

Use of Table of Specification in Construction of Teacher-Made Achievement Test in Mathematics in the Primary and Secondary Schools.

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Abstract

A sound primary and secondary education is fundamental in our educational system. Therefore, the use of table of specifications in the construction of teacher-made achievement test should not be overlooked in order to attain a sound primary and secondary education. The preparation of teacher made achievement test has been relegated to the background. When teacher made achievement test were introduced, results were good and easily understood. However because of lack of proper training on its use, it was abandoned. Hence false result and assessment were obtained, consequently resulting to students' poor performance in the subject (Mathematics). Teachers are no longer prepared to test students and for most schools, teachers and administrators are still relatively blank as far as skills in test construction and interpretation are concerned. Therefore, this paper examined the possibility of achieving adequate assessment of pupils/students through the use of table of specification during the preparation of teacher-made achievement test in Mathematics in the primary school and secondary school levels. The importance of table of specifications and the inherent dangers of not using it were highlighted and recommendations to ameliorate the situation were proffered.

Keywords: *Table of specification, Teacher-made Achievement test, Mathematics, Primary and Secondary Schools*

Introduction

Mathematics according to Maliki, Ngban and Ibu (2009), is described as a subject that affects all aspects of human life at different degrees. Also according to the National Mathematics Advisory Panel (2008), "Mathematics is used throughout daily lives". Therefore, priority should be placed in the way and manner mathematics is taught and assessed especially in our primary and secondary school levels as it is a foundation to sound education. To achieve this, the use of table of specifications in the construction of teacher-made achievement test in Mathematics is highly recommended in order to assess the pupils/students in Mathematics in the primary and secondary school levels adequately.

Joshua (2005), defined a table of specification as a plan just like a building plan which provides a guide to item construction and takes into account the relative emphasis or importance shown to each area of the content as well as the cognitive level during teaching. Onunkwo (2002), defined table of specifications as a two dimensional diagram with subject matter to examine content listed along the rows and the different educational objectives to be tested, listed along the columns.

The intention of any achievement test is to translate well defined subject matter content into test items, which will provoke or elicit from the learner the expected behavior they were intended to develop. In other words, the construction of any test needs a proper

consideration of the subject matter content and the behavior under consideration. Nenty & Umoinyang (2004) posited that these are both adequately sampled and involved in the construction of test items. It is necessary to develop a two-dimension table that brings together the course content in one dimension and the instructional or behavioral objectives on the other dimension as a blue print or guide for test construction. Such table is called a table of specification (Grondlund, 2006).

Teacher- Made Achievement Test

The teacher-made tests in our Nigerian schools are prone to so many deficiencies. Most teachers set few questions so as to finish marking on time and also set test which are easily marked. Such test lack validity and reliability as well as measure mere recall of factual information. Teacher-made test are more specifically focused and they usually reflect the content of a particular unit or course. The teacher made test is tailored to measure the achievement of students and intended objectives for them after completing a series of learning tasks for the course (Hopkins, 1990)

The purpose of teacher-made achievement test is to assess how much of the teachers instructional objectives the pupils/students have achieved after being taught t he lesson. The instructional objectives are based on the content of the course. To evaluate pupils/students achievement in the course therefore, the teacher should ensure that:

1. His test items cover the assessment of the mastery of the learning materials by the students; and
2. The learning or mastery of the materials is tested at the relevant levels of educational objectives.

One way of making sure that an achievement test fulfils the two purposes stated above is through the construction of a two-way table of specifications (Anthony, 1986).

Table of Specifications in Test Construction

Often times, students complain of imbalance in the teacher made test where attention is paid to minute details in the examination or that emphasis was placed in certain portions of the content. Either too many items are drawn from an aspect that was given scant attention during teaching process or an aspect that is not covered in the class receive high weighting when it comes to the test or examination. This is because of the non use of table of specifications, though table of specifications does not promise a perfectly equitable distribution of weight but it greatly improves the content validity of a teacher- made test (Denga, 2003).

Teachers' nonchalant attitude towards the use of table of specifications in preparing test has resulted to so many errors in assessing students' mathematics achievement in the primary and secondary levels, therefore, the true mathematics achievement standing of students could not be ascertained through such tests without table of specifications. This is not surprising or unexpected since in their pre-service education programmes our teachers were trained to teach students and not to assess (test) their students. (Gullickson, 1986), (Gullicksonhu & Ellwein 1985; Marso & Pigge 1989). Against this background, the use of

table of specifications by our teachers in the primary and secondary school levels in preparing test will enable teachers produce test items that will cover the desired content and objectives.

