ITEM ANALYSIS OF UNIFIED MATHEMATICS EXAMINATION IN EKITI STATE, NIGERIA

BY

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Abstract
The study investigated the item analysis of the Unified Mathematics examination in Ekiti State. Specifically, the study examined the difficulty indices of the items and the discriminating power of the items. The descriptive research design of the survey type was used in this study. The population for this study consisted of 15,967 senior secondary two Students (SS2) in Ekiti State. The sample for the study consisted of 360 senior secondary students selected from 189 secondary schools in the state based on multistage sampling procedure. The instrument for the study was SS2 Unified Mathematics Promotion Examination which was adopted. The data collected was analyzed using difficulty index and discriminating power formulae to answer research questions. The study revealed that 2 items were classified as very difficult items, 28 items were classified as difficult items, 2 items were classified as moderately difficult while 13 items were classified as easy. Five items of the total 50 items were bad item with no key. The result further revealed that 21 items were classified as items having poor discriminating power, 3 items were classified as items with fair discriminating power, 7 items were classified as items with very good discriminating power and 14 items were classified as items with very good discriminating power. It was recommended that th P-values and D-values of the Examination should be done by experts before the administration of the examination.
Key words: Item analysis, Unified Mathematics Examination,

Introduction

Examinations are usually designed to assess students knowledge in particular content or materials. It is a measurement device or technique used to quantify behaviour or aid in the understanding and prediction of behaviour. Examination as noted by Opara (2014) is an instrument which is designed to measure the knowledge, intelligence, ability, traits, skills, aptitude, interest, attitude which an individual or thing exhibits. It is a systematic procedure for observing an individuals behaviour as well as describing such behaviour or performance by numerical scale or category. It is also observed by the researcher that majority of students find it difficult to pass Mathematics examination effectively. This implies that many students have developed examination phobia for the subject and as such attach negative attitude toward the subject which at times are extended toward the teachers handling them (Festus, 2014).

The State Government introduced the Unified examination when it was observed that majority of the students who performed well in the promotion examination to senior secondary III did not perform well in external examination. Some of the reasons adduce to this include inability of some teachers in some school to cover syllabus, lack of content validity of the promotion examination among others (Report of SSII Uniform Promotion Examination, 2009). Also, the standard used in promoting students varies from one school to another. Hence, the State Government introduced the Unified examination to have a common standard for the promotion of SS II students

to SSS III. Unified promotion examination serves as a mechanism to improve students performance in external examination.

The objectives of Unified promotion examination in Ekiti State schools are multi-dimensional: basically to improve the standard of teaching, make learning more meaningful, develop sound attitude and manipulations of skills among others. The present conduct of Unified promotion examination in the State seems to indicate that the objective of the 6-3-3-4 system of education have not been achieved because teachers no more involve in grading their students, but only concentrate on cognitive as observed by the researcher. Alonge (2004) observed that examination and assessment in the schools system today is being misinterpreted because parents and students have the impression that the importance of schooling is to obtain a certificate (either through fair or foul means) at the end of the course. In order to eradicate these problems, Unified Examination was introduced.

The Ekiti State Ministry of Education uses the result of the examination as standard across the secondary schools for promotion of students to SSIII. However, it has been observed that the items in the examination seem not to be standardized because they are not constructed by test expert. According to Adebule (2004), majority of the teachers do not give adequate attention and due consideration to the quality of the items they construct.

It is also observed by the researcher that Unified examination seems to have flaws not only that, the instruments used for this examination seems not to cover the entire syllabus. This seems to affect the validity of the items constructed because the content validity appears to be faulty and it might not be able to measure what it supposed to measure accurately. Such items seem not standardized and should not be used as a Uniform examination but they are using it.

