ANALYSIS OF DIFFERENTIAL ITEM FUNCTIONING IN PRIMARY SCHOOL LEAVING CERTIFICATE EXAMINATION OF 2016 MATHEMATICS MULTIPLE CHOICE TEST ITEMS IN DELTA STATE, NIGERIA.

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Abstract

This study focused on the analysis of differential item functioning (DIF) in Primary School Leaving Certificate Examination of 2016 Mathematics Objective Test Questions in Delta State. To achieve the aim of the study two research questions and two null hypotheses were raised to guide the study. The study employed the ex-post facto survey research design. The population for the study consisted of 2,600 primary school pupils who enrolled and sat for the Primary School Leaving Certificate Examination in 2016 in Kwale educational zone of Delta State. A sample of 520 pupils were selected using the purposive and stratified random sampling technique. The instrument used was 2016 mathematics objective test questions prepared by Delta State Ministry of Secondary and Basic Education. The researcher personally visited the Examination and Standard Unit to collect scores of the examinees. The Area Index (Raju) were used to identify DIF items while the inferential statistics of chi-square goodness of fit (x^2) were used to test the hypotheses at 0.05 level of significance. The findings revealed that items of Primary School Leaving Certificate Examination (PSLCE) of 2016 Mathematics objective questions significantly function differentially between male and female examinees. Items of Primary School Leaving Certificate Examination (PSLCE) of 2016 Mathematics objective questions do not significantly function differentially between urban and rural. Based on these findings summary, conclusion and suggestions for studies were made. It was recommended thattest writers should use IRT methods of detecting DIF before administering their test items

Keywords: DIF, Test, Sex and Location

Introduction

The issue of educational measurement in research point towards enhancing the equity of test or examination across sub groups of examinees is very essential in decisions based on scores of the examinees. Testsare set of items to which an examinee is to respond independently and the result of which can be treated in such a way as to provide a quantitative comparison of the performance among different students (Nworgu, 2011). Testing is done to determine whether or not an objective or goal has been obtained. In other words, testing concerns specific achievement of a student in terms of a given objective. By implication test items have to measure the same thing for individuals from different groups who have the same subject ability. However, using test items that measure different things from different subgroups of examinees who are of the same ability level is contrary to the principle of an egalitarian society that emphasized no deprivation of any kind. Examinees of same latent trait should respond to test item correctly irrespective of their gender and school location.

A test is "an instrument for systematic measure of examinees behaviour". A test is a series of items/tasks or a set of items that learners respond to orally or in writing which makes it possible to examine differences between learners. Testis used to gain useful information about examinees' knowledge, skills and progress; it helps each professional to perform work effectively. Testare used for placement, selection, certification and decision making. Sometimes, the outcome of these tests are incorrect due to differences in test performances among various groups of examinees. A fair test is one which is valid for all examinees and that affords all examinees equal opportunity to demonstrate the skills and knowledge which they have acquired and which are relevant to the tests purpose. As test results is usually the basis for decision that affects student's educational future, test should provide the same and equal opportunities to all students to demonstrate their skills, ability and knowledge. It therefore becomes necessary to avoid bias which may negatively influence examinees scores. The existence of Differential Item Functioning is an issue to be addressed because tests are used as a gateway for educational opportunities and is very important issue that test items are fair for all examinees irrespective of sex and location.

Differential item functioning is a "measurement bias" among examinees of different background such as sex, location and ethnicity with comparable ability level having different tendency of endorsing a particular item during testing. DIF occur if different subgroups, who have equal standing display different probabilities of passing an item or endorsing an item right. DIF exists if an item is relatively difficult, discriminating, or easily guessed for one group than for another. Omorogiuwa and Iro-Aghedo (2016) Observed that an item display DIF if examinees who have equal ability level but are members of different population subgroups (e.g different gender, location or ethnicity) do not have an equal probability of getting an item right. In essence, DIF occur when examinees from different groups with equal latent trait have systematically different responses to test items. For instance, when a mathematics test item have males answering correctly the test items more often than females of equal latent trait because the task in the question is on a topic more familiar to males (e.g sports), then the question is said to exhibit differential item functioning. DIF of an item can therefore be understood as a lack of conditional independence between an item response and group membership (often sex or location) giving the same latent trait in mathematics.

