EQUIPERCENTILE EQUATING OF WAEC, NECO AND NABTEB SENIOR SCHOOL CERTIFICATE MULTIPLE CHOICE TEST ITEMS IN ECONOMICS

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Abstract

This study investigated equipercentile equating of WAEC (West African Examinations Council), NECO (National Examinations Council) and NABTEB (National Business and Technical Examinations Board) Senior School Certificate Multiple Choice Test Items in Economics. A Non-Equivalent Groups Anchor Test (NEAT) design of test score equating was adopted for the study. Sample for the study consisted of 1,119 senior secondary three students drawn from 30 selected secondary schools in Kwara State through multi-stage sampling technique. The 2009 WAEC, NECO and NABTEB SSCE multiple-choice Economics papers were adapted and used for data collection. Coefficients of content validity of 0.67, 0.64, and 0.60 as well as reliability of 0.79, 0.67 and 0.70 were obtained respectively. Data collected were analyzed using means and Percentiles. Findings of the study revealed that respondents' performance on the common items of WAEC, NECO and NABTEB were not different ($\overline{X}_{WA=}$ 1 0.98; $\overline{X}_{NE=}$11.30; $\overline{X}_{NA}$ =11.28) and respondents performed differently in unique items across the test forms ($\overline{X}_{WA=}$35.45 < $\overline{X}_{NE=}$36.40 < $\overline{X}_{NA}$ = 41.54). In addition, the finding showed that score of 54 in WAEC was equivalent to 57 and 60 in NECO and NABTEB respectively which corresponded to the percentile rank of 93. Based on these findings, the researchers recommended that equating method with lower coefficient of variation should be employed for equating scores by examining bodies in Nigeria and a regulatory body to standardize and monitor examinations conducted by the examining bodies should be established in Nigeria.

Keywords: Equipercentile Equating, WAEC, NECO, NABTEB, Multiple-Choice Test Items

Introduction

Equating process is used to obtain comparable scores when more than one test forms are used in test administration. The goal of score equating is to allow the scores from both tests to be used interchangeably. Kolen and Brennan (2004) pointed out that the process of equating is used to ensure that scores resulting from the administration of the multiple forms can be used interchangeably. Thus, they defined equating as

empirical procedures for establishing a relationship between raw scores on two test forms that can then be used to express the scores on one form in term of the scores on the other form. In equating process, the role of common/anchor items and unique items cannot be overemphasized.

Common/Anchor items are items common to all the tests forms, kept in the same position and are expected to remove any bias. In order to determine to what the differences in total scores are attributable, test forms are constructed with items in common (common items, anchor items or linking items) between test forms. The anchor items or test can be considered as part of each of the test forms or as a separate test. When it is considered as a part of each of the test forms it is called internal anchor and the items are used in the computation of the score of the test to be equated but, if it is considered as separate test, it is called external anchor and the items do not play a role in the computation of the test scores. An advantage of internal anchor over external anchors is that their correlations with the test being equated are usually high because the anchor items contribute to the total scores. Longer anchors are usually more reliable and more highly correlated with the tests (Dorans, Moses & Eignor, 2010). In this study, the researcher used internal anchor. In addition, unique items are items peculiar to each test form. In this study, the unique items are items peculiar to FORM A items (WAEC items), FORM B items (NECO items) and FORM C items (NABTEB items). There are different types of equating.

Equipercentile equating is the second type of equating in classical test theory (CTT) equating approach. It is used when two test forms X and Y, are equally reliable and parallel measures in the sense that both forms are measures of the same underlying trait and the percentile ranks of the two sets of scores from form X and Y can be considered to be equal. Equipercentile equating can be used to put two test scores, X and Y, on to the same scale when they share the same percentile in equivalent groups. It is also necessary that both tests X and Y measure the same ability. The basic principle of frequency estimation equipercentile equating is that, in two groups of equal ability, one taking each test, equal percentile ranks indicate equal ability, whatever the corresponding raw scores may be (Skaggs & Lissitz, 1986).