There seems not to be proper coordination in terms of marking, scoring and the grading system. In standardized test, the grading is done by the test experts but in Unified examination, the grading system just follows the trend of SSCE standard viz: A1: Stanine 9, B2: Stanine 8, B3: Stanine7, C4: Stanine 6, C5: Stanine 5, C6: Stanine 4, D7: Stanine 3, E8: Stanine 2, and F9: Stanine 1. It implies that Stanine 1-3: Below Average (approx. 10-30%), Stanine 4-5: Average (approx. 30-60%), Stanine 6-8: Above Average (approx.60-90%), Stanine 9: Highly Above Average (approx. 90-100%) (Report of SSII Uniform Promotion Examination, 2009). The students raw score is graded using standard nine. According to Kolawole (2005), raw score is a poor way of reporting tests scores because it is unprocessed and unrefined which only shows the numbers of problem solved correctly by the students. As a result of this, such tests should not be used to compare the performance of students from one school to another.

The method of constructing Unified examination seems not to follow method of test construction and standardization. It is also observed that Unified examination can be regarded as a teacher-made test because the questions are set, administered, marked and graded by the teachers, and also coordinated by the Ministry of Education. In constructing standardized test, there should be table of specification which will guide the constructors to evenly distribute the items in line with the syllabus. Alonge (2004) says, in constructing blue-print that would assist classroom teacher in test construction, the following steps are to be taken: give an outline of the content and the objective of each test item; suggest what might be covered under each item; allocate percentage of the total test by content and objectives;

make decision on what types of test item to be used; specify the difficulty level of each item; specify the discrimination index of each item of the test; arrangement of the test items. It seems that Unified examination does not pass through these steps because it is just constructed by selected class teachers and not experts which might make the test unreliable.

Psychometric characteristics of examinations refer to certain attributes inherent in tests upon which an assessment of candidates is determined. These characteristics include the difficulty indices, the discriminating index, the power of distractor, validity and reliability indices. It is perhaps worth mentioning that these attributes of a test seems most often ignored and when this occurs, the items will not measure what it is supposed to measure correctly (Adebule, 2004).

Test items are indispensable tools in the evaluation of students achievement at school. According to Oshkosh (2002), item analysis (difficult and discriminating indices) is concerned with ascertaining the worth of the test items. Item analysis is based on the responses to individual items. He further considers Item Analysis as probably the most important tool to increase test effectiveness. It is a scientific way of improving the quality of tests, and test items in an item bank. An item analysis provides three kinds of important information about the quality of test items. *Item difficulty*, which measure whether an item is too easy or too difficult, also called facility index. *Item discrimination* measures whether an item discriminates between candidates who know the test well and candidates who do not. *Effectiveness of alternatives* determines whether distractor (incorrect but plausible options) tend to be chosen by the dull students and not by the brilliant students. It is therefore observed by the researcher that responses of students to each items of the examination seems not to be considered to know whether the items are good/bad, whether the items discriminate correctly between the bright/dull, and whether the incorrect options are chosen by the dull/brilliant candidates.

A good test should be able to differentiate the brilliant students from the dull students in terms of its difficulty and discrimination. This can only be realizable when tests are carefully constructed, administered and scored. Tests that are too difficult or too simple rarely make effective evaluation possible. Therefore, there is a need to assess and analyze the difficulty indices and discriminating powers of Unified Mathematics Examination conducted by Ekiti State Government to establish the quality of the items presented and administered on secondary school students for the purpose of promotion and placement.

Statement of the Problem

The Unified SSII examination conducted in Ekiti State and the way it is being used as standardized tests to select students for promotion to SSIII across secondary schools in Ekiti State seems to be inappropriate. There seems to be no correlation between the performances of students in the Unified Mathematics examination when compared with the external examination. Had it been there is proper coordination in the construction of the Unified examination items, and proper test trial is conducted on it before given it out to the public, all the flaws and the reasons for the persistent failure in the external examination would have been detected. It also seems that item analysis was not conducted because teachers ended their works on examination. As a result of this, to test whether the Unified examination is too difficult or not, discriminate between brilliant and dull students, seem to be unknown. It

also seems that the steps to test construction were not critically followed while constructing Unified Mathematics examination, because if this is done all the items would have covered the syllabus through the use of test blue-print.
Therefore, these factors constitute the need to analyze the Unified Mathematics promotion examination in Ekiti State.

