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DETERMINATION OF DIFFERENTIAL ITEM FUNCTIONING OF SENIOR SCHOOL CERTIFICATE ECONOMICS MULTIPLE CHOICE ITEMS IN DELTA STATE

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ABSTRACT

This study sought to examine differential item functioning of NECO Senior School Certificate Economics multiple choice items in Delta State. This study adopted ex-post facto research designs. The study was guided by three research questions and three hypotheses. The population of this study comprised 66,632 Senior Secondary three (SS3) students in Senior Secondary Schools in Delta State. The sample for this study consists 677 Senior Secondary three (SS 3) using multi-stage procedure. The instruments for data collection were National Examinations Council (NECO) Senior School Certificate Economics 2022 and 2023 multiple choice items which contain 60 items each for the two years. The reliability of the instruments was not estimated by the researchers because they were estimated by National Examinations Council. Data were analysed using the Raju Area estimation technique of BILOG-MG software to determine differential item functioning. Differential item functioning occurs when the value of Raju's Z of an item is significant (p<.05). Frequency count and percentage (%) were used to answer the research questions while chi-square statistics was used to test the hypotheses at 0.05 alpha level. The findings of the study showed that the items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between male and female examinees, rural and urban school examinees and public and private school examinees. Based on the findings of this study, it was recommended among others that National Examinations Council (NECO) should consider and include differential item functioning (DIF) evaluation in test item development process.

Keywords: Economics, Multiple Choice Items and Differential Item Functioning

Introduction

Economics is a science which involves the act of choosing between alternatives in order to obtain the maximum satisfaction from limited resources. In other words, Economics is a science of scarcity and choice. Every family is a part of an economy and everyone uses the rules of

Economics consciously or unconsciously. From the time individuals were born, they become consumers of various products and services. They grow and diversify to attain various roles as consumers, producers, traders, mediators and agents of goods and services. Economic factors, most importantly, money, dictate most of the elements of the society. Economics is one of the subjects that examination bodies used to test students during external examinations.

In the use of a particular test item format, what really matters is the ability of the test type to measure aspects of learner achievement by recall or application of knowledge and by any other reliable demonstrations of change in behaviour after instruction. As such, the major concern to all testers in the use of any test format is to make sure that test takers' performance is not affected by extraneous factors which are not part of the ability that is being measured, otherwise the meaningfulness or validity of score interpretations will be reduced. The multiple-choice objective type of test seems to be gaining popularity particularly in Nigeria as it is also commonly used even in several national standardised examinations due to the fact that it allows for wider curriculum coverage and gives the fairest opportunity to test takers to prove their ability.

The primary purpose of testing under standardised conditions is to compare a student's performance to a normative group. The norms are sets of descriptive data which make it possible to determine the standing of a candidate in relation to a specified reference group. Due to the importance often placed on the results of standardised testing, it is essential that the resulting test scores provide a fair and equitable evaluation of the skills or abilities that the test is purported to measure. Therefore, the provision of a fair and equitable means of psychological or educational assessment is one of the major reasons for the existence of standardised testing, otherwise it will result in test bias or differential item functioning. Differential item functioning (DIF) occurs when students who have the same ability level but from different groups have a different probability of a correct response. In other words, DIF occurs when testees from different groups with equal latent trait have systematically different responses to test items. Items may be judged relatively more or less difficult for a particular group by comparison with the performance of another group drawn from the same population (Sa'ad, Ali & Abdullahi, 2020).

A DIF analysis is a means of statistically identifying unexpected differences in performance across matched groups of examinees. Galle, Alaku and Samuel (2020) opined that there are several methods of detecting DIF which are based on Item Response Theory (IRT). Item response theory is a modeling technique that tries to describe the relationship between an examinee's test performance and the latent trait underlying the performance. Item Response Theory (IRT) looks at the examinee's performance by using item distributions based on the examinee's probability of success on a latent variable. Some of the methods based on Item Response Theory (IRT) include Lord's chi

square test, Raju's area measures and IRT-Likelihood Ratio (IRT-LR).

