



Mathematics Multiple Choice Test Items used in 2021 Basic Education Certificate Examination (BECE) and its Implications on the Quality of Education in Delta State

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ABSTRACT

Abstract: The Problem of students' deficiency in the manifestation of the Achievements of the Basic Education goals in Mathematics which include: the application of simple arithmetic operations of addition, subtraction, division and multiplication in real life situation has raise the question of quality Basic Education in Delta State. Educators have opined that how well learning outcomes is tested is related to how well teaching has taken place. The purpose of this study is to investigate how multiple questions used in BECE reflect the objectives of Basic Education Curriculum. Using Delphi research design, the researcher developed a theoretical table of specification for the subject and uses the outcome to test how questions used in BECE examination in 2021 fits the theoretical model. The results showed that the Mathematics multiple choice test items used in 2021 BECE did not significantly fit the developed theoretical model. A high percentage (65%) of the questions were measuring the lower order cognitive process while only 35% measures the higher order questions used in the examination did not reflect the amount of time spent on the content as well as the objective emphasised. The study concluded that based on the questions used in measuring learning outcomes in 2021 BECE, the curriculum as implemented cannot achieve quality education envisioned in the curriculum. The study recommended that for quality education in the state, questions used in BECE examination should reflect the Basic Education Curriculum as well as emphasised on the higher order cognitive process.

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INTRODUCTION

Education is the process of achieving the desired intellectual, moral, physical and emotional changes among children in order for them to be responsible and useful people in the society. It involves the acquisition of skills, knowledge and competencies required for a successful living in order to be self-dependent, solve complex problems as well as to contribute positively to the growth and Development of the Society. The advent of European Missionaries in Nigeria brought about Western Education. Prior to this time, there was no official assessment or examination for assessing change in behaviours

due to teaching and learning. . The two forms of Examination introduced by the Missionaries were standardized and non- standardized. The non-standardized examinations otherwise known as internal exams are tests developed and conducted within the domain of the institution (Teacher made Test), e.g. terminal and Promotions Examinations conducted by teachers, On the other hand, Standardized tests otherwise known as external Examinations are tests developed and conducted by external examination bodies (Omorogories & Iri-Aghodo ,2016). For instance, examinations administered by various educational bodies such as the State Ministry of Education, the National

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Examination Council of Nigeria (NECO), the Joint Admission and Matriculation Board (JAMB), the West African Examination Council (WAEC), the National Business and Technical Examination Board (NABTEB), and the Basic Education Certificate Examination (BECE), among others.

According to the National Policy on Education (2014), education in Nigeria is formally categorized into three stages: primary, secondary, and tertiary education. The concept of basic education, encompassing primary and junior secondary levels, was introduced in Nigeria in September 1988 (FRN, 2004). Additionally, the Federal Government, through the Nigerian Educational Research and Development Council (NERDC), instituted the 9-year Basic Education Curriculum (BEC) to restructure existing primary and junior secondary school curricula. This initiative aims to equip students with essential literacy, numeracy, manipulative, communicative, and life skills, along with moral values, to establish a solid foundation for lifelong learning and to foster scientific and philosophical reasoning (Orluweme, 2017).

REVIEW OF LITERATURE

A test is a valid and reliable instrument used in assessing learning outcomes. It is said to be valid if it measures what it is supposed to measure (Moyinoluwa, 2015). Validity is the most important aspect of test development without which the entire testing is a waste of time. Therefore, it is a compulsory task upon any test developer to follow strictly the procedures of ensuring the validity of any given test (Okwori, 2019).

Achievement test is a type of test used in determining the extent to which students have covered a given content are in line with the cognitive domain (Osadebe, 2018). It can be in the form of objective or essay. One form of the objective test is the multiple choice test which is the focus of this study. In this form, questions are asked and testees are expected to respond by ticking the correct answer from the list of the given options (Lok, 2021).

Multiple-choice assessment, as highlighted by Ani (2014), stands as a

longstanding and effective method of educational evaluation still widely used today. Ani emphasizes its versatility in evaluating various levels of cognitive skills. Rodriguez (2016) underscores its efficiency in administration and objectivity in scoring, noting its ability to cover diverse content in a short timeframe. Downing (2006) supports the use of multiple-choice questions, particularly for assessing higher-order cognitive abilities like problem-solving and synthesis. He suggests that this format is suitable for creating exams that measure a broad spectrum of knowledge and skills across different domains. According to Kirkendall, Grubar and Johnson (1987, cited in Etaga, 2013)

Multiple choice the most useful type of objective test, multiple choice item can be used to measure both simple and complex learning outcome, for example, it can be used to measure knowledge of terminologies, specific facts, principles, methods, procedures, etc. It is also to apply facts and principles, effect relationship (p.71). Therefore, multiple-choice tests are of considerably widespread use as a means of objective measurements. The main reason behind such popularity is the many advantages associated with multiple-choice test items.