The use of table of specifications in constructing a test ensures a test with high content validity and in any other measuring instrument designed to measure mastery of content.

How to Use Table of Specifications (TOS) to Construct Teacher- Made Achievement Test in Mathematics in the Primary and Secondary Schools

Table of specification as we have already mentioned has two dimensions to it, these are the content dimensions and the behavioral objectives dimensions. Along the vertical or left hand axis/column, the teacher lists the specific content area taught in the units. For example, the content of mathematics units could be whole numbers and decimals, addition and subtraction, numerical form and expanded form. While along the horizontal or right hand axis/column he lists the relevant behavioral objectives.

It must be appreciated that a complete table of specification should cover all the six major categories in the cognitive domain as identified by Benjamin Bloom and his colleagues (1956). For beginners, however, the table of specification may exclude the higher order categories since they are not expected to acquire such skills at that stage of their academic development. Cognitive domain refers to the domain which deals with the “call or recognition of knowledge and the development of intellectual abilities and skills” (Bloom, 1956).

In order to construct table of specifications, or test blue print, which will adequately guide in developing a test that truly represents its content and objectives, Joshua (2005), pointed out the following:

- Decide on the total number of items that will constitute the test.
- Decide on the percentage of items to be prepared on each content topic or unit.
- Decide on the percentage of items to be prepared in each level of the instructional objectives (cognitive domain)
- Determine on the actual number of items to be prepared on each level of the instructional objectives.
- Determine the actual number of items to be prepared on each content topic/unit for the different cognitive levels.
- Make the necessary minor adjustments, if any.

A table of specification (Tos) for objectives achievement test designed to assess the ability of pupils in the specified units in mathematics in the primary school (primary four) is represented in the table below with total number of 20 items (objective test)

Table 1.1: Two–way table of specification (Tos) for objectives achievement test in Mathematics (primary four)

S/N	Contents Syllabus section (topics)	Behavioral objectives (Bloom`s Taxonomy			Total (100%)
		cognitive level)			
		Knowledge (20%)	Comprehension (20%)	Application (60%)	
1	Addition (25%)	1	1	3	5
2	Subtraction (25%)	1	1	3	5
3	Division (25%)	1	1	3	5
4	Multiplication (25%)	1	1	3	5
	Total (100%)	4	4	12	20

From the table of specification (Tos) above, let’s assume that the criterion for assigning the percentage is the number of weeks spent teaching each content area. Four (4) weeks were spent teaching all the four content areas, one week each spent on topics 1 to 4.

The teacher decided to set 20 objectives test items on the whole content from working out the number of items to be set on each content area in proportion to the relative percentage attached to each content area, this worked up to $5+5+5+5=20$

Consequently, the teacher distributes the number of items allocated to each content area along the levels of behavioral objectives. The teacher emphasized more on the application of the basic principles of Mathematics in problem solving, hence more in application level.

Similarly, the teacher has decided to test the learning of the subject (Mathematics) at three levels of knowledge, comprehension and application. This is because the test was meant to assess elementary school class i.e. primary school, though Mathematics has a lot of specific facts embodied in it to be analyzed and evaluated. However at the elementary level the pupils are expected to learn the specific facts where applicable. These are the principles that have guided the teacher’s distribution of the test items along the behavioral objectives axis of the table.

Table 1.2

A table of specification (TOS) for an achievement test designed to assess the ability of students in Arithmetic and Geometric progressions in Mathematics in the secondary school (SS 2) is represented in the table below with total items of 20

A table of specification (Tos) for Arithmetic and Geometric progressions achievement test.

S/N	Content (topics)	Syllabus	Section	Cognitive taxonomy (Bloom's categories)						Total (100%)
				Knowledge (40%)	Comprehension (25%)	Application (15%)	Analysis (10%)	Synthesis (5%)	Evaluation (5%)	
1	Sequences (10%)			8	5	3	2	1	1	20
2	Arithmetic progression (15%)	progression	(AP)	12	8	4	3	2	1	30
3	Arithmetic mean (30%)			24	15	9	6	3	3	60
4	Geometric progression (15%)	progression	(GP)	12	7	5	3	1	2	30
5	Geometric mean (30%)			24	15	9	6	3	3	60
TOTAL				80	50	30	20	10	10	200

From the table of specification (Tos) above the overall test length is specified as 200 items. This table of specification includes the five major content areas of the topic and the six levels of cognitive taxonomy are specified. Each test item written in this table of specifications will include 10% of the total test (or 20 items) in the content area of sequences. In addressing cognitive levels, 40% of the overall test items (or 80% items) will be included at the knowledge level. The interior cells of the table indicate the number of items that are intended to be the test item from each content and cognitive area combination. For example, the test item for sequences at the knowledge level in the content area will be 8 items.

