
ANALYSIS OF ITEM BIAS IN NECO ECONOMICS MULTIPLE-CHOICE TEST ITEMS IN KEFFI EDUCATIONAL ZONE, NASARAWA STATE, NIGERIA

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Abstract

This research explores the presence of potential item bias in National examination council (NECO) of 2020 Economics multiple-choice items within the Keffi Educational Zone, Nasarawa State, Nigeria. Using Differential Item Functioning (DIF) techniques, the study adopted a descriptive research design of survey type with target population that comprises of all SSS 3 economics students in Keffi Educational Zone, Nasarawa State, Nigeria. A multi-stage random sampling procedure was used to select a total of 600 students from 20 public and private senior secondary schools. The researcher used already standardized NECO Economics 2020 Senior School Certificate Examination (SSCE) multiple choice test items as an instrument to identify items that function differently against subgroups. Binary Logistic regression was used to analysed the data collected and the findings revealed significant disparities of three (3) items in regards to gender and (6) items in regards to schools ownership out of the sixty (60) NECO (SSCE) 2020 Economics objective test items. This findings have implications for educational equity and the validity of standardized tests in Nigeria, highlighting the need for more equitable test design and evaluation practices. Therefore, examining bodies, Psychometricians and others test developer should employ DIF techniques using logistic method of analysis for validating their test items.

Keywords: Item Bias, Differential Item Functioning, Multiple Choice Item, National Examinations Council, Economics

Introduction

Item bias can undermine the fairness of standardized tests, such as the NECO Economics examination items, especially in a diverse region like the Keffi educational Zone of Nasarawa state, located in Nigeria. The essence of testing is to reveal the latent ability of examinee. Therefore, testing has been fully accepted in most modern societies as the most objective method of decision making in schools, industries and government establishments. It is now used for admission, recruitment, promotion, placement, evaluation, guidance, researches and teaching purpose among others (Emaikwu, 2012). Testing according to Odili (2010) is the act of using a test to obtain data about a given attribute. Moreover, in a study carried out by Emaikwu (2012), opined the claimed that some of the national examinations unfairly favour examinees of some particular groups such as cultural, gender, locations, school types, ethnic, or even socioeconomic status (SES) subgroups to the point that it is now believed a particular section of the country or strata perform most poorly in these national examinations when compared to their counterparts on a common ground. The most serious concerns voiced so far against testing pivots around the social issues that test may show culture or class bias (Anastasia & Urbina, 2006).

Therefore, this brings us to the issues of item bias in NECO Economics standardized examination and the fairness of test items. Economics is a social science that studies human behaviours in their effort to allocate scarce resources efficiently and effectively in order to minimize cost (Amaechi, 2015). However, considering the large number of students that offered economics subject in the Senior School Certificate Examination in Nigeria, the examination still suffers from item bias as noted by Emaikwu (2012). Therefore, to ensure fairness in the test, the exam should be free from such bias as recommended by the Joint Committee on Testing Practices (2004).

Meanwhile, it will be of great important for any individual who will come across this study to understand the differences between some of the common terms such as {test fairness, test bias, item bias and differential item functioning (DIF)} used in the study, especially for those coming to the educational measurement and evaluation profession from unrelated fields. Hence, below are some of the common terms mention in the study.

Test Fairness

A fair test is a test that is comparably valid for all groups and individuals and which affords all testees or examinees an equal opportunity to demonstrate the skills and knowledge which they have acquired and which are relevant to the purpose of the test (Roever, 2005). Whereas **fairness** applies to the *entire test* process, **bias** applies to the *unintended consequences* on the test.

Test Bias

Test bias can be describe as a test in which there exist systematic differences in the meaning of test scores associated with group membership. Penfield and Lam (2010) stated that test bias can occur when performance on a test requires sources of knowledge different from those intended to be measured, causing test scores to be less valid for a particular group. Also, a biased test is one in which learners from two groups who have the same observed score do not have the same standing in the trait of interest.

Item Bias

Item bias could occur if the test item contain languages or contents that are differently difficult for different subgroups of examinees. An item is biased if its construction, setting, language, idea or interest, portrayed, picture/diagram used, relevance, illustrations, and administration give an undue advantages or disadvantage to a particular group of testees over the other group (Nenty, 2010). *Item bias* is often examined at the item level, with differential item functioning (DIF) analyses being part of framework for probing item bias.