Mathematics is very crucial in teaching of science and many other school subjects. Mathematics is a unifying subject and pupils' interest in science cannot be alienated from mathematics. Mathematics as a science tool is used to interpret scientific phenomena. Nasir (2011) asserted that mathematics is an indispensable tool used by engineers, scientists and many other professionals for clear understanding of the physical world. He stressed that mathematics is a considerable tool that contain the skills for problem-solving, organising, simplifying,

interpreting data and performing calculations that arecrucial in fields of business and industry. Today mathematics is so important to the extent that a pass is required to gain admission into JSSI while a credit pass is required to get admission into SSSI and various courses in higher institutions of learning. Mathematics is the origin of any science subject and technological development of any nation. It entails techniques of counting, measuring, locating, designing and explaining.

Sex related differential item functioning is very crucial on standardized tests in mathematics because differences between females and males are often found (Teodora, 2013). Nidoy (2011). Results reported from many research are varied, perhaps due to intricacy of gender-related issues.Kalaycioglu and Berberoglu (2010) carried out a study with the aim to detect DIF items across sex groups; analysed item content for the possible source of differential item functioning and eventually investigated the effect of differential item functioning items on the criterion-related validity of the test scores in the quantitative section of the university entrance examination (UEE) in Turkey. The result revealed that there was sex differences in item selection.

Hyde et al, (2012) analysed results from 10 states mathematics tests, representing more than seven million students and found only small differences in performance by gender; standardized effect sizes, with positive effects favouring male and negative effects favouring females, were all less than 0.01. Lyons et al, (2014) investigated trends and variations in mathematics item functioning on the basis of gender across four participating jurisdictions in the 2009 PISA administration. The results of each jurisdiction were consistent with previous research findings. Selected response formats tended to favour boys while constructed response item formats tended to favour females. Similar proportions of items favoured one gender group over the other across jurisdictions and Finland had the greatest number of items that exhibited differential item functioning in favour of both genders. Boys outperformed girls in mathematics statistically significantly in Canada and Turkey, but there was no statistically significant difference between boys and girls' math performance in Finland or Shanghai (OECD, 2010b).

However, Adeblue (2013) found no item functioning differentially among examinees based on gender when he investigated DIF in Ekiti State Unified Mathematics Examination for senior classes. Adediwura (2013) conducted a study to identify differential item functioning in relation to gender and students' course of study using IRT and GLM methods to compare the nature of DIF identified by the two models in a dichotomous test. The study adopted descriptive survey design with a population consisting of all the part three students in the Faculty of Education of ObafemiAwolowo University Ile-Ife. Hence, both procedures detected six (6) items as exhibiting uniform DIF while four (4) items were identified as exhibiting non-uniform DIF. The researcher reported further by comparing the strength of both methods in detecting DIF, the IRT method was found to be powerful in detecting not only uniform DIF but also non-uniform DIF items while the GLM-LR method allowed for DIF items be screened quickly and easily. The study concluded that there were substantial differences across methods in terms of identifying items that exhibited DIF.

Adedoyin (2010) employed IRT to identify gender-biased questions on public exams: a case study of the mathematics section of the junior certificate test in Botswana. The study employed survey research design. The population of the study consisted of all examinees that enrolled and sat for paper 1 of 2004 Botswana Junior secondary school examinations in mathematics. The population of all candidates thatwrote the Junior secondary school examination was thirty five thousand two hundred and sixty two (35,262). A sample of 4000 students were selected (2000 males and 2000 females) using random sampling procedure. The examination paper contained 38 items. The method of data analysis used was IRT 3PL. The IRT statistical analysis produced parameter estimates for the two sub-groups and their corresponding item characteristics curves. In the study, the ICC curves for boys and girls were examined, and it was discovered that 5 of the 16 items that met the 3PL item response theory (IRT) statistical analysis

were biased against women. The research concluded that through the application of IRT methodology, it was clear that the biased item were detected, hence called for further need to identify gender DIF from other subjects in any public examinations, through the use of item response approach.