Purpose of the Study
The study examined the item analysis of the Unified Mathematics examination in Ekiti State. Specifically, the study:
1. determine the difficulty index of the items;
2. determine the discriminating power of the items; and

Research Questions
The following research questions were used to guide this study:
1. What are the difficulty indices of the Unified Mathematics examination?
2. What are the discriminating indices of the Unified Mathematics examination?

Methodology
This study employed descriptive design of the survey type. The design was considered appropriate because this approach allows information to be obtained from a sample of the population in the actual situation as they exist. The design was considered appropriate because it focuses on the observations and perception of the existing situation. A survey research studies a small sample from a large population from where inferences would be drawn about the characteristics of the defined population. Therefore, the survey research provides conceptual and methodological design for investigating the problem of the study.

The population for this study consisted of 15,967 students in all Senior Secondary School two Students in Ekiti State. The state comprises of 16 Local Government Areas and it is divided into three senatorial districts which include North, South and Central. The total number of Senior Secondary Schools in Ekiti State is 189 as at the time of this study. (Source: Ekiti State Ministry of Education, Science and Technology)
The sample for the study consisted of 360 senior secondary school students selected from 189 secondary schools in the state using multistage sampling procedure.

In the first stage, two Local Government Areas were randomly selected from each of the three senatorial districts in the state. In the second stage, two senior secondary schools were selected from each selected LGA using simple random sampling technique. In the third stage, 30 students were randomly selected from each of the sampled schools using stratified random sampling technique comprising of 15 male and 15 female students.
The instrument for the study was the Unified Mathematics Promotion Examination constructed by Ekiti State Ministry of Education for 2017/2018 session. The instrument was adopted. The examination consisted of 50 objective items with four options.

The data collected was analyzed using difficulty index and discriminating power formulae to answer research questions. The Kuder-Richardson 20 (Kr-20) was used to determine the internal consistency of the instrument.

Results
Question 1: What are the difficulty indices of test items of the Unified examination?
Rule of thumb
1. Difficulty: 0.21-0.50
2. Easy Item: 0.80-1.00
3. Moderately difficult Item: 0.50-0.80
4. Very difficult Item: 0.00-0.20

Table 1: Difficulty indices of Mathematics test items of the unified examination

Item	Difficulty Index	Remark	Item	Difficulty Index	Remark
1	-	Bad Item	**26**	1.00	Easy
2	0.37	Difficult	**27**	0.25	Difficult
3	0.39	Difficult	**28**	0.29	Difficult
4	0.45	Difficult	**29**	1.00	Easy
5	0.56	Moderately Difficult	**30**	1.00	Easy
6	1.00	Easy	**31**	1.00	Easy
7	0.28	Difficult	**32**	0.29	Difficult
8	-	Bad Item	**33**	1.00	Easy
9	1.00	Easy	**34**	0.28	Difficult
10	0.24	Difficult	**35**	0.60	Moderately Difficult
11	0.49	Difficult	**36**	0.26	Difficult
12	0.18	Very Difficult	**37**	1.00	Easy
13	0.39	Difficult	**38**	1.00	Easy
14	0.25	Difficult	**39**	-	Bad Item
15	-	Bad Item	**40**	0.20	Very Difficult
16	0.35	Difficult	**41**	0.28	Difficult
17	0.40	Difficult	**42**	0.40	Difficult
18	-	Bad Item	**43**	0.37	Difficult
19	0.34	Difficult	**44**	1.00	Easy
20	1.00	Easy	**45**	0.38	Difficult
21	0.27	Difficult	**46**	1.00	Easy
22	0.25	Difficult	**47**	0.24	Difficult
23	0.30	Difficult	**48**	0.44	Difficult
24	0.36	Difficult	**49**	1.00	Easy
25	0.30	Difficult	**50**	0.38	Difficult