Differential Item Functioning (DIF)

Differential Item Functioning (DIF) occur whenever a group of testees with identical level of abilities, taught and measured on equal construct of interest display different chances of answering an item correctly in the test (Camilli & Shepard, 2009). Meanwhile, this study focuses on Logistic regression procedure. Logistic regression is a statistical method for analyzing a data set in which there are one or more independent variables that determine an outcome of dependent variable. The outcome is measured with a dichotomous variable in which there are only two possible outcomes (e.g. "passed or failed", "yes or no", "correct or incorrect", etc.) that is coded (0 and 1). It is useful when you want to predict a categorical variable from a set of predictor variables.

Several demographic variables or attributes were determined for potential differential item functioning. These variables are school ownership, ethnicity, age, school location, race, sex and religion etc. The researcher`s focus variables for this study is school ownership and gender. In fact, school ownership

factor is the reason for the study because of the widespread presence of privately owned schools across Nigeria in recent time.

Statement of the Problem

Due to the importance's of test scores to the development of educational system and for the fact that Nasarawa state is a heterogeneous state in Nigeria, bias item in our test has been an issue of concern as most often times, public outcry greets the release of Senior School Certificate Examinations (SSCE) in the country (Nigeria) due to poor performance of candidates, as majority of examinee's do not often meet the university entry benchmark of credit passes in five subjects. Also, candidates that passes WAEC in their first attempt recently do perform below standard in NECO despite the experience gained in WAEC examination. This could be associated with items bias or lack of unidimensionality of test items as it was noted by various researchers.

The researcher also noted that many studies has been carried out on school location, race/ethnicity, religion, socioeconomic status and gender. Many research findings in Nigeria have shown that there are always differences in the performance between examinee from gender and school location (Olutola, 2011, Okeke, 2016, Olutola, 2016, Olutola, Ihechu & Nuraddeen, 2022). While gender remains inconclusive, there is but a little on school ownership in regard to bias test items in the Northern region and variables such as gender and school ownership were mostly carried out in the western and southern regions of Nigeria.

Thus, this study explored and analyzed item bias of (NECO) 2020 Economics multiple-choice test items, using DIF method in regards to the differences in performance between male and female examinee's, as well as school ownership (Public) and (Private) while focusing on Keffi Educational Zone.

Objectives of the Study

Specifically, the study find out whether the:

1. 2020 NECO June/July SSCE Economics Multiple choice test items vary by grade between male and female students in Keffi Education Zone, Nasarawa State.
2. 2020 NECO June/July SSCE Economics Multiple choice test items function differentially among test taker from public and private schools.

Research Questions

To guide the investigation of study, the following research questions were raised.

1. How many of the 2020 NECO June/July SSCE Economics multiple choice test items vary by grade between male and female students in Keffi Educational Zone, Nasarawa State?
2. The 2020 NECO June/July SSCE Economics multiple choice test items function differentially among test takers of public and private schools in Keffi Educational Zone, Nasarawa State?

Methodology

The study adopted a descriptive research design of survey type and the population of the study consist of all students who sat for NECO SSCE 2020 Economics multiple-choice examination in Keffi Education Zone, Nasarawa State and a sample size of six hundred (600) students who participated in the study were selected from twenty (20) public and private schools in the Keffi Educational Zone. The instrument for data collection was the NECO (SSCE) 2020 June/July Economics multiple choice test items and the Binary Logistic Regression Analysis was used to examine the item performance and score distributions across genders and schools ownership using a non-proportional stratified random sampling technique with the aid of SPSS Version 20 to re-affirm test dimensionality and bias.

Results

Research Question One: How many of the 2020 NECO June/July SSCE Economics multiple choice test items vary by grade between male and female students in Keffi Educational Zone, Nasarawa State?

Table 1: Summary of Binary Logistic Regression for detecting DIF in Gender.