Consequently, Senior School Certificate Economics multiple choice items in large scale examination such as the National Examinations Council (NECO) could exhibit DIF with respect to gender, school location and school ownership. Gender is a psychological term as well as a cultural construct used by society to distinguish between male and female roles, behaviour, mental and emotional characteristics. Gender differences in educational assessments that use standardised tests have been the subject of numerous studies for at least half a century (Borgonovi & Grieff, 2020). An item displays DIF if male and female students with the same underlying true ability have a different probability of giving a correct response to the item (Khorramdel, Pokropek, Joo, Kirsch & Halderman, 2020).

The location of a school determines to a large extent the level of students' achievement. School location implies urban-rural setting. Abamba (2021) stated that a school located in a rural area is usually faced with problems like shortage of teachers, lack of laboratories, poorly equipped laboratories, among others. These shortcomings negatively affect both students' motivation and achievement. Evidence abounds that the educational aspirations of students who study in rural areas are weaker than those of their urban counterparts. Faleye and Rasheed (2020) in their study on differential item functioning of 2015/2016 Biology multiple-choice items of Osun State joint promotion examination revealed that there are incidences of differential item functioning in 2016 Osun State Joint Promotion Examination (OSJPE) Biology multiple-choice items.

Furthermore, the importance of school ownership and property mechanisms to the performance of students is one of the most controversial topics in the education literature. Okosun and Isabu (2023) observed that private school results are seen to be significantly better than those of public school. The issue of educational measurement in research pointing towards enhancing the fairness of test or examination across subgroups of examinees is very essential because important decisions are made based on performance of the examinees. Test takers of the same latent trait should respond to test item correctly irrespective of their gender, school location and school ownership. A fair test is one that affords all examinees an equal opportunity to demonstrate the skills and knowledge which they have acquired and which are relevant to the test's purpose. Test bias is the existence of some irrelevant elements present in items that causes differential item functioning of individuals. Hence, this study sought to determine differential item functioning of National Examinations Council Senior School Certificate Economics multiple choice items in Delta State.

Statement of the Problem

The performance of students in Economics has remain an issue of concern to stakeholders in education. NECO Chief Examiner's report (2021) revealed that some

of the candidates failed to use the correct economic terminologies in providing answers to the questions they attempted. This made it difficult for them to put forward their points which obviously resulted in poor scores. This suggests that the nature of Economics test items could be one of the causes of students' poor achievement in the NECO examinations. This might be attributed to inadequacy of the questions to measure individuals' abilities and latent trait as a result of item bias. Test with differential functioning items could bring about underachievement of students in Economics examination. The examination should ensure that no particular candidate has an unfair advantage over others irrespective of their gender, location and school ownership. This study is therefore designed to determine differential item functioning because test is used as gateway for educational opportunities and it is very crucial that test items are analysed to determine the fairness to all examinees of the same trait level.

Purpose of the Study

The general purpose of this study was to determine differential item functioning of NECO Senior School Certificate Economics multiple choice items examination conducted in Delta State. Specifically, the study sought to examine:

1. if items of 2022-2023 NECO Senior School Certificate Economics multiple choice items function differentially based on gender.
2. if items of 2022-2023 NECO Senior School Certificate Economics multiple choice items function differentially based on school location.
3. if items of 2022-2023 NECO Senior School Certificate Economics multiple choice items function differentially based on school ownership.

Research Questions

The following research questions guided this study.

1. What proportion of NECO 2022-2023 Senior School Certificate Economics multiple choice items function differentially based on gender?
2. What proportion of NECO 2022-2023 Senior School Certificate Economics multiple choice items function differentially based on school location?
3. What proportion of NECO 2022-2023 Senior School Certificate Economics multiple choice items function differentially based on school ownership?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance.

1. Items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between male and female examinees.
2. Items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not

significantly function differentially between rural and urban school examinees.