According to Kingston and Holland (1986), equipercentile equating provides a transformation such that scores from two tests will be considered equated if they correspond to the same percentile rank in a specified population of examinee. To equate scores on the new form to scores on the reference form in a group of test-takers, scores on the new form is to be transformed to the score on the reference form that has the same percentile rank in that group (Livingston, 2004). This means that every score on the new form is adjusted to be equal to the raw score on the reference form that has the same percentile rank in the target population. Equipercentile equating methods are described as a two stage process. The first stage is carried out by tabulating or plotting the relative cumulative frequency distribution of the scores for the two forms to be equated. The second stage is to obtain the equated scores by smoothing to remove sample irregularities where the number of test takers is not large."

The frequency estimation equipercentile equating procedure is employed by directly equating two test forms, tests X and Y. However, test X and test Y can also be equated indirectly through a third test (test V). This procedure is referred to as the chained equipercentile equating (Dorans, Moses & Eignor, 2010). Kolen and Bennan (1995) describe that this indirect procedure is referred to as the chained equipercentile equating because it involves "a chain of two equipercentile equatings, one in population 1 and another in population 2". The first step in this procedure is to convert the scores of form X to the scores of common items based on the responses of the students in population 1. The second step is to convert the scores of the common items obtained from the first step to the scores of form Y based on the responses of the students in population 2. The third step will link the two conversions produced in steps 1 and 2 to obtain the conversion of form X to form Y scores (Livingston 2004). In this study, equipercentile equating refers to transformation method that considered examinees scores in WAEC, NECO and NABTEB Economics Multiple Choice (MC) items equated as they correspond to the same percentile rank.

In Nigeria, examination bodies such as West African Examinations Council (WAEC), Joint Admissions and Matriculation Board (JAMB), National Business and Technical Examinations Board (NABTEB), National Examinations Council (NECO), National Teachers' Institute (NTI), among others conduct public examinations. In this study, WAEC, NECO and NABTEB are the focus of the study. Their historical briefs are as follows:

West African Examinations Council (WAEC)

West African Examinations Council (WAEC) was established in 1952. West African Senior School Certificate Examination (WASSCE) is a Senior School Certificate Examination (SSCE) conducted by West African Examination Council. West African Examinations Council (WAEC) is one of the examination bodies authorized by the Nigerian law to conduct the Senior Secondary School Certificate Examination (SSSCE), General Certificate Examination (GCE) and other exams. Its headquarters is in Accra, Ghana while the Nigeria headquarters is in Yaba, Lagos (WAEC Diary, 2004). The West African Examinations Council (WAEC) as an international organization has undoubtedly played a unique role in West Africa.

National Examinations Council (NECO)

Also, the National Examinations Council (NECO) was established in April, 1999 with the sole responsibility of conducting the Senior School Certificate Examination (SSCE), hither-to being conducted by West African Examinations Council (WAEC) (WAEC, 2007) but only in Nigeria. The National Examination Council (NECO) conducted its maiden June/July SSCE in the year 2000 and has since continued to conduct Senior School Certificate Examination (SSCE) twice in a year (June/July and November/December) alongside with the West African Examinations Council (NECO, 2007).

National Business and Technical Examinations Board (NABTEB)

The National Business and Technical Examinations Board (NABTEB) was established in 1992 with the promulgation of Decree 70 of August 1993. The Board was charged with the responsibility to conduct examinations leading to the award of National Technical Certificate (NTC), National Business Certificate (NBC), Advanced National Business Certificate (ANBC), Advanced National Technical Certificate (ANTC), Advanced National Business Certificate (ANBC) and Modular Trade Certificate (MTC). The National headquarters of the Board is located in Benin City, Edo State (NABTEB, 2017).

The Senior Secondary Certificate Examination (SSCE) conducted by WAEC, NECO and NABTEB are essentially for certification and they are public examinations. Public examinations are examinations that are conducted by recognized examining bodies such as WAEC. Obioma and Salawu (2007), viewed public examination as external school examinations open to the general public and conducted by certain bodies using test that have appropriate psychometric properties.