Given that multiple-objective tests are the most often employed kind of test by accreditation agencies, it is imperative that their validity be examined. The features of tests and other measures of human traits known as psychometric properties serve to identify and characterise the qualities of an instrument, such as its validity, reliability, and suitability for use in a certain situation. Validity, reliability, difficulty index, and discrimination index are among the psychometric qualities of all excellent multiple-choice test questions, according to Okerinde (2010). The degree to which a test captures the intended outcome is known as its validity. A test's ability to measure what it was intended to assess is what makes it the most important and significant component of test creation.

Table of Specification

Table of specification is the most widely used method in obtaining content of a test

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(Dickson, et al. 2020). Table of specification serves as a crucial guide for item development and showcases the achievement domain been measured. The essence of table of specification is to identify the achievement domain being assessed and to ensure that a fair and representative sample of questions appears on the test. Table of specification help to avoid overlapping in the construction of the test items, helps to determine the weighting of learning outcomes regarding content area and ensures that justice is done to all aspects of the course (Dickson, et al. 2019). A table of specifications may assist increase the content validity of teacher-made tests, but it does not ensure that faults in the test item will be fixed (Quansah & Amoako, 2018). The test developer must first list all of the material covered in the course, give each topic a numerical weighting, choose the item format, determine how many items need to be created for each topic, and choose the kind of question to include under each cognitive learning domain before creating a table of specifications.

Quality Education is a system of education that enables the achievement of educational goals and objectives. It involves the acquisition of appropriate skills, knowledge and competencies required for the well-being of an individual in order to contribute positively to the growth and development of the society. Thus, how developed a country is, is a function of the quality of her education. According to Odili (2019), quality education is an educational process that guarantees acquisition of knowledge, competencies and skills for living. It creates enabling environment in terms of input, process and product that ensures acquisition of abilities for critical thinking and life-long learning. Furthermore, Arundhati et.al (2016) noted that quality education includes: technology modules done, lecturing methodology, programme enrolled attachments, co-curricular activities, qualification, learning resources, appraisal towards educational and opinion among others.

The essence of education is to acquit and empower learners with appropriate knowledge, skills and competencies. Therefore, it is important that one acquires education that is of

quality. This is because, what a person acquires, directly affects their mindset, philosophy and lifestyle. Odili (2019) noted that education in Nigeria cannot be judged as being of high quality. This is probably the reason why the goals of Basic Education have not been achieved in Nigeria.

The lack of access to high Quality Education is the major reason why politicians, high business men and women and top civil servants send their children abroad for studies. Furthermore, UNICEF (2019), asserted that Nigeria has a low educational access. Thus, quality Education is required for the attainment of the Basic Education goals in order to produce people who can solve meaningful problems in the society.

Research Questions

1. How well does the Mathematics objective test items used in 2021 BECE reflect the Mathematics curriculum?
2. What are the areas of mismatch between the observed and the expected tables of specifications in Mathematics BECE examination in 2021?
3. What cognitive order skill does the Mathematics object test items used in 2021 BECE measure most?

Hypotheses

- H₁: There is no significant difference between the expected table of specification and the observed table in 2021 Mathematics BECE.
H₂: There is no significant difference between upper and lower order cognitive Mathematics test items used in 2021 BECE.

METHODOLOGY

The design for this study was Delphi. The questions used for 2021 Basic Education Certificate Examination in Delta State which was made up of 5 theory and 60 Multiple Questions was the Population of the study. The 60 Multiple Choice was purposively sampled for this study. The observed and expected table of specifications developed with the assistance of the 30 experts were analyzed using goodness of fit chi-square

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and t-test statistics at $P \leq 0.05$ alpha level of Significance.

RESULTS

Classes	Arithmetic	Algebra	Geometry	Trigonometry	Variation	Probability & Statistics	Total
JSS1 1 st Term	Wk 2 – 8 (7weeks)	Wk 9 (1 week)	_____	_____	_____	_____	8 weeks
2 nd Term	Wk 2-8 (7weeks)	Wk 9 (1 week)	_____	_____	_____	_____	8 weeks
3 rd Term	Wk 2-5 (4 weeks)	Wk 6, 7, 10 & 11 (4 weeks)	Wk 8, 9 (2 weeks)	_____	_____	_____	10 weeks
JSS2 1 st Term	Wk 2-10 (9 weeks)	Wk 11 (1 week)	_____	_____	_____	_____	10 weeks
2 nd Term	Wk 2-8 (7 weeks)	_____	Wk 9, 10 (2 weeks)	_____	_____	_____	9 weeks
3 rd Term	_____	_____	Wk 2 & 3 (2 weeks)	_____	_____	Wk 4-6 (3 weeks)	5 weeks
JSS3 1 st Term	Wk 2, 3, 7, 8, 9, 10, 11 (7 weeks)	Wk 4, 5 (2 weeks)	_____	_____	Wk 6 (1 week)	_____	10 weeks
2 nd Term	_____	Wk 2 (4weeks)	Wk 6, 8, 9, 10, 11(5weeks)	Wk 7 (1 week)	_____	_____	10 Weeks
3 rd Term	_____	_____	Wk (1 week)	Wk 3-6 (4 weeks)	_____	Wk 7, 8 & 9 (3 weeks)	7 weeks
Total	36	17	12	5	1	6	77weeks
%	46.8%	22%	15.6%	6.5%	1.3%	7.8%	100%
	28	13	9	4	1	5	60 items

Note; Variation does not fits into any of the branches of Mathematics above.