3. Items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between public and private school examinees.

Research Method

This study adopted descriptive survey and ex-post facto research designs in the determination of differential item functioning of NECO Senior School Certificate Economics multiple choice items in Delta State. The population of this study comprised 66,632 Senior Secondary three (SS3) students in Senior Secondary Schools in Delta State. There are 1,447 Secondary Schools in Delta State made up of 489 public secondary schools and 958 private secondary schools. The total population of SS3 students in both public and private secondary schools is 66,632 students with 25,372 and 41,260 in public and private secondary schools respectively. The sample for this study consists of 677 Senior Secondary three (SS 3) using multi-stage procedure was used. The instruments for data collection were National Examinations Council (NECO) Senior School Certificate Economics 2022 and 2023 Multiple Choice Items which contain 60 items each for the two years. The National Examinations Council (NECO) Senior School Certificate Economics 2022 and 2023 Multiple Choice Items were retyped to include the demographic data of the respondents. The reliability of the instruments was not estimated by the researchers because they were estimated by National Examinations Council Data were analysed using the Raju Area estimation technique of BILOG-MG software to determine differential item functioning. Differential item functioning occurs when the value of Raju's Z of an item is significant ($p<.05$). Frequency count and percentage (%) were used to answer the research questions while chi-square statistics was used to test the hypotheses at 0.05 alpha level.

Presentation of Results

Research Question 1: What proportion of NECO 2022-2023 Senior School Certificate Economics multiple choice items function differentially based on gender?

Table 1: Percentage of NECO 2022-2023 SSCE Economics Multiple Choice Items that Display DIF based on gender

Year	No. of Items	No. of items with DIF	% of items with DIF	Items with DIF
2022	60	13	21 %	4, 9, 15, 18, 19, 22, 23, 35, 42, 53, 56, 57, 60
2023	60	33	55%	2, 4, 10, 14, 16, 17, 19, 20, 21, 22, 24, 25, 26, 31, 35, 36, 37, 39, 40, 41, 43, 44, 46, 47, 48, 49, 50, 51, 53, 57, 59, 60

Table 1 shows that 13 items, that is, items 4, 9, 15, 18, 19, 22, 23, 35, 42, 53, 56, 57 and 60 representing 21% of the total items in NECO 2022 SSCE Economics multiple choice items display differential item functioning based on gender. In 2023, 33 items, that is, items 2, 4, 10, 14, 16, 17, 19, 20, 21, 22, 24, 25, 26, 31, 35, 36, 37, 39, 40, 41, 43, 44, 46, 47, 48, 49, 50, 51, 53, 57, 59, and 60 representing 55% of the items in NECO SSCE Economics multiple choice items display differential item functioning based on gender. This suggests that NECO 2022-2023 SSCE Economics multiple choice items display differential item functioning based on gender.

Research Question 2: What proportion of NECO 2022-2023 Senior School Certificate Economics multiple choice items function differentially based on school location?

Table 2: Percentage of NECO 2022-2023 SSCE Economics Multiple Choice Items that Display DIF in based on School location

Year	No. of Items	No. of items with DIF	% of items with DIF	Items with DIF
2022	60	15	25 %	10, 14, 16, 17, 24, 31, 35, 36, 42, 47, 49, 50, 51, 56, 57
2023	60	30	50%	3, 4, 5, 10, 14, 15, 16, 17, 18, 20, 21, 22, 25, 27, 29, 32, 35, 36, 37, 41, 43, 44, 48, 51,53, 56, 57, 58, 59, 60

Table 2 shows that 15 items, that is, items 10, 14, 16, 17, 24, 31, 35, 36, 42, 47, 49, 50, 51, 56, 57 representing 25% of the total items in NECO 2022 SSCE Economics multiple choice items display differential item functioning based on school location. In 2023, 30 items, that is, items 3, 4, 5, 10, 14, 15, 16, 17, 18, 20, 21, 22, 25, 27, 29, 32, 35, 36, 37, 41, 43, 44, 48, 51, 53, 56, 57, 58, 59 and 60 representing 50% of the items in NECO SSCE Economics multiple choice questions display differential item functioning based on school location. This suggests that NECO 2022-2023 SSCE Economics multiple choice items display differential item functioning based on location.

Research Questions 3: What proportion of NECO 2022-2023 Senior School Certificate Economics multiple choice items function differentially based on school ownership?

