EQUIPERCENTILE EQUATING OF WAEC, NECO AND NABTEB SENIOR SCHOOL CERTIFICATE MULTIPLE-CHOICE ECONOMICS EXAMINATIONS IN NORTH WEST, NIGERIA

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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 Economics Examinations in North West, Nigeria. A Non-Equivalent Groups Anchor Test (NEAT) design was adopted for the study. The population comprised 404,521 public senior secondary school students of 2023/2024 academic session and a target population of 216,001in which a sample of 1,532 SSII Economics students was drawn through multi-stage sampling procedure. The instruments used for data collection were the adapted 2023 WAEC, NECO, and NABTEB SSCE multiple-choice Economics papers with reliability coefficient of 0.75, 0.89, and 0.88 respectively obtained by the researcher using split half method. The research questions were answered using descriptive statistics of mean, standard deviation and percentile rank. Findings revealed that there was no significant difference in the respondents performance on common items across the three examinations ($\bar{X}_{WA} = 2.121$; $\bar{X}_{NE} = 2.114$; $\bar{X}_{NA} = 2.504$), conversely, performance on unique items varied across the test forms ($\bar{X}_{WA} = 7.30 < \bar{X}_{NE} = 7.40 < \bar{X}_{NA} = 8.34$), with form C exhibiting the highest mean performance and form A the least performance. Equipercentile equating finding showed that score varies across the three test forms with notable wide gap of 2 to 22, but the scores were consistent at 22 above. Based on these findings, the researchers recommended a detailed analysis of the unique items and as well further investigation of score distributions on equipercentile method due to the large gaps of equated scores observed, also to include establishment of a regulatory body to monitor and standardize these examinations conducted in Nigeria.

Keywords: Equipercentile Equating, WAEC, NECO, NABTEB, Items.

Introduction

The West African Examinations Council (WAEC), National Examinations Council (NECO), and National Business and Technical Examination Board (NABTEB) are the primary bodies administering the Senior School Certificate Examination (SSCE) in Nigeria. NECO, NABTEB and WAEC carry out the summative evaluation of the Criterion Referenced Tests (Olutola, 2015). These organizations issue Senior School Certificates upon successful completion of the SSCE. In the context of test equating, these bodies can be considered different test forms. Test equating is a statistical process employed to ensure score

comparability when multiple test forms are used, allowing scores to be used interchangeably despite potential differences in test difficulty as highlighted by Daramola et al. (2022) and Kolen and Brennan (2014). This process is considered crucial as tests are designed to measure the quality, ability, skill or knowledge of a sample against a given curriculum standard (Adom, Mensah & Dake, 2020).

However, a significant challenge arises from the public's perception of these examination bodies, with candidates, employers, and educational institutions often favouring one over another due to perceived differences in items difficulty or superiority. This perceived societal impression highlighted the critical need for test equating in the SSCE conducted by these credentialing awarding institutions in Nigeria. Equating **a**djust for variations in difficulty across different test forms, thereby yielding comparable score scales and more accurate estimations of ability as noted by Albano (2011). This comparability of scores across these examinations is crucial for fairness and accurate assessment, since their syllabi are developed from the same approved curriculum provided by the National Educational Research and Development Council (NERDC).

Test equating frequently incorporates common or anchor items**,** which are questions shared across all test forms and are consistently positioned to minimize bias (Daramola et al,. 2018). Conversely, unique items are specific to each test form (e.g., WAEC items as FORM A, NECO items as FORM B, and NABTEB items as FORM C). To determine the source of score differences, test forms are constructed with these common items, also known as linking items. Anchor items can be classified as either internal or external. Internal anchors are part or integrated into each test form and contribute to the total score, whereas external anchors are separate and do not influence score computation. Internal anchors are generally favoured due to their stronger correlation with the tests being equated as they directly contribute to the overall score.

Meanwhile, among various equating methods, equipercentile equating is a key approach in classical test theory (CTT). This method aligns scores from different test forms by matching their percentile ranks. This means a score at a specific percentile on one test form corresponds to a score at the same percentile on another, thus making scores equivalence in terms of test-takers' ranks. For instance, if 75th percentile corresponds to raw scores of 50 (Form A), 43 (Form B) and 47 (Form C), these scores are equivalent in terms of test-takers' ranks. Kolen and Brennan (2014) define equipercentile equating as a method for making test scores comparable by matching scores based on their percentile ranks. This non-linear statistical technique effectively accounts for variations in score distributions across different points, providing a more flexible and precise comparison, particularly when distributions differ significantly. In the context of this study, equipercentile equating is specifically applied to equate examinees' scores in WAEC, NECO, and NABTEB Economics Multiple Choice items by matching scores based on the same percentile rank for the same population of test-takers in North West, Nigeria.