The common form of test used by statutory examining bodies like WAEC, NECO and NABTEB for external assessment is of the objective, essay and practical variants. However, WAEC, NECO and NABTEB make use of multiple-choice tests in their papers. Multiple-choice tests are becoming more and more popular particularly in public examinations. Multiple-choice tests are not only popular in external examinations; they also play a crucial role in assessment processes in the school system (Olutola, 2015). This may be because they ease and objectifies the assessment procedures. Multiple-choice tests are widely acclaimed as most reliable because of consistency in scoring the test as well as its fairness to all students (Osunde, 2009). Multiple-choice tests discourage the learner's tendency to anticipate likely questions but encourage them to cover the whole contents taught in their preparations. They are also useful in assessing learners' mastery of specific- facts, concepts, terms, laws and principles (Lawal, 2001 & Kolawole, 2005). According to Kolawole (2005), multiple-choice tests require students to select the answer from a number of possible alternatives. Multiple-choice items give the fairest opportunity to testees to prove their competence and testers to prove their integrity. Its objectivity is both in terms of development and in terms of scoring as

items cover wider curriculum contents and objectives of instruction. It is adjudged as having good validity since it has the tendency to cover all aspects of learning content (Alonge, 2003 & Lawal, 2001).

WAEC, NECO and NABTEB used multiple-choice tests in their Economics test items. Economics is one of social science subjects offer by the students in senior secondary schools in Nigeria. According to Hansen (2001) Economics is one of the few social science subjects that heavily utilize statistical and mathematical models to analyze real-life economic problems. Economics is a social science that studies human behaviours in their effort to allocate scare resources efficiently and effectively in order to minimize cost (Amaechi, 2015). Moreover, the significance of the study of economics in the economic development of any nation, especially the developing country such as Nigeria cannot be overemphasized. However, since 1990 up to date the performance of students in economics is contrary to the expectation. The senior school Certificate Examination (SSCE) result of 1990s to date shows how majorities of students, fell within pass grades (P7 and P8 or D7 and D8) which cannot qualify them for admission into any higher institution of learning (WAEC 2003). Olatunji (2007) attributed students' poor performances in economics to a number of factors such a item difficulty, lack of validity and reliability, scope and depth of syllabus, difficulty level of certain concepts and teachers ineffectiveness.

The three examining bodies (NECO, WAEC & NABTEB) prepare the syllabi that will entertain a uniqueness of goals and purposes in the senior school certificate examination. The question then is, could the scores yielded from different tests measuring the same construct be comparable to each other? In reality, it is virtually impossible to construct multiple forms of test that are strictly parallel. Thus, statistical process of determining comparable scores on different test forms should be applied. Therefore, this study investigated equipercentile equating of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice Test Items in Economics.

Statement of the Problem

It is virtually impossible to develop multiple forms of test that have exactly the same psychometric properties. Some stakeholders seem to have the impression that anyone with NECO or NABTEB SSCE results is half baked and to them only WASCE is qualitative enough for acceptance. In Nigeria, some studies have indicated doubt about the quality of the Senior Secondary School Certificate Examinations. Oni (2001) pointed out that there are vast differences in the quality of certificate examinations conducted by the various examination bodies. Eze (2002), Olutola (2011), Olatunji (2007), Alfred (2011) remarked that the standard of SSCE conducted by NECO is low compared to SSCE conducted by WAEC. Moreover, some tertiary institutions and employers of labour tend to prefer students with credit passes in the SSCE conducted by WAEC to those conducted by NECO and NABTEB. They believed that the SSCE conducted by WAEC has higher standard than the SSCE conducted by NECO (Okoro, 2004). It is therefore, necessary to conduct a study on conversion of units of WAEC, NECO and NABTEB for common comparison to establish whether this assertion is true. Thus, this study statistically analyzed equipercentile equating of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice Test Items in Economics.

Objective of the Study

The main objective of this study is to analysis the equipercentile equating of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice Test Items in Economics. Specifically the study examined the:

i. form of students' performance on the common items of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice Test Items in Economics;

ii. form of students' performance on the unique items of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice Test Items in Economics;

iii. results of equipercentile equating of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice Test Items in Economics with the use of percentile rank.