This table of specification will now help the teacher to develop or construct test items adhering very strictly to the specification on the table. This will ensure item representativeness of the content in line with pre-specified objectives.

Importance of Table of Specifications (TOS)

The purpose of a table of specifications is to identify the achievement domains being measured and to ensure that a fair and representative sample of questions appear on the test, thereby improving the validity of teacher's evaluation based on a given assessment. The

importance of table of specifications as a guide to test construction cannot be over emphasized as opined by Denga (2003). Thus:

- It defines as clearly as possible the scope and emphasis of the test, to relate the objective to the content and to construct a balanced test.
- Through the use of table of specifications, teachers are able to determine what topic is being stressed and also assist in the preparation of test that reflect what students have learnt and also limit the amount of time spent on each unit.
- It constrains the tester and ensures that only those objectives involved in the instructional process are assessed. There is a balance in testing the materials taught because each objective receives proportional emphasis in relation to the amount of time given it and the value placed on it.
- It helps the teacher in organizing teaching and learning, assessment and evaluation as well as all the resources he plans to achieve during teaching and learning.
- It assists immensely in the preparation of test items, production of the valid and well robust test, in the classification of objectives to both teacher and students, and in assisting the teacher to select the most appropriate teaching strategy.
- It minimizes the chances of inadvertently omitting important objectives or content. According to Piaget in Lahey (2004), the pupils/students in the primary and secondary level fall between the concrete operational stage and formal operational stage. The teacher bearing this in mind is afforded the opportunity to put the cognitive level of the test into consideration and apportion items accordingly. The actual academic performance of the pupils/students could be obtained and misinterpretation and placement errors will be highly minimized.

Dangers of not using table of specifications in the construction of teacher-made achievement test in mathematics.

- The test so prepared without table of specifications will lack content validity.
- The scores obtain from such test are not true representative of the pupils/students actual Mathematics standing, since all the topics are not covered. The pupils/students might be denied the areas he will have performed excellently and given the area he/she could not perform well.
- There will be errors in placement and interpretation of student's actual mathematics performances
- The test items without table of specifications might not be suitable of the testee cognitive level. It might be below or above the testee cognitive ability.

Recommendations for the use of table of specifications.

- There should be specific period for testing during school term such as first and second continuous assessment test as it is done in federal government colleges and private primary and secondary schools
- The teachers should duly be informed of the testing periods so as to prepare their test in time.
- Teacher-made achievement test should only be considered adequate for testing pupils'/students' performances in mathematics if it is accompanied by a table of specifications.

- Refresher or retaining courses should regularly be organized for serving teachers. These include seminars, symposium, workshops conferences, etc on test construction.
- The government should employ enough mathematics teachers in the school system so as to reduce the high teacher-students ratio.
- The government should supply testing facilities to facilitate test construction.
- A mathematics testing committee should be set up in various schools which should be headed by expert in test and measurement to regularly supervise the type of test teachers administer to pupils/students.

Summary

This paper has discussed exhaustively, the need of the use of table of specifications in the construction of teacher-made achievement test in mathematics. It has given the purpose of such a test as that of determining the degree of achievement by the pupils/students of the teacher's specified instructional objectives. The objectives are the expected learning outcomes which are described in measurable behavioral terms.

To ensure adequate coverage of the learning materials and the levels of behavioral objectives, it is suggested that the teacher construct a two-way table of specifications that will enable the construction of teacher-made achievement test.

Conclusion

The construction and use of table of specifications serves as blue print that provides a guide and dictates the number of items that must be administered to measure the subject matter content in each of the topic at each of the cognitive levels. It thus ensures the adequate coverage of both the subject matter content and the different levels of human cognitive behavior. Therefore, it is one of the most effective empirical means within the teacher's reach of ensuring or building in a high level of content validity for an achievement test and must be made evidence to examination committees in schools before any administration of test.

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