Item	B	S. E	Wald	Sig	Exp (B)	95% C.I for Exp (B)	
						Lower	Upper
1.	.200	.199	1.006	.316	1.221	.826	1.805
2.	.314	.211	2.204	.138	1.369	.904	2.072
3.	.098	.178	.304	.581	1.103	.778	1.565
4.	-.290	.171	2.882	.090	.748	.536	1.046
5.	-.045	.185	.060	.806	.956	.665	1.373
6.	.081	.182	.195	.659	1.084	.758	1.550
7.	.133	.197	.455	.500	1.142	.776	1.681
8.	-.291	.196	2.201	.138	.747	.509	1.098
9.	.355	.176	4.053	.044*	1.426	1.009	2.014
10.	-.238	.196	1.472	.225	.788	.537	1.158
11.	.224	.175	1.641	.200	1.251	.888	1.763
12.	.095	.187	.261	.609	1.100	.763	1.586
13.	.218	.205	1.125	.289	1.243	.831	1.859
14.	-.065	.200	.107	.744	.937	.634	1.385
15.	-.113	.202	.310	.578	.893	.601	1.329
16.	-.023	.201	.014	.907	.977	.659	1.449
17.	-.005	.175	.001	.978	.995	.706	1.403
18.	-.114	.182	.392	.531	.892	.625	1.274
19.	-.156	.180	.751	.386	.855	.600	1.218
20.	-.156	.180	.746	.388	.856	.601	1.219
21.	.259	.206	1.578	.209	1.295	.865	1.939
22.	-.118	.193	.371	.542	.889	.609	1.298
23.	-.230	.187	1.512	.219	.795	.551	1.146
24.	-.034	.191	.032	.858	.966	.665	1.405
25.	-.108	.178	.367	.545	.898	.634	1.272
26.	-.259	.190	1.867	.172	.772	.532	1.119
27.	.255	.193	1.745	.187	1.290	.884	1.882
28.	.194	.196	.983	.321	1.215	.827	1.784
29.	.530	.201	6.964	.008*	1.698	1.146	2.516
30.	-.034	.185	.033	.855	.967	.673	1.389
31.	-.048	.174	.077	.782	.953	.678	1.340
32.	-.150	.189	.633	.426	.860	.594	1.246
33.	-.156	.169	.849	.357	.855	.614	1.192
34.	-.281	.189	2.219	.136	.755	.521	1.093
35.	-.270	.192	1.984	.159	.763	.524	1.112
36.	-.364	.184	3.931	.047*	.695	.485	.996
37.	-.198	.182	1.180	.277	.821	.575	1.172
38.	-.088	.181	.236	.627	.916	.642	1.307
39.	-.006	.189	.001	.975	.994	.686	1.441
40.	.164	.203	.649	.421	1.178	.791	1.755
41.	-.058	.186	.099	.753	.943	.656	1.357
42.	.314	.192	2.676	.102	1.368	.940	1.992
43.	.197	.190	1.082	.298	1.218	.840	1.766
44.	-.149	.188	.626	.429	.862	.596	1.246
45.	-.049	.180	.074	.786	.952	.669	1.355
46.	-.018	.179	.010	.921	.982	.691	1.397
47.	-.033	.176	.036	.850	.967	.684	1.367
48.	.092	.171	.291	.589	1.097	.784	1.533

49.	-.097	.167	.339	.561	.907	.653	1.260
50.	-.207	.173	1.422	.233	.813	.579	1.142
51.	-.211	.170	1.525	.217	.810	.580	1.132
52.	-.112	.170	.437	.509	.894	.640	1.247
53.	-.179	.169	1.120	.290	.836	.600	1.165
54.	-.293	.187	2.454	.117	.746	.517	1.076
55.	-.012	.185	.004	.948	.988	.687	1.420
56.	-.045	.187	.058	.810	.956	.662	1.380
57.	.095	.171	.305	.581	1.099	.786	1.537
58.	.014	.173	.006	.937	1.014	.723	1.422
59.	.098	.195	.253	.615	1.103	.753	1.615
60.	-.273	.183	2.214	.137	.761	.531	1.090

Variables on Gender: *DIF EXIST; Item 9, 29 and Item 36 Only

Table 1 above shown three (3) items that identified significant DIF in gender of students using logistic regression method of analysis with the help of SPSS version 20. That is item 9, 29 and 36 reveal significant difference between male and female students with significant level less than .05, i.e (P<.05). This represents 5% of the total economics items while 95% of the items do not differentiate significantly between male and female students.

Research Question Two: The 2020 NECO June/July SSCE Economics multiple choice test items function differentially among test takers of public and private schools in Keffi Educational Zone, Nasarawa State?