Table 3: Percentage of NECO 2022-2023 SSCE Economics Multiple Choice Items that Display DIF in based on School Ownership

Year	No. of Items	No. of items with DIF	% of items with DIF	Items with DIF
2022	60	33	55 %	2, 4, 10, 11, 14, 16, 17, 19, 20, 21, 22, 24, 25, 26, 31, 35, 36, 37, 39, 40, 41, 43, 44, 46, 47, 48, 49, 50, 53,51, 57, 59, 60.
2023	60	11	18%	3, 4, 6, 17, 19, 20, 23, 29, 30, 33, 37

Table 3 shows that 33 items, that is Items 2, 4, 10, 11, 14, 16, 17, 19, 20, 21, 22, 24, 25, 26, 31, 35, 36, 37, 39, 40, 41, 43, 44, 46, 47, 48, 49, 50, 51, 53, 57, 59, and 60 representing 55% of the total items in NECO 2022 SSCE Economics multiple choice items display differential item functioning based on school ownership. In 2023, 11 items, that is Items 3, 4, 6, 17, 19, 20, 23, 29, 30, 33, 37 representing 30% of the items in NECO SSCE Economics multiple choice items display differential item functioning based on school ownership. This suggests that NECO 2022-2023 SSCE Economics multiple choice items display differential item functioning based on ownership.

Hypothesis 1: Items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between male and female examinees.

Table 4: Chi-square Summary of Differential Item Functioning between Male and Female Examinees

Year	DIF favour female	DIF favour male	Df	Chi-square	p-value
2022	7 (7.6)	6 (5.4)			
			1	.176	.675
2023	20 (19.4)	13 (13.6)			

Table 4 shows a chi-square value of .176 and a p-value of .675, testing the hypothesis at an alpha level of 0.05, the p-value is greater than the alpha level, so the null hypothesis which states that 'items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between male and female examinees' was not rejected. This means that items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between male and female examinees.

Hypothesis 2: Items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between rural and urban school examinees.

Table 5: Chi-square Summary of Differential Item Functioning between Rural and Urban School Examinees

Year	DIF favour urban location	DIF favour rural location	Df	Chi-square	p-value
2022	11 (9.7)	4 (5.3)			
			1	.776	.378
2023	19 (19.3)	11 (10.7)			

Table 5 shows a chi-square value of .776 and a p-value of .378, testing the hypothesis at an alpha level of .05, the p-value is greater than the alpha level, so the null hypothesis which states that 'items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between rural and urban school examinees' questions was not rejected. This implies that items of NECO 2022-2023 Senior School Certificate Economics multiple choice item do not significantly function differentially between rural and urban school examinees.

Hypothesis 3: Items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between public and private school examinees.

Table 6: Chi-square summary of Differential Item Functioning between Public and Private School Examinees

Year	DIF favour private	DIF favour public	Df	Chi-square	p-value
2022	19 (17.3)	14 (15.8)	1	1.488	.223
2023	4 (5.8)	7 (5.3)			

Table 6 shows a chi-square value of 1.488 and a p-value of .223, testing the hypothesis at an alpha level of .05, the p-value is greater than the alpha level, so the null hypothesis which states that 'items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between public and private school examinees' questions was not rejected. This means that items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between public and private school examinees.

Discussion of Findings

Proportion of NECO 2022-2023 Senior School Certificate Economics multiple choice differential items functioning based on gender

Findings from research question 1 and hypothesis 1 of the study on the proportion of NECO 2022-2023 Senior School Certificate Economics multiple choice differential items functioning based on gender showed that 13 items representing 21% of the total items in NECO 2022 SSCE Economics multiple choice questions display differential item functioning based on gender. In 2023, 33 items representing 55% of the items in NECO SSCE Economics multiple choice questions display differential item functioning based on gender. Hypothesis one tested revealed that items of NECO 2022-2023 Senior