However, location is the geographical area where a school is sited which could be urban or rural. School location is seen in terms of city (urban) and less city (rural). There could be variations in educational opportunities in schools due to location. The emphasis on education and the amount given to children varies from one locality to another. One of the effects of geographical location is the difference between the educational conditions in the urban and rural areas. Most parents in the rural areas are from low socio-economic status and less exposed than those in the urban areas. There are notions that location may influence pupils' in answering question correctly in examination. Studies has shown that items function differentially among sex and location (Nworgu, 2011 and Obinne&Amali, 2014).

Adeyemi (2011) stated that there is a significant difference between rural and urban students achievement in public examinations. Onuoha, et al (2017) stated that there are claims that location of the schools has a role to play in pupils academic achievements. They believe that rural schools are confronted by many problems in areas like modern library, recreational facilities, power supply, internet service and shortage of teachers among others.Adebule and Ibitoba (2015) investigated differential item functioning of senior secondary school uniform promotion English language multiple-choice examination questions (MCEQ) organised marked and scored by Ekiti state ministry of education in respect of senior secondary school examinees gender and location. Three research questions and two null hypotheses guided the study. The study was conducted in three local government areas, one from each of the three sensational districts of the state. The descriptive survey research design was employed. The population of the study comprised 21,697 senior secondary two students in public schools in Ekiti State. A sample of 542 examinees was chosen from Ado, Ilejemeje and Gbonyin local government areas through multi-stage sampling technique from nine-co-educational schools. The 2010/2011 SSII English language MCEQ of uniform promotion examination was used as instrument. The three general questions raised were analysed using means, standards deviation and logistic regression while the two hypotheses formulated were tested using student t-test at 95% confidence level. The mean scores of the examinees in relation to location and gender were very close. The standard deviation values were also at par. Nine items possessed DIF in relation to gender and eleven (11) items had evidence of DIF in relation to location. The findings revealed that English language MCEQ items function differentially between boys and girls and between rural and urban examinees.

Mokobi and Adedoyin (2014) also carried out quantitative study to identify location biased items with respect to rural and urban schools in the 2010Mathematics paper 1 from the Botswana Junior Certificate Examination utilising IRT Item Response Characteristics Curves. The study further identified rural/ urban location biased items with respect to gender of students. The study employed survey research design. The population was 36,938 students. The researchers used stratified sampling to draw the population into 18668 females and 18271 males. Secondly, they used cluster sampling to select the males and females into rural and urban areas. The result of the sampling procedure was a population divided into four clusters of males from schools in rural location, males from schools in urban location, females from schools in rural location and females from schools in urban location. From each of the clusters, simple random procedure was used to draw 1250 examinees to make up 5000 examinees.

The instrument used for data collection was 2010 Botswana Junior Certificate Examination Mathematics examination Paper 1 consisted of forty (40) multiple choice test items. The study employed the 3PL (Multilog software) Item Response Theory (IRT) statistical analysis. The findings of the study revealed that from the 24 items that matched IRT (3PLM) model, six (6)

items were rural /urban location biased. The study further found out that three (3) items were rural /urban location biased with respect to males and six (6) items were rural /urban location biased with respect to females. Thus, this implied that 2010 Botswana Junior Certificate Examination Mathematics examination Paper1 function differentially between rural and urban location examinees.

Amuche and Fan (2014) focused on evaluating item bias in the Taraba State NECO Biology Examination utilising differential item functioning approach. The National Examinations Council (NECO) Biology 2012items were used to examine items that are bias utilising the DIF approach in relation to school type and school location. The research design employed was a comparative research type of design. The targeted population comprised of all students in SSS3 in Taraba State who enrolled for senior secondary certificate examination in 2012. Four hundred and thirty-two (432) candidates were sampled using multi-stage sampling technique. The instrument used for gathering data was a 60 items of NECO Biology examination questions. Logistic regression was used for analysis. Research findings showed that out of the sixty items in NECO Biology questions, 10 items were biased in relation to school type and 8 items in relation to school location. The result indicated that NECO Biology examination questions have incidences of items functioning differentially.

Adebule (2013) investigated DIF in Ekiti State Unified Mathematics examination for senior classes. Survey research design was adopted. The population comprised of all 2011/2012 senior secondary III students in Ekiti State. 400 students was sampled using stratified sampling technique. The instrument used to collect data was a 3-20 item multiple choice objective mathematics test items selected from Ekiti State unified examination for 2008/2009, 2009/2010 and 2010/2011 academic sessions totalling 60 items in all for each examinees. The instrument was administered on the students with the assistance of their mathematics teachers and research assistant trained. Mean, Standard deviation and t-test were used for the analysis. The result showed that items of Ekiti State unified mathematics examination (ESUME) did not function differentially among examinees on the basis of gender, age, parental qualifications and location.