Research Questions

This study provided answers to the following research questions:

i. What is the form of students' performance on the common items of WAEC, NECO and NABTEB Senior School Certificate multiple-choice test items in Economics?
ii. What is the form of students' performance on the unique items of WAEC, NECO and NABTEB Senior School Certificate multiple-choice test items in Economics?
iii. What are the results of equipercentile equating of WAEC, NECO and NABTEB Senior School Certificate multiple-choice test items in Economics with the use of percentile rank?

Methodology

The researchers adopted a Non-equivalent Groups Anchor Test (NEAT) design of test score equating for this study because the study is designed to equate WAEC, NECO and NABTEB Senior School Certificate multiple choice test items in Economics. All public senior secondary school students in Kwara State constituted the population for the study. Kwara State is one of the states in Nigeria and its capital is Ilorin. It is located in the North Central of Nigeria and Agriculture is the main source of economy of the state. The primary ethnic group of the state is Yoruba with significant Nupe, Bariba and Fulani minorities. The target population for this study consists of senior secondary school three (SS3) students in Kwara State.

Multi-stage sampling technique was adopted for the study. The schools were stratified along the three Senatorial Districts in Kwara State. Ten percent (10%) of the total public senior secondary school in each Senatorial District was proportional selected. Seven (7), Eight (8) and Fifteen (15) public senior secondary schools were selected in Kwara North, Kwara Central and Kwara South respectively. Thus, thirty (30) public senior secondary schools were selected for the study. Purposive sampling technique was used to select respondents in each of the public senior secondary schools selected for the study and intact class was used. 264 (23.6%) respondents were selected in from Kwara North, followed by Kwara Central with 478 (42.7%) while Kwara South had 377 (33.7%) respondents. A total of one thousand one hundred and nineteen (1,119) students participated in the study.

The researcher adopted 2009 WAEC (Form A), NECO (Form B) and NABTEB (Form C) Economics Multiple choice papers were adopted for data collection and composed into independent and anchor tests for this study. Each test form has unique items and also shared a set of twenty common items located at numbers 11-30 in each test form. Test forms A, B and C contained 30, 40 and 30 WAEC, NECO and NABTEB MC items (unique items) respectively and each form also contained 20 MC items (common items). The researcher determined the reliability of the instruments (test forms A, B, & C) through the measures of internal consistency. A split-half method of estimating reliability was employed. The following coefficients of reliability were obtained 0.79, 0.67 and 0.70 as well as coefficients of content validity of 0.67, 0.64, and 0.60 for forms A, B and C respectively. This shows that the instruments are reliable. The researchers used these Economics Multiple choice papers because they were interested in equating the Nigerian Senior Secondary School Certificate Examination (SSCE) Economics Multiple Choice papers of the three different examination bodies. The data collected were analyzed with respect to the three research questions generated for the study. Mean was used to answer research questions one and two while research questions three was answered using percentile rank.

Results and Discussion

Answers to Research Questions

Research Question One: *What is the pattern of students' performance on the common items of Senior School Certificate Economics multiple-choice papers?*

Students scores in common items of test form A, B and C were independently summed and their mean and standard deviation was computed.

Table 3: Mean of respondents' pattern of performance in common items

Test Form	*Mean*	*Maximum*	*Minimum*	*Standard Deviation*
Form A	10.98	17	5	2.44
Form B	11.30	17	5	2.38
Form C	11.28	17	5	2.38

Table 3 revealed 10.98 as the mean performance of respondents in common items in test form A, while the mean performance of respondents in common items in test form B & C are 11.30 and 11.28 respectively. Also, 17 and 5 were shown as the respondents highest and least scores in common items in the three test forms while standard deviations of 2.49, 2.38 and 2.38 were revealed for forms A, B and C respectively. This implies that there is no difference in examinees' ability or proficiency, thus equating process can take place.

To ensure that condition for equating using Non-equivalent method is not violated respondents scores in common items were subjected to One-way ANOVA.