Table 1 provides the action to be taken on each of the items in the test; the actions to be taken were based on the difficulty index of each of the items. Items with acceptable difficulty index are retained; items with moderate difficulty index are revised while items with poor difficulty index are deleted. Items 2, 3, 4, 5, 11, 13, 16, 17, 19, 23, 24, 25, 35, 42, 43, 45, 48 and 50 were accepted and retained. Items , 7, 10, 14,21, 22, 27, 28, 32, 34, 36, 41 and 47 need to be revised and corrected while items 1, 6, 8, 9, 12, 15, 18, 20, 26, 29, 30, 31, 33, 37, 38, 39, 40, 44, 46 and 49 were deleted. In all 18 items representing 36% of the total items were retained, 12 items representing 24% of the total items need to be revised while 20 items representing 40% of the total items were deleted.

The remark was based on classification done by Schreyer Institute Testing Centre, where items with difficulty index of 0 - 0.20 are classified as very difficult, items with difficulty index of 0.21 — 0.50 are classified as difficult, items with difficulty index of 0.51 — 0.80 are classified as moderately difficult, and items with difficulty index of 0.81 — 1.00 are classified as easy.

Table 2: Classification of difficulty indices of Mathematics test items of the unified examination

S/N	CLASSIFICATION	NO OF ITEMS	PERCENTAGE
1	Very Difficult (0.00 — 0.20)	2	4.00
2	Good items (moderately Difficult) (0.21 — 0.50)	30	60.00
3	Easy (0.81 — 1.00)	13	26.00
4	Bad items (0.00)	5	10.00
	Total	**50**	**100.00**

Table 2 shows the summary of the difficulty indices of test items of the Unified examination. Two items representing 4% are classified as very difficult items, 30 items representing 60% are classified as good and moderately difficult items, while 13 items representing 26% are classified as easy. Five items of the total 50 items representing 10% were bad items because they are not functional. The graph below further shows the summary of the difficulty indices of test items of the Unified examination.

Question 2: What are the discriminating powers of the Unified Mathematics examination?

Table 3: Analysis of discriminating powers of Mathematics test items of the Unified examination

Item	Discriminating Powers	Remark	Item	Discriminating Powers	Remark
1	-	Not functional	**26**	0.000	Poor
2	0.509	Very good	**27**	0.272	Fair
3	0.206	Poor	**28**	0.316	Good
4	0.372	Good	**29**	0.000	Poor
5	0.441	Very good	**30**	0.000	Poor
6	0.000	Poor	**31**	0.000	Poor
7	0.459	Very good	**32**	0.404	Very good
8	-	Not functional	**33**	0.000	Poor
9	0.000	Poor	**34**	0.021	Poor
10	0.365	Good	**35**	0.405	Very good
11	0.347	Good	**36**	0.435	Very good
12	0.144	Poor	**37**	0.000	Poor
13	0.380	Good	**38**	0.000	Poor
14	0.132	Poor	**39**	-	Not functional
15	-	Not functional	**40**	0.033	Poor
16	0.508	Very good	**41**	0.417	Very good
17	0.237	Fair	**42**	0.473	Very good
18	-	Not functional	**43**	0.413	Very good
19	0.400	Very good	**44**	0.000	Poor
20	0.000	Poor	**45**	0.331	Good
21	0.095	Poor	**46**	0.000	Poor
22	0.211	Poor	**47**	0.264	Fair
23	0.430	Very good	**48**	0.275	Fair
24	0.514	Very good	**49**	0.000	Poor
25	0.409	Very good	**50**	0.319	Good

Table 3 provides the action to be taken on each of the items in the test; the actions to be taken were based on the discriminating power of each of the items. Items with acceptable discriminating power are retained; items with fair discriminating power are revised while items with poor discriminating power are deleted.

Items 2, 4, 5, 7, 10, 11, 13, 16, 19, 23, 24, 25, 35, 42, 43, 45 and 50 were accepted and retained. Items 3, 17, 22, 27, 28, 32, 36, 41, 47 and 48 need to be revised and corrected while items 1, 6, 8, 9, 12, 14, 15, 18, 20, 21, 22, 26, 29, 30, 31, 33, 34, 37, 38, 39, 40, 44, 46 and 49 were deleted. In all 17 items representing 34% of the total items were retained, 10 items representing 20% of the total items need to be revised while 23 items representing 46% of the total items were deleted.