Ozdemir (2015) observed that differential item functioning is a condition when an item function differently for respondents from one group to another. In other words, respondents with similar levels on a latent trait θ (e,g physical functioning) but who belong to different populations, havevarious probabilities of responding to an item. DIF elements pose a major danger to the instruments' validity to measure the trait levels of numbers from different populations or groups. Instruments containing such items may have reduced validity for between-group comparison, because their scores may be related to some attributes other than those the scale is intended to measure (Motshabi&Nenty, 2012). Similarly Lincare (2011) stated that when an item is not equally demanding in maximum achievement of tests or equally popular in typical achievementtests for groups that have been compared on the construct being tested, differential item functioning occurs. Queensoap and Orluwene (2017) observed that differential item functioning as the probabilities of success on an item of examinees of the same ability but belonging to different groups; that is, when examinees from various group have a different probabilities of endorsing an item right after controlling for overall test performance. The authors further stated that, differential item functioning may be attributed to item bias but may also reflect performance difference that the testintend to measure.

Research Questions

These question guided this study:

1. How many items function differentially in Primary School Leaving Certificate Examination of 2016 Mathematics multiple choice questions by sex?
2. How many items function differentially in Primary School Leaving Certificate Examination of 2016 Mathematics multiple choice questions by location?

Hypotheses

The tworesearch questions were hypothesize and tested:

1. Items in Mathematics Multiple Choice test of Primary School Leaving Certificate Examination of 2016 do not significantly function differentially between male and female examinees.
2. Items in Mathematics Multiple Choice test of Primary School Leaving Certificate Examination of 2016 do not significantly function differentially between urban and rural examinees.

Method

This study employed the survey research design adopting the ex-post-facto type to analyse differential item functioning of Primary School Leaving Certificate Examination of 2016 Mathematics multiple choice test questions in Delta State. The population for this study comprised all public primary school pupils that enrolled and sat for the Primary School Leaving Certificate Examination in 2016 in Kwale Educational Zone of Delta State. The population of pupils who enrolled and sat for primary School Leaving Certificate examination was 2600 for 2016 pupils.A sample of five hundred and twenty (520) pupils were selected usingpurposive sampling was used to select Kwale Educational Zone while the stratified random sampling technique was adopted in the classification of the sample into urban and rural areas. The instrument used was 2016 mathematics multiple choice questions containing forty-five items. A soft copy of the dichotomously scored items was obtained from the Examinations and Standard Unit of the Ministry of basic and secondary education Delta State as well as the demographic variables of the pupils such as sex and location. The instrument has been validated by the Examinations and Standard Unit of the Ministry of Basic and Secondary Education Delta State. Thus, there was no need for validityof the instrument again. The reliability of the instrument was not determined by the researcher, since it is an instrument of the Examinations and Standard unit of the Delta State Ministry of Basic and Secondary Education, the instrument was deemed reliable. The researcher collected the scores of the pupils who sat for the Primary School Leaving Certificate Examination in 2016 from Examinations and Standard Unit of the Ministry of Basic and Secondary Education Delta State.The scores collected from examinations and standard unit of the ministry of basic and secondary education was analysed. The Raju Area Method was used to determine the presence of differential item functioning. An item is said to possess differential item functioning when the area index is greater than a critical value of 0.22, but when the area index of an item is zero (0), the item is said not to possess differential item functioning. The hypotheses were tested using chi-square goodness of fit statistic at 0.05 alpha level.

Research Question 1

How many items function differentially in Primary School Leaving Certificate Examination of 2016 mathematics multiple objective questions between by gender?