School Certificate Economics multiple choice items do not significantly function differentially between male and female examinees. It means that there is no significant difference between male and female examinees on differential item functioning of NECO 2022-2023 Senior School Certificate Economics multiple choice items. This is related to a study carried out by Omorogiuwa and Iro-Aghedo (2023) on sex differential item functioning in the National Business and Technical Examination Board (NABTEB) 2015 Mathematics Multiple choice test items (Dichotomous) Examination in Nigeria revealed that male and female testees do not significantly function differentially in 33 items (66%). This finding disagrees with the study of Ohiri and Okoye (2023) on gender-related differential item functioning of the WAEC May/June mathematics multiple-choice items in Owerri Education Zone 1 who revealed that twelve items (24%) in 2019, fifteen items (30%) in 2020 and eleven items (22%) in 2021 respectively, functioned differentially based on gender of the students. The findings of this study also disagree with Obilor and Asinye-Igoni (2022) carried out a study on differential item functioning in Christian religious studies mock 2022 basic education certificate examination (BECE) in Rivers State revealed that 10% of the total items in the MOCK 2022 Christian Religious Studies examination exhibited statistically significant differential item functioning (DIF) in relation to gender. In the same vein, Effiom (2021) in his study on test fairness and assessment of differential item functioning of mathematics achievement test for senior secondary students in cross River State, Nigeria revealed that 6% of the total items exhibited differential item functioning between the male and female students.

Proportion of NECO 2022-2023 Senior School Certificate Economics multiple choice differential items functioning based on school location

The results from research question 2 and hypothesis 2 of the study on the proportion of NECO 2022-2023 Senior School Certificate Economics multiple choice differential items functioning based on school location indicated that 15 items representing 25% of the total items in NECO 2022 SSCE Economics multiple choice questions display differential item functioning based on school location. In 2023, 30 items representing 50% of the items in NECO SSCE Economics multiple choice questions display differential item functioning based on school location. However, hypothesis two tested showed that items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between rural and urban school examinees. This implies that there is no significant difference between rural and urban school examinees on differential item functioning of NECO 2022-2023 Senior School Certificate Economics multiple choice items. This is related to a study carried out by Boi, Ezeamaenyi, Ebuoh and Okechineke (2023) on differential item functioning (DIF) technique for detection of item bias in Economics among secondary school students in Enugu State revealed that there

was no significant difference between the mean achievement scores of students in the both urban and rural locations. In the same vein, Gyamfi (2023) carried out a study on differential item functioning of performance-based assessment in mathematics for senior high schools revealed that there was no presence of DIF in the items for location of school.

Proportion of NECO 2022-2023 Senior School Certificate Economics multiple choice differential items functioning based on school ownership

The results from research question 3 and hypothesis 3 of the study on the proportion of NECO 2022-2023 Senior School Certificate Economics multiple choice differential items functioning based on school ownership revealed that 33 items representing 55% of the total items in NECO 2022 SSCE Economics multiple choice questions display differential item functioning based on school ownership. In 2023, 11 items representing 30% of the items in NECO SSCE Economics multiple choice questions display differential item functioning based school ownership. In the same vein, hypothesis three showed that items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between public and private school examinees. This indicated that there is no significant difference between public and private school examinees on differential item functioning of NECO 2022-2023 Senior School Certificate Economics multiple choice items. This finding corroborates a study of Moses (2023) who in his study on the impact of test accommodations on test scores by school types: Private Vs public school comparisons revealed that there was no significant DIF between private and public school students, indicating that the test items functioned equivalently for both groups. In the same vein, Skaggs and Lissitz (2021) in their study on the effect of school ownership on item difficulty: A comparison of public and privates revealed that no significant DIF across school ownership, suggesting that item difficulty was consistent for both private and public school students. The findings disagree with the findings of Evans, Uko and Ekim (2022) who in their study on investigation of differential item functioning of basic education certificate examination (BECE) mathematics items in Akwa Ibom State, Nigeria revealed that 22 items functioned differently with respect to school ownership.

Conclusion

Based on the findings of the study, it was concluded that the items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between male and female examinees. Items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between rural and urban school examinees and items of NECO 2022-2023 Senior School Certificate Economics multiple choice test do not significantly function differentially between public and private school examinees.

Recommendations

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

1. National Examinations Council (NECO) should consider and include differential item functioning (DIF) evaluation in test item development process.
2. National Examinations Council (NECO) should strengthen its efforts to minimize the impact of differential item functioning.
3. Ministry of Basic Education should ensure that Economics multiple choice test developed at classroom level should be adequate to reduce the effect of DIF.

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