Rules of thumb for discriminating index

D-value	Item Evaluation
1.00	All the students in the upper group got it right while all in the lower group got it wrong
0.40 and above	Very good item
0.30 — 0.39	Reasonably good but subject to possible improvement Marginal item (subject to improvement poor item to be rejected.
0.29 — 0.38	Very poor item (a lot of improvement) To be rejected.
0.20 — 0.28	It does not discriminate
Below 0.19	
0.0	

Table 4: Summary of Classification of discriminating powers of Mathematics test items of the Unified examination

S/N	CLASSIFICATION	NO OF ITEMS	PERCENTAGE
1	Poor (<0.250)	21	42.00
2	Fair (0.251 — 0.300)	3	6.00
3	Good (0.301 — 0.400)	7	14.00
4	Very good (0.401 — 1.000)	14	28.00
5	Bad Items (0.00)	5	10.00
	Total	**50**	**100.00**

Table 3 and 4 shows the discriminating powers of the Unified examination. The discriminating power in table 3 is the discriminating indices of test items of the Unified examination. The remark was based on classification done by Schreyer Institute Testing Centre, where items with discriminating index of 0.0 — 0.250 are classified as very poor discriminating power, items with discriminating index of 0.251 — 0.300 are classified as fair discriminating power, items with discriminating index of 0.301 — 0.400 are classified as good discriminating power, and items with discriminating index of 0.401 — 1.000 are classified as very good discriminating power.

Table 4 shows the summary of the discriminating power of test items of the Unified examination. Twenty one items representing 42% are classified as items having poor discriminating power, 3 items representing 6% are classified as items with fair discriminating power, 7 items

representing 14% are classified as items with good discriminating power while 14 items representing 28% are classified as items with very good discriminating power. Five items of the total 50 items representing 10% were Bad items since it is not functional.

Discussion

The findings revealed that items of the Unified Mathematics Examinations maintained different difficulty indices. 2 items were classified as very difficult items, 28 items were classified as difficult items, 2 items were classified as moderately difficult while 13 items were classified as easy. Five items of the total 50 items were not functional since it has no key. This finding is in consonance with the findings of Joe-Kinanee and Orluwene (2017) who concluded that the Junior Secondary School Certificate Examination (JSSCE) for Mathematics varies in their difficulty index. However, this finding contradicted the psychometric properties of WAEC and NECO Mathematics as reported by Kolawole (2007) who concluded that all their items maintained the same difficulty level. Based on the criteria set for 2018 Unified examination items analyses, all the items did not have good difficulty indices. The difficulty indices observed could be attributed to unfamiliarity of the questions to the students, test questions may have been too challenging relative to the ability of the students. This prevented the students from performing up to expectation.

It was also revealed that the discriminating power of the Unified Mathematics Examination were not the same. 21 items were classified as items having poor discriminating power, 3 items were classified as items with fair discriminating power, 7 items were classified as items with good discriminating power while 14 items were classified as items with very good discriminating power. Five items of the total 50 items were not functional since it has no key. This finding contradicted the psychometric properties of WAEC and NECO Mathematics as reported by Kolawole (2007) who concluded that all their items maintained the same discriminating power. However, Joe-Kinanee and Orluwene (2017) finding supported the present finding as they concluded that the Junior Secondary School Certificate Examination (JSSCE) for Mathematics vary in their discriminating power. Almost half of the Unified examination items did not discriminate between the brilliant and the dull students, which indirectly means that some items were too cheap that allowed both the dull and the brilliant to get the same items right.

Recommendations

Based on the findings of this study, the following recommendations were made.

1. It was recommended that the P-values of the Examination should be done by experts before the administration of the examination.

2. It was recommended that the D-values of the Examination should be done by experts before the administration of the examination.

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