Table 1: Item Parameter/Area Index to identify DIF (Male/Female 2016 PSLCE)

Items	male a1	Female a2	male b1	female b2	Area Index	Decision Favoured
Q1	0.143	0.193	-9.734	-5.246	0.168	NON DIF
Q2	0.273	0.430	-2.728	-2.855	0.029	NON DIF
Q3	2.464	0.216	-1.383	-2.556	0.248	DIF Female
Q4	0.318	0.169	-0.2 67	-2.551	0.273	DIF Female
Q5	1.037	0.160	1.041	5.128	1.786	DIF Male
Q6	0.224	0.111	-0.512	2.445	0.172	NON DIF
Q7	1.141	0.146	0.729	6.944	2.831	DIF Male

Q8	0.234	0.168	-2.307	-0.268	0.023	NON DIF
Q9	1.160	0.149	0.411	0.227	0.019	NON DIF
Q10	0.387	0.306	-1.773	-1.422	0.073	NON DIF
Q11	0.273	0.302	-0.084	-1.165	0.201	NON DIF
Q12	0.178	0.169	-0.213	-2.561	0.152	NON DIF
Q13	0.369	0.113	-0.316	-1.662	0.121	NON DIF
Q14	0.402	0.190	-1.125	-0.824	0.038	NON DIF
Q15	0.227	0.210	-0.303	-2.220	0.198	NON DIF
Q16	0.225	0.134	0.102	-3.964	0.273	DIF Female
Q17	0.410	0.207	-1.510	-2.999	0.265	DIF Female
Q18	0.647	0.130	-1.838	-5.965	0.775	DIF Female
Q19	0.304	0.248	-1.465	-1.748	0.04	NON DIF
Q20	0.464	0.161	-1.309	-1.665	0.051	NON DIF
Q21	1.209	0.130	0.112	-4.077	1.83	DIF Female
Q22	0.416	0.198	-0.739	-2.866	0.39	DIF Female
Q23	0.421	0.115	-0.998	-5.200	0.445	DIF Female
Q24	0.514	0.132	-1.093	-3.277	0.318	DIF Female
Q25	0.184	0.197	0.124	-1.201	0.106	NON DIF
Q26	0.411	6.502	-1.382	-0.342	9.539	DIF Male
Q27	0.330	0.274	-3.055	-3.706	0.114	NON DIF
Q28	0.178	0.301	0.470	-1.614	0.263	DIF Female
Q29	0.163	0.160	-2.998	-2.395	0.026	NON DIF
Q30	0.222	0.242	0.931	0.014	0.205	NON DIF
Q31	0.379	0.267	-2.936	-3.888	0.192	NON DIF
Q32	0.236	0.174	0.162	-3.854	0.375	DIF Female
Q33	0.446	0.117	2.384	8.438	0.684	DIF Male
Q34	0.381	1.551	-1.399	-0.443	1.049	DIF Male
Q35	0.192	0.146	-0.437	-2.287	0.109	NON DIF
Q36	0.195	0.247	-4.286	-3.859	0.047	NON DIF
Q37	0.249	1.727	4.994	0.889	1.536	DIF Female
Q38	0.238	0.159	0.161	-3.570	0.317	DIF Female
Q39	0.224	0.131	-0.786	-1.555	0.044	NON DIF
Q40	0.290	0.249	-0.986	-1.409	0.50	DIF Female
Q41	0.158	8.477	-0.144	-0.145	0.01	NON DIF
Q42	0.448	0.186	-1.203	-1.622	0.068	NON DIF
Q43	0.532	0.250	-0.560	-1.209	0.196	NON DIF
Q44	0.480	0.266	-2.578	-3.894	0.355	DIF Female
Q45	0.204	0.108	-1.239	-2.486	0.054	NON DIF

Table 1 shows that 20 (twenty) items or 44.4 percent of the Primary School Leaving Certificate Examination of 2016 Mathematics multiple choice test revealed DIF while 25 (twenty-five) items or 55.6 percent revealed no DIF. Five (5) items favoured male examinees and fifteen (15) items favoured female examinees.

Research Question 2

How many items function differentially in Primary School Leaving Certificate Examination of 2016 mathematics multiple choice questions between urban and rural examinees?