Table 4: ANOVA summary table of respondents' performance in SSCE common items

Source	***Sum of Squares***	***df***	***Mean Square***	***F***	***p-value***	***Decision***
Between Groups	22.812	2	11.406			
Within Groups	6518.348	1116	5.841	1.953	.142	**NS**
Total	**6541.160**	**1118**				

Table 4 reveals an F-value of 1.953, which is not significant at 0.05 alpha level since p-value is greater than 0.05 (.142>0.05). It implies that respondents are not statistically different in proficiency/ability. This is a further confirmation that equating process can take place

Research Question Two: *What is the pattern of students' performance on the unique items of Senior School Certificate Economics multiple choice papers?*

Students scores in unique items of test form A, B and C were independently converted to percentage, summed and were subjected to mean, standard deviation, maximum, minimum, skewness and kurtosis

Table 5: Descriptive statistics of pattern of students' performance on unique items

Test Form	***Mean***	***Std. D.***	***Maximun***	***Minimum***	***Skewness***	***Kurtosis***
Form A	35.45	5.23	47	24	.136	-.822
Form B	36.40	6.44	54	15	.203	-.220
Form C	41.54	8.71	56	5	-.1.83	4.295

Table 5 shows the performance of the students on the unique items. Respondents in form C with mean performance of 41.54, skewness of -1.83 and kurtosis of 4.295 has the best performance because the skewness value of -1.83 indicated that mass of the scores clustered to the right at the high values. Kurtosis value of 4.295 indicated a sharp peak of which the distribution concentrated on the right values. Respondents in form B have better performance with mean of 36.40, skewness of .203 and kurtosis of -.220 while a least mean performance of 35.45 was recorded by the respondents in form A with skewness of .136 and kurtosis of -.822. Positive skewnesses indicate that mass of the scores clustered to the left at the low values. This implies that there is a difference in pattern of students' performance in unique items across the test forms. A higher mean performance and negative skewness value of students in the test form C indicated that it is relatively easy compared to test form A & B.

Research Question Three: *What are the results of equipercentile equating of WAEC, NECO and NABTEB Senior School Certificate Economics multiple choice papers with the use of percentile rank?*

The percentile rank of students' scores in each of the test form A, B and C were independently computed and was used as scale on which examinees raw score in each of the test form was compared.

Table 6: Equipercentile Equating of WAEC, NECO and NABTEB SSCE Multiple-Choice Papers

Percentile Rank	*Student's raw score in WAEC*	*Student's raw score in NECO*	*Student's raw score in NABTEB*
1	-	-	20
2	-	-	
3	-	-	29
4	-	39	32
5	39	-	37
6	-	-	-
7	-	-	39
8	-	-	-
9	-	-	-
10	-	-	40
11	-	40	42
12	40	-	45
13	-	-	46
14	-	41	47
15	-	-	-
16	-	-	-
17	41	42	48
18	-	-	-
19	42	-	-
20	-	-	-
21	-	-	49
22	-	-	-
23	-	-	-
24	-	-	
25	-	-	-
26	-	44	-
27	-	-	-
28	-	-	
29	-	-	50
30	-	-	-
31	44	-	-
32	-	-	-
33	-		-
34	-	-	-
35	-	-	-
36	-	-	51
37	-	45	52
38	-	-	54
39	-	-	-
40	-	-	-
41	-	-	-
42	-	-	46
43	-	46	-
44	45	-	-
45	-	-	-
46	-	-	-
47	-	-	-
48	-	-	-
49	-	-	-
50	-	-	-
51	46	47	55
52	-	-	-
53	-	-	-
54	-	-	-
55	-	-	56
56	-	48	-
57	-	-	-
58	47	-	-
59	-	-	-
60	-	-	-
61	-	49	-
62	-	-	-