Table 2: Summary of Binary Logistic Regression for detecting DIF in School Ownership

Item	B	S. E	Wald	Sig	Exp (B)	95% C.I for Exp (B)	
						Lower	Upper
1.	.256	.196	1.707	.191	1.292	.880	1.898
2.	-.012	.208	.004	.952	.988	.657	1.484
3.	-.078	.178	.190	.663	.925	.653	1.312
4.	-.195	.174	1.251	.263	.823	.585	1.158
5.	-.394	.188	4.376	.036*	.675	.467	.975
6.	.138	.181	.582	.446	1.148	.805	1.638
7.	-.029	.199	.022	.883	.971	.657	1.435
8.	-.085	.199	.183	.669	.919	.622	1.356
9.	.045	.177	.064	.800	1.046	.739	1.481
10.	-.259	.200	1.674	.196	.772	.522	1.142
11.	.227	.173	1.712	.191	1.255	.893	1.763
12.	-.041	.186	.049	.825	.960	.666	1.383
13.	.178	.202	.773	.379	1.195	.804	1.776
14.	.083	.200	.173	.678	1.086	.735	1.607
15.	.254	.202	1.585	.208	1.289	.868	1.915
16.	-.124	.203	.376	.540	.883	.594	1.314
17.	.088	.175	.251	.616	1.092	.775	1.539
18.	.066	.182	.132	.717	1.068	.748	1.526
19.	-.124	.182	.462	.497	.884	.618	1.262
20.	-.091	.182	.248	.618	.913	.640	1.304
21.	.097	.203	.227	.634	1.101	.740	1.639
22.	-.286	.197	2.121	.145	.751	.511	1.104
23.	-.132	.189	.483	.487	.877	.605	1.271
24.	-.172	.193	.792	.374	.842	.577	1.229
25.	-.001	.178	.000	.996	.999	.704	1.417

26.	-.061	.192	.101	.750	.941	.646	1.370	
27.	-.124	.192	.419	.517	.883	.607	1.286	
28.	.017	.195	.008	.931	1.017	.695	1.489	
29.	.132	.200	.432	.511	1.141	.770	1.689	
30.	-.122	.186	.427	.513	.886	.615	1.275	
31.	.282	.173	2.657	.103	1.326	.944	1.862	
32.	-.160	.191	.703	.402	.852	.586	1.239	
33.	-.576	.172	11.275	.001*	.562	.402	.787	
34.	-.394	.193	4.143	.042*	.675	.462	.986	
35.	-.358	.197	3.312	.069	.699	.475	1.028	
36.	-.292	.187	2.429	.119	.747	.518	1.078	
37.	-.121	.184	.437	.508	.886	.618	1.269	
38.	-.161	.183	.779	.377	.851	.595	1.218	
39.	-.085	.190	.201	.654	.918	.632	1.333	
40.	-.105	.203	.265	.607	.901	.605	1.341	
41.	.251	.185	1.842	.175	1.285	.895	1.846	
42.	-.111	.190	.342	.559	.895	.616	1.299	
43.	-.142	.189	.565	.452	.867	.598	1.257	
44.	.167	.188	.793	.373	1.182	.818	1.709	
45.	-.163	.181	.809	.368	.850	.595	1.212	
46.	.037	.180	.044	.835	1.038	.730	1.476	
47.	-.077	.178	.184	.668	.926	.653	1.314	
48.	-.398	.172	5.333	.021*	.672	.479	.942	
49.	-.136	.168	.656	.418	.873	.628	1.213	
50.	-.264	.175	2.273	.132	.768	.544	1.083	
51.	-.004	.171	.001	.981	.996	.712	1.393	
52.	.105	.170	.381	.537	1.111	.796	1.551	
53.	.173	.169	1.039	.308	1.189	.853	1.657	Variables on
54.	.419	.186	5.067	.024*	1.521	1.056	2.192	School
55.	.031	.185	.028	.867	1.032	.718	1.483	Ownership:
56.	-.441	.192	5.304	.021*	.643	.442	.936	*DIF EXIST;
57.	.075	.171	.195	.658	1.078	.772	1.507	Item 5,
58.	.308	.172	3.214	.073	1.361	.972	1.906	33,34,48,54
59.	.149	.193	.596	.440	1.161	.795	1.695	and Item 56
60.	-.051	.185	.077	.782	.950	.661	1.365	Only

Table 2 above shown six (6) items that identified significant DIF in school ownership using logistic regression method analysis of SPSS version 20. Item 5,33,34,48,54 and Item 56 reveal significant difference between Public and Private schools with significant level less than .05, i.e. ($P < .05$). This represents 10% of the total economics items while 90% of the items do not differentiate significantly between male and female students.

