to improve the learning process, diagnose the problems of the learners and motivate the pupils. If remediation lessons are not given to the pupils then the pupils cannot improve their states of learning. Some teachers do not give remediation lessons due to high workload and the rush to cover the scheme of work for the term. This is not good for the effective teaching and learning of mathematics in schools.

This study has revealed many problems facing the implementing good assessments of pupils in mathematics at the primary school level in Nigeria. Some of them include: Absenteeism, lateness and truancy of pupils from school; Lack of interest by pupils; Lack of materials for organising tests; Lack of time to organise tests and do corrections for pupils; Lack of preparation by the pupils for assessment; Lack of knowledge about assessment techniques by some teachers; Poor attitude of teachers to assessment due to poor condition of service, Lack of infrastructure such as tables and chairs for the students to take tests; Large class size; and Lack of textbooks and stationeries by the students. These problems are common in Nigerian schools. Some pupils usually absent themselves from school, teachers lack the knowledge of good test construction and administration and teachers have high workload in the school system

Recommendations

Based on the results of this study, it is recommended that:

- (a) Teachers should be encouraged to use variety of assessment instruments apart from written examinations in the assessment of the pupils in mathematics
- (b) Teachers should be retrained on the techniques of test construction and administration in schools
- (c) Teachers should be guided and encouraged to set questions that relate to real life problems

- (d). Mathematics teachers should be required to give remediation lessons after the formative tests in order to improve the learning capacity of the pupils. Assessment should stimulate, orientate and promote better understanding and control of knowledge by pupils.
- (e) The learning condition of the schools needs to be improved upon to attract pupils to school. Also, necessary infrastructures such as desks, chairs, equipment and stationeries required for test construction and administration should be provided in schools.
- (f) More teachers should be employed to reduce the high workload of the teachers. This will give them more time to effectively construct valid, reliable and useable test instruments.

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