Table 2: Item Parameter/Area Index to identify DIF (Urban/Rural 2016 PSLCE)

Items	urban a1	rural a2	urban b1	rural b2	Area Index	Decision Favoured
Q1	0.434	0.369	-0.900	-2.340	0.172	NONDIF
Q2	0.327	0.491	-2.698	-2.235	1.395	DIF urban
Q3	0.233	0.176	-5.455	-6.392	3.88	DIF rural
Q4	0.268	0.830	-0.704	-0.471	1.172	DIF urban
Q5	0.293	0.567	-0.950	-0.015	2.388	DIF urban
Q6	0.172	0.222	0.085	0.648	3.419	DIF urban
Q7	0.433	0.180	1.992	4.821	0.721	DIF urban
Q8	0.752	0.839	-1.935	-1.803	0.112	NON DIF
Q9	0.477	0.871	-1.46	-0.774	0.167	NON DIF
Q10	1.007	1.152	-1.871	-1.818	0.212	NON DIF
Q11	0.163	0.521	-3.812	-0.666	8.789	DIF urban
Q12	0.804	0.793	-1.833	-1.85	0.017	NON DIF
Q13	1.468	1.13	-0.579	-0.843	0.071	NON DIF
Q14	0.269	0.191	-1.253	-0.838	1.901	DIF urban
Q15	0.925	1.013	-1.339	-1.325	0.064	NON DIF
Q16	0.293	0.508	-1.101	-0.540	1.942	DIF urban
Q17	0.273	0.296	-1.618	-2.755	0.612	DIF rural
Q18	0.234	1.089	-4.117	-1.040	4.354	DIF urban
Q19	1.192	1.286	-1.286	-1.399	0.161	NON DIF
Q20	0.379	0.303	-1.596	-0.821	4.172	DIF urban
Q21	0.999	0.944	-1.295	-1.353	0.059	NON DIF
Q22	0.628	0.174	-0.594	-1.315	4.515	DIF rural
Q23	0.262	0.229	-2.098	-1.988	2.800	DIF urban
Q24	0.391	0.291	-0.263	-1.032	1.65	DIF rural
Q25	0.239	0.176	-1.406	-1.495	1.535	DIF rural
Q26	0.359	0.227	0.575	1.010	1.625	DIF urban
Q27	0.272	0.299	-3.814	-3.208	0.667	DIF urban
Q28	0.268	0.180	-0.270	-1.844	4.918	DIF rural
Q29	0.243	0.298	2.667	2.694	0.056	NON DIF
Q30	0.254	0.267	0.286	0.542	0.204	NON DIF
Q31	0.368	0.483	-2.907	-2.268	0.992	DIF urban
Q32	0.198	0.158	-0.072	-1.228	4.004	DIF rural
Q33	0.211	0.314	4.541	3.406	2.175	DIF rural
Q34	0.177	0.206	-1.059	-1.028	0.683	DIF urban
Q35	0.480	0.401	-2.148	-2.112	0.198	NON DIF
Q36	1.064	0.271	-0.769	-1.235	1.712	DIF rural
Q37	0.331	0.225	-1.206	-1.868	2.839	DIF rural
Q38	0.202	0.171	-1.146	-1.535	2.427	DIF rural
Q39	0.79	0.897	-1.397	-1.325	0.094	NON DIF
Q40	0.772	0.377	-0.082	-0.665	1.381	DIF rural
Q41	0.081	0.106	2.667	2.694	0.020	NON DIF
Q42	0.635	0.547	1.830	2.375	0.389	DIF urban
Q43	1.161	1.237	-1.397	-1.446	0.075	NON DIF
Q44	0.418	0.530	-0.248	-1.076	0.412	DIF rural
Q45	0.926	0.976	-1.519	-1.305	0.177	NON DIF

Table 2 shows that 29 (twenty-nine) items or 64.4 percent of the Primary School Leaving Certificate Examination of 2016 Mathematics multiple choice test revealed DIF while 16 (sixteen) items or 35.6 percent revealed no DIF. Sixteen (16) items favoured urban location examinees and twenty (13) items favoured rural location examinees.

Hypothesis 1: Items in mathematics objective test in primary school leaving certificate examination of 2016 do not significantly function differentially by sex.

Table 3: Chi-square summary of 2016 DIF by sex.

Sex	Item favoured due to DIF	Df	Chi-square	Sig.(2tailed)
Male	5 (10)			
Female	15 (10)	1	5.000	.025
Total	20			

05. Since the p-value is lower than the alpha level of 0.05, therefore, the null hypothesis is rejected and the conclusion is that there is a significant difference in the number of items functioning differentially by sex in favour of female examinees in 2016 PSLCE Mathematics objective examination.