Major Findings of the Study

1. The 2020 NECO June/July SSCE Economics multiple choice test items vary by grade between male and female students in Keffi Educational Zone, Nasarawa State.
2. The 2020 NECO June/July SSCE Economics multiple choice test items function differentially among test takers of public and private schools in Keffi Educational Zone, Nasarawa State.

Discussions

To predict DIF for a sample size of 600 students that participated in this study, a logistic regression analysis was conducted in regards to gender and schools ownership with the aid of SPSS version 20. On gender, the result from table 1 above revealed three (3) items that have DIF out of the sixty (60) NECO economics objective test items (i.e. item 9, 29 and 36) which represents 5% of the total economics items, while 95% of the items do not differentiate significantly between male and female students. The result

further revealed that items 9, 29 favoured male students while only item 36 favoured the female students which eventually placed them at disadvantaged group.

The study of Madu (2011) provided evidence on gender differences in mathematics multiple-choice test items as it varies according to the content area even when the substance is nearly linked to the course of study. The findings equally agreed with that of Pedrajita (2009) study when he used logistic regression to detect test items in Chemistry Achievement test, the result revealed that there is gender bias in the Chemistry Achievement test administered to the examinees. The findings Olutola and Ihechu (2023) also supported the result of this study. The results of their study showed that Agricultural Science multiple-choice test items used in NECO 2015-2017, contain test items that significantly functioned differentially for testees on the basis of gender. But the findings of this study disagree with Igbokwe (2004) study, who found out that there was no significant difference between boys and girls when she developed item bank in Mathematics for NECO common entrance examination. While on the issue of public and privately owned school, the result from table 2 above reveals a total of six (6) items, i.e. Item 5, 33, 34, 48, 54 and Item 56 that has DIF against subgroups that consist of Public and Private schools examinees with significant level at $P < .05$. This represents 10% of the total NECO economics items, while 90% of the items do not differentiate significantly between Public and Private schools. Four (4) items was found to have significant DIF that favoured Private schools, which are item 5, 33, 48 and 56, while two (2) items favoured Public schools, i.e. item 34 and 54 and this result gives undue advantages to private schools examinees over their counterpart from public schools.

The findings of this study are consistent with the study of Ogbebor and Onuka (2013), Abedalaziz (2011) and Nworgu (2010) who reported the incidence of gender, location and school type DIF in mathematics, Economics and Biology respectively. The implication of the findings of this study is that students' responses to items in high stake National examinations such as NECO standardized examination in Nigeria varied and were affected by their gender and school ownership. Moreover, Olutola, Ihechu and Nuraddeen (2022) disagreed with findings of this study. The results of their findings reported no significant difference between male and female students on the percentage of items which functioned differentially in the 2020 Basic Education Certificate Examination (BECE) mathematics multiple choice test examination.

Conclusion

Therefore, the conclusion for this study are as follow:

1. This study will definitely serves as an eye opener for various examining bodies for the evaluation of psychometric properties through the use of DIF.
2. It is cleared that NECO objective test items are not properly validated before been administered on examinees when it comes to aspect of gender and school ownership.
3. This study will provides measurement experts, test developers/constructors, Psychometricians and even the various examining bodies on the effects of DIF in high stake standardized test items.
4. Examining bodies, schools and individual teachers/lecturers should ensure that the items they use to examine their students even in continuous assessment tests are of high quality, within the ability level of their students and does not give undue advantages to any subgroup by considering test fairness for various subgroups of examinee's.

Recommendations

The recommendations are made based on the findings and discussions of the study;

1. Seminars, workshops and conferences should be organize for researchers, teachers, lecturers, Psychometricians on the general principles of testing and measurement since the issues of differential item functioning still remain inconclusive in Nigeria.

2. Examining bodies, Evaluators, and educational practitioner involves in the development of assessment instruments should use logistic regression for data analysis.
3. It is strongly recommended that a study of this nature should be carried out to provide further empirical evidences on the fairness of test items in Nigeria standardized examinations.
4. The Examining bodies, Psychometricians, government, private firms, and all other stakeholders should explore the use of differential item functioning in the detection of bias test item.
5. Examining bodies, Evaluators, and all others educational practitioners should pay serious attention on gender and school ownership when constructing test items for examinees.

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