Statement of the Problem

It is important for testing and government approved public examinations agencies in Nigeria, such as WAEC, NECO, and NABTEB to adopt equating practices for standardized examination. As Senior School Certificate Examination (SSCE) conducted by these credentialing awarding testing programs often require alternate test forms that assess the same contents but uses different sets of test items that might be easier or harder, which produces higher or lower scores across different test form taken by the candidates. These organizations serve candidates from diverse backgrounds across the country, leading to challenges related to test item difficulty and discrimination in their assessments across forms. Alfred (2013) 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. Hence, a statistical process called equating can therefore, be used to adjust for differences in difficulty across alternate forms resulting in comparable score scales and more accurate estimates of ability. In this study therefore, an attempt was made to examine how scores from WAEC, NECO, and NABTEB Senior School Certificate Multiple Choice Economics Examinations can be made comparable using a statistical equating method called equipercentile equating in North West Nigerian.

Objectives of the Study:

This study sought to:

1. investigate the pattern of students' performance on the common items of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice papers in Economics in North West region, Nigeria.
2. determine the pattern of students' performance on the unique items of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice papers in Economics in North West region, Nigeria.
3. investigate the results of equipercentile equating of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice Test Items in Economics papers with the use of percentile ranking in North West region, Nigeria.

Research Questions

This study provide answers to the following research questions:

1. What is the pattern of student's performance on the common items of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice papers in Economics in North West region, Nigeria?
2. What is the pattern of student's performance on the unique items of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice papers in Economics in North West region, Nigeria?
3. What are the results of equipercentile equating of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice Test Items in Economics papers in North West region, Nigeria?

Results

Research Question One: What is the pattern of student's performance on the common items of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice papers in Economics in North West, Nigeria?

Pattern of students' scores in common items of test form A, B, and C are independently summed and their mean and standard deviation are computed.

Table 1. Mean of Respondents' Pattern of Performance in Common Items

Test forms	No of Students	Minimum	Maximum	Mean	Std. Deviation
WAEC (A)	511	0	13	4.94	2.121
NECO (B)	510	0	17	4.55	2.114
NABTEB (C)	511	0	18	5.10	2.504

Table 1 above showed the result of mean performance of respondents in common items test. Test form A

(WAEC) mean performance was 4.94, while the mean performance in test form B (NECO) and C (NABTEB) are 4.55 and 5.10, (indicating equal mean of 5 if round off to 1 sig. fig.) respectively. Respondents' highest scores in the three test forms were 13, 17 and 18 respectively and Zero (0) was their lowest score. Also, test form A had standard deviation of 2.121, while test form B and C had 2.114 and 2.504 as their standard deviation respectively.

One-way ANOVA was conducted if there is any significant difference in the test-takers' performance at 0.05 level of significant on common items. This is to ensure that condition for equating using Non-equivalent method is not violated, Check the table 2 below:

Table 2: ANOVA Summary Table of Respondents' Performance in Common Items

	Sum of Squares	Df	Mean Square	F-value	Sig.	Decision
Between Groups	10.331	3	10.331	2.314	1.909	NS
Within Groups	8012.812	1526	15.249			
Total	**8023.143**	**1529**				

α = 0.05, NS= Non-Significant

Table 2 above reveals an F-value of 2.314, which is not significant at the 0.05 alpha level, since the p-value of (1.909) is greater than 0.05 (1.909 > 0.05). This therefore, implies that test-takers are not statistically different in proficiency/ability in common items of Economics multiple-choice test items conducted by the WAEC, NECO, and NABTEB in 2023 Senior School Certificate Examination. This is a further confirmation of the usefulness of this test equating process.

Research Question Two: What is the pattern of student's performance on the unique items of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice papers in Economics in North West, Nigeria?

The pattern of students' scores in unique items of test form A, B, and C are independently summed and their mean and standard deviation are computed to determine the pattern of respondents.

Table 3. Descriptive Statistics of the Pattern of Students' Performance on Unique Items

Test Forms	No of Students	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
WAEC (A)	511	0	19	7.30	2.977	.310	.197
NECO (B)	510	0	24	7.40	3.524	.616	1.182
NABTEB (C)	511	0	22	8.34	4.178	.645	.157

Table 3 showed the statistical pattern of student's performance on the unique items. Test form C with a mean performance of 8.34, standard deviation of 4.178, positive Skewness of .645 and kurtosis of .157 indicated best performance. Form C has the highest Skewness .645, suggesting a greater concentration of high scores and have Kurtosis values of .157 that is closer to zero.