63	-	-	-
64	48	-	-
65	-	40	-
66	-	-	-
67	-	51	57
68	-	-	-
69	49	-	-
70	-	-	-
71	-	52	-
72	-	-	-
73	50		-
74	-	-	-
75	-	-	58
76	-	-	-
77	-		-
78	-		-
79	-		-
80	-		-
81	52	53	-
82	-	-	-
83	-		-
84	-	-	59
85	-	-	-
86	-	54	-
87	-	55	-
88	-	-	-
89	-	-	-
90	53	56	-
91	-		-
92	-		-
93	54	57	60
94	-	58	-
95	-	59	-
96	-	-	-
97	56	60	61
98	-	62	-
99	-	63	65

In order to clearly established the outcome of Equipercentile Equating the summary of equated scores of WAEC, NECO and NABTEB were presented in Table 7

Table 7: Summary of comparison of Equipercentile equating of SSCE multiple-choice papers

WAEC (Form A)	*NECO (Form B)*	*NABTEB (Form C)*
41	42	48
46	47	55
54	57	60
56	60	61

Table 7 revealed that scores of 41 in WAEC is equivalent to 42 and 48 in NECO and NABTEB respectively and a score of 46 in WAEC is equivalent to 47 and 55 in NECO and NABTEB respectively. In the same vein, score of 54 in WAEC is equivalent to 57 and 60 in NECO and NABTEB respectively while a score of 56 in WAEC is equivalent to 60 and 61 in NECO and NABTEB respectively.

Discussion of Findings

It was found out that the respondents are similar in proficiency because their scores on common items on the three test forms A, B & C are 10.98, 11.30, and 11.28 respectively. This implies that the conditions for carrying out scores equating for WAEC, NECO and NABTEB multiple choice items in Economics was not violated. This is supported by Doran, Moses and Eignor (2010) which noted that examinees that take different test forms were the same in proficiency if they have the same distribution of common items scores on different test forms taken. The researchers also submitted that differences in difficulty are what test score

equating take care of but, differences in examinees ability or proficiency is a confounding factor that needs to be eliminated before the equating process can take place.

This study also revealed differences in respondents' performance in unique items across the test forms. This finding is consistent with Kolen and Brennan's (2004) submission that it is virtually impossible to construct multiple forms of tests that are strictly parallel. Hence, equating is necessary because it adjusts for differences in difficulty among or across test forms constructed to be similar in difficulty and content just like the senior school certificates examinations investigated.

Findings on equipercentile equating of WAEC, NECO and NABTEB Senior School Certificate Economics multiple choice papers with the use of percentile rank revealed that score of 41 in WAEC (Form A) is equivalent to 42 and 48 in NECO (Form B) and NABTEB (Form C) because they corresponded to the same percentile rank (17). This finding is consistent with the submission of Olatunji (2007) that Economics multiple choice items constructed by WAEC is significantly better than that of NECO in terms of difficulty level. The reason for this is not far-fetched, WAEC has been in operation for long and practice they say makes perfect. The result was contrary to Ogunjemilua (2001) submission that the psychometric properties of WAEC and NECO in Mathematics multiple-choice items were not significantly different but, the finding is support Alfred (2007) submission that multiple choice items constructed by WAEC, NECO and NABTEB are significantly different in terms of difficulty level. In addition, the result of equipercentile equating also revealed that score of 54 in WAEC is equivalent to 57 and 60 in NECO and NABTEB respectively because they corresponded to the same percentile rank (93). This finding is not consistent with the submission of Bandele and Adewale, (2013) that there is no significant difference in the difficulty level, reliability and validity coefficients of mathematics items constructed by WAEC, NECO and NABTEB.

Conclusion

The researchers concluded that, in order to eliminate comparison between the examinations conducted by these examining bodies and the certificate awarded to their candidates, examining bodies especially WAEC, NECO and NABTEB must put more attention on equating process of their papers in other to avoid unnecessary comparison of their papers and certificates by stakeholders. All these findings can lead to achievement of desired objectives of the Government in establishing these examining bodies.

Recommendations

Based on the findings and conclusions drawn in this study, the following recommendations were made:

i. Quality of items used by each of the examining bodies should be investigated thoroughly.
ii. A regulatory body to standardize and monitor examinations conducted by the examining bodies should be established in Nigeria.

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