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Table 1: Observed Table of Specification For 2021

Contents	Knowledge 43%	Comprehension 22%	Application 20%	Analysis 7%	Synthesis 5%	Evaluation 3%	Total 100%
Arithmetic 41%	11	5	5	2	1	2	25
Algebra 21%	5	3	3	1	1	-	13
Trigonometry 17%	4	2	2	1	1	-	10
Geometry 12%	3	2	1	1	-	-	7
Variation 4%	1	1	-	-	-	-	2
Probability & Statistics 5%	2	1	-	-	-	-	3
Total	26	13	12	4	3	2	60

Table2: Expected table of specification.

Branches of Mathematics	Knowledge 20 %	Comprehension 15%	Application 20 %	Analysis 20 %	Synthesis 15 %	Evaluation 10 %	Total 100 %
Arithmetic 47 %	6	4	6	5	4	3	28
Algebra 22 %	3	2	3	2	2	1	13
Trigonometry 6 %	-	1	1	1	1	-	4
Geometry 16 %	2	1	2	2	1	1	9
Variation 1 %	-	-	-	1	-	-	1
Probability & Statistics 8 %	1	1	1	1	1	1	5
Total 100 %	12	9	12	12	9	6	60

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Research Hypothesis 1: There is no significant difference between the expected table of specification and the observed table in 2021 Mathematics BECE.

Table 3: The Goodness of fit of the Expected table of specification and the Observed used 2021 BECE

Variables	N	Chi-square	Df	P-value	Decision
Observed	60	35.60	5	0.000	Reject
Expected	60				

The result in the table 3, shows the X^2 – value of 15.60 and p-value of 0.000. Testing the null hypothesis at an alpha level of 0.05, the p-value of 0.000 is less than the alpha level of 0.05. Therefore, the null hypothesis which states that there is no significant difference between the

expected table of specification and the observed in 2021 BECE is rejected. This means that there is a significant difference in the mathematics objective test items used in 2021 BECE in Delta State and the objectives of the curriculum.

Research Hypothesis 2

There is no significant difference between upper and lower order cognitive Mathematics test items used in 2021 BECE.

Table 4: The paired t- test statistics for higher and lower order cognitive objective test items used 2021 Mathematics BECE.

Cognitive order	N	Mean	SD	Mean difference	Df	t	p-value (2-tailed)	Decision
Higher	20	3.3334	3.44480	3.33333	5	4.385	0.007	Reject
Lower	40	6.6667	5.04645					

Table 4 revealed the t –value of 4.385 and p-value of 0.007. Testing the null hypothesis at an alpha level of 0.05, the p-value of 0.007 is less than the alpha level of 0.05. Therefore, the null hypothesis which states that there is no significant difference between upper and lower order cognitive test items used in 2021 Mathematics BECE is rejected. This means that the Mathematics objective test items used for lower and higher cognitive skills differ significantly in 2021 BECE in Delta State.

Furthermore, as shown in the table 4.16 above, the lower cognitive test with the mean of 6.67, S.D =5.05 has a mean difference of 3.33 over the higher order test that has a mean of 3.33, S.D =3.44. The mean difference of 3.33 was found to be significant at $p \leq 0.05$ level of significance. The conclusion was drawn that the effect size of 3.33 which was in favour of lower cognitive test indicates that more items was allocated to the lower order domain in Delta State 2021 BECE.

DISCUSSION

As shown in table 1, there is a significant difference in the mathematics objective test items used in 2021 BECE in Delta State and the objectives of the curriculum. This finding supports the work of Chinelo, and Osaze, (2016) that Junior Secondary School Mathematics test items have moderate internal consistency reliability and low in content validity. The low content validity in BECE may be due to the fact that BECE do not use test experts in the construction of Mathematics test items.

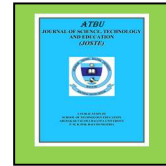
Furthermore, as also revealed in table 2, there is a significant difference between upper and lower order cognitive Mathematics test items used in 2021 BECE. This finding is in line with the study of Robin, et al. (2013) which revealed that that questions designed by examiners to assess students’ progress in a particular unit or curriculum were not given proper weights in the examination papers.

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RECOMMENDATIONS

The following recommendations were made based on the findings of the study; Delta State ministry of education should ensure that the Basic Education Certificate Examination test items are constructed in line with the Basic Education Curriculum in the various subjects. This will help to achieve the goals of Basic Education spelt out in the National policy on Education as revised in 2014. Also, that State Ministries of Education should place more emphasis on higher cognitive tests to enable students acquire higher order skills required for quality education and their survival in the society.

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