Test form B with a mean performance of 7.40, standard deviation of 3.524, positive Skewness of .616 and kurtosis of 1.182 indicated a better performance. Form B Kurtosis has a more peaked distribution with heavier tails compared to forms A and C. While testees who did test form A had the least performance with mean of 7.30, standard deviation of 2.977, positive Skewness of .310 and kurtosis of .197. Forms A

and C have kurtosis values closer to zero, suggesting a distribution closer to a normal distribution.

Research Question Three: What are the results of equipercentile equating of WAEC, NECO and NABTEB Senior School Certificate Multiple Choice Test Items in Economics papers in North West Nigeria with the use of percentile rank?

Percentile ranks of students' scores in each test form were used to determine the equivalence of scores obtained from WAEC, NECO and NABTEB such that scores with the same percentile ranks were considered equivalent.

Table 4: Equipercentile Equating of WAEC, NECO and NABTEB Economics SSCE Multiple Choice Papers.

Percentile Rank	Students' raw scores in WAEC (A)	Students' raw scores in NECO (B)	Students' raw scores in NABTEB (C)
0	2 and 3	2	1 and 2
1	4	-	3
2	-	3	4
3	-	4	5
4	5	-	-
5	-	-	-
6	-	5	6
7	6	-	-
8	-	-	-
9	-	-	-
10	7	6	-
11	-	-	-
12	-	-	-
13	-	-	7
14	-	-	-
15	-	-	-
16	-	7	-
17	8	-	-
18	-	-	-
19	-	-	8
20	-	-	-
21	-	-	-
22	-	8	-
23	-	-	-
24	-	-	-
25	9	-	-
26	-	-	9
27	-	-	-
28	-	-	-
29	-	-	-
30	-	9	-
31	-	-	-
32	-	-	-
33	-	-	-
34	-	-	10

35	10	-	-
36	-	-	-
37	-	-	-
38	-	10	-
39	-	-	-
40	-	-	-
41	-	-	11
42	-	-	-
43	-	-	-
44	-	-	-
45	11	-	-
46	-	-	12
47	-	11	-
48	-	-	-
49	-	-	-
50	-	-	-
51	-	-	-
52	-	-	-
53	-	-	-
54	-	-	13
55	12	12	-
56	-	-	-
57	-	-	-
58	-	-	-
59	-	-	-
60	-	-	-
61	-	13	-
62	13	-	14
63	-	-	-
64	-	-	-
65	-	-	-
66	-	-	-
67	-	-	-
68	-	-	-
69	14	-	-
70	-	-	-
71	-	-	15
72	-	14	-
73	-	-	-
74	-	-	-
75	-	-	-
76	-	-	-
77	15	-	16
78	-	-	-
79	-	-	-
80	-	15	-
81	-	-	17
82	-	-	-

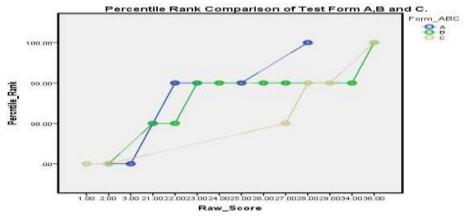|			
83	16	-	18
84	-	-	-
85	-	-	-
86	-	-	19
87	-	-	-
88	-	16	21 and 22
89	17	-	-
90	-	-	-
91	-	-	23
92	-	17	-
93	-	-	24
94	-	18	-
95	18	-	-
96	-	19 and 20	25
97	19	-	26
98	21	21 and 22	27
99	22, 23 and 25	23, 24, 26,27 and 34	28 and 29
100	28	36	36

In order to clearly establish the outcome of Equipercentile Equating, the summary of equated scores of WAEC, NECO and NABTEB were presented in Table 4 below:

Table 5: Equipercentile Equating Comparison Summary of Economics SSCE Multiple Choice Papers.

WAEC (A)	NECO (B)	NABTEB (C)
2 and 3	2	1 and 2
21	21 and 22	27
22, 23 and 25	23, 24, 26,27 and 34	28 and 29
28	36	36

Table 5 revealed scores of 2 and 3 in WAEC corresponding to 2 in NECO and in NABTEB is 1 and 2, while the score of 21 in WAEC was equivalent in NECO score of 21 and 22 and NABTEB score of 27, likewise the score of 22, 23 and 25 in WAEC corresponding to 23, 24, 26,27and 34 in NECO and score of 28 and 29 in NABTEB, and finally the score of 28 in WAEC corresponding to 36 of NECO and NABTEB respectively. Figure 1 is a graphical representation of a line graph of the three forms showing percentile rank of SSCE Economics multiple choice papers scores

Figure 1: Percentile rank of scores on WAEC, NECO and NABTEB SSCE Economics multiple choice papers.

The graph in Figure 1 above showed that scores from the three forms are not equivalent, the distribution of scores had dissimilar shape with notable gaps. Though scores obtained from test forms A and B (WAEC and NECO) were more equivalent when compared to those from test form C (NABTEB).

Findings of the Study

The key results of this study are:

1. There was no significant differences in examinee proficiency on common items across the three test forms.

2. Performance of testees on unique items varied significantly across the three test forms. It revealed that Form C (NECO) had the highest performance, while form A (WAEC) had the lowest.

3. Equipercentile equating results showed variation across the test forms with notable wide gap of (2 to 21 points) in the equated scores, but scores were consistent especially above a raw score of 22.

Discussion of Findings

The result of the common items revealed that respondents are similar in proficiency/ability. Thus, test forms A, B and C (WAEC, NECO & NABTEB) had their mean 2.121, 2.114 and 2.504 respectively, which are not significant at 0.05 alpha level. This suggested that the average difficulty levels of the year 2023 Economics multiple-choice test items conducted by WAEC, NECO, and NABTEB (SSCE) are the same under the common items and could be used interchangeably. The inclusion of common items is to ensure that the conditions for carrying out scores equating for WAEC, NECO and NABTEB multiple choice items in Economics was not violated.

This finding is in line with the submission of Doran, Moses and Eignor (2010) that test-takers that take different test forms are the same in proficiency, if the test-takers have the same distribution of common items scores on different test forms taken. But the finding is contrary to the study of Arokoyo (2021) that examinees differed in their proficiency level because the mean performance on their common items scores on the three test forms A, B and C were 5.46, 6.04 and 7.36 respectively, with submission that, the result might be attributed to differences in the proficiency level of testees who sat for the three test forms. Meanwhile, 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 Daramola et al. (2022).

Unique items revealed that there were differences in the performance of examinees across the three test forms. The unique items of test forms A, B and C had mean performance of 7.30, 7.40 and 8.34 respectively, with form C having the highest mean (8.34) and form A having the lowest (7.30). This suggests that Form C might be slightly easier than the other two forms. Also form A, B and C revealed standard deviation of 2.977, 3.524 and 4.178 respectively, with scores on Form C are mostly spread out (4.178) and scores on Form A are the least spread out (2.977). This implies that there is more variation in the performance on Form C.

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. The finding also corroborated those of Daramola et al, (2022) and Arokoyo, (2021) where they submitted in their separate studies in Economics and Chemistry that there were differences in the performance of examinees across the three test forms in

unique items.

The result of Equipercentile Equating of WAEC**,** NECO**,** and NABTEB Senior School Certificate Economics multiple-choice papers revealed varying score equivalencies. The WAEC scores of 2 and 3 equated to NECO's 2 and NABTEB's 1 and 2, based on corresponding percentile ranks. A WAEC score of 21 was equivalent to NECO scores of 21 and 22 and NABTEB 27. Similarly, WAEC scores of 22, 23, and 25 corresponded to NECO scores of 23, 24, 26, 27, 34 and NABTEB scores of 28 and 29. Notably, a WAEC score of 28 was equivalent to 36 in both NECO and NABTEB. 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.

Conclusions

In conclusion, this study was conducted on the Senior School Certificate Economics multiple-choice examinations administered by WAEC, NECO, and NABTEB forms of year 2023 using equipercentile equating method in North-West Nigeria. It found that test-takers had similar proficiency on common items across all three bodies. However, unique items showed significant performance differences, with NABTEB appearing slightly easier. The comparable difficulty of common items supports valid score equating. Equipercentile equating also established specific score equivalencies (e.g., WAEC 21 equivalent to NECO 21-22 and NABTEB 27), proving raw scores are not directly interchangeable. This research highlights the critical need for test equating to ensure fairness and accurate assessment by adjusting for varying item difficulties that can lead to achievement of desired objectives of the Government in establishing these examining bodies.

Recommendations

1. Despite the consistency of the common items in this study, the researcher still recommends a periodic review of the alignment of future test form with the curriculum to ensure that the same intended constructs are measure continuously.

2. The researcher recommended a detailed analysis of the unique items to further understand why testees' performance on unique items varied significantly across the three test forms.

3. The researcher recommends further investigation of score distributions on equipercentile method due to the large gaps of equated scores observed that make it unsuitable for these tests in their current form.

4. The researcher recommends the establishment of regulatory body to standardize and monitor examinations conducted by these examining bodies in Nigeria.

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