Hypothesis 2: Items in mathematics objective test in primary school leaving certificate examination of 2016 do not significantly function differently between urban and rural examinees .

Table 4: Chi-square summary of 2016 Differential Item Functioning by location.

Location	Item favoured due to DIF	DF	Chi-square	Sig.(2tailed)
Urban	16 (14.5)			
Rural	13 (14.5)	1	**.095**	**.758**
Total	29			

Table 4 shows a chi-square value of .095 and a p-value of .758. Testing at an alpha level of 0.05, the p-value of .758 is higher than the alpha level of 0.05. Hence, the null hypothesis is retained and the conclusion is that items in Mathematics multiple choice test administered by Delta State Ministry of Basic and Secondary Education do not significantly function differentially between urban and rural location examinees in 2016 PSLCE Mathematics objective questions.

Discussion of Findings

Research question one table 1 revealed that twenty (20) items of the Primary School Leaving Certificate Examination (PSLCE) of 2016 Mathematics Multiple Choice Questions functioned differentially with respect to sex. Out of the twenty (20) items flagged DIF, five (5) favoured male examinees while fifteen (15) items favoured female examinees. The findings of this study is in line with the study carried out by Omorogiuwa and Iro-Aghedo (2016) on Gender Differences in Differential Item Functioning in the 2015 National Business and Technical Examination Board (NABTEB) Mathematics Multiple Choice Examination. The result showed that out of the fifty (50) items administered, seventeen items flagged DIF, six (6) items favoured male student and eleven (11) items favoured female students.

Research question two table 2 showed that twenty-nine (29) items of the Primary School Leaving Certificate Examination (PSLCE) 2016 Mathematics Multiple Choice Questions functioned differentially with respect location. Sixteen (16) items favoured urban examinees

while thirteen (13) items favoured rural examinees. The result of this finding collaborated the findings of Moyo and Nenty (2017) on the Dimensionality Analysis of Students achievement in 2013 BGCSE Agricultural Examination. The study found that out of the forty (40) items administered eighteen (18) items flagged location DIF, ten (10) items favoured urban location while eight (8) items favoured rural location.

Hypothesis one table 3 showed that items of 2016 PSLCE Mathematics Objective Questions significantly function differentially by sex. This result is in line with the studies of Madu (2012a) who investigated gender-related DIF of 2011 NECO mathematics examination, the result of the studyshowed that items significantly function differentially by gender for male and female examinees; Abedalaziz (2012b) study on gender-related DIF using Logistic Regression and Mantel-Haenszel approach, the result of the findings revealed that both Logistic Regression and Mantel-Haenszel approach identified that the items significantly function differently by sex and Ebisine (2015) on the analysis of DIF responses by students in NECO SSCE mathematics objective questions in June/July 2012 showed that the instances of test items with DIF in NECO SSCE mathematics objective questions significantly differ for boys and girls while the result of this finding did not support that of Abiam&Odok (2006) who found no significant relationship between gender and achievement in mathematics.

Hypothesis two table 4 revealed that items of 2016 PSLCE Mathematics Multiple Choice Questions do not significantly function differently between urban and rural location. This means that the 2016 PSLCE Mathematics Multiple Choice Questions measured the same thing for with the same mathematics ability for different location (urban/rural). This result is in agreement with the study of Adebule (2013) who investigated DIF in a 3-20 item mathematics multiple choice test items selected from Ekiti State Unified Mathematics Examination for 2008/2009, 2009/2010 and 2010/2011 academic sessions totalling sixty (60) items for each students. The study concluded that the items of ESUME do not significantly function differentially among testeesby gender, age, parental qualification and location. While the analysis disagreed with the findings of Hogan-Bassey and Madu (2010) study on the Analysis of location context DIF in NECO mathematics multiple choice test items; Mokobi and Adedoyin (2014); Ogbebor and Onuka (2013) andAdebule and Ibitoba (2015) whose findings revealed that there was significant location DIF.

Conclusion

Based on the findings, the study concluded that the items of the **P**rimary School Leaving Certificate Examination (PSLCE) of 2016 Mathematics multiple choice questions exhibit differential item functioning (DIF). Also, the items of Primary School Leaving Certificate Examination (PSLCE) of 2016 Mathematics multiple choice questions significantly function differentially with respect to sex.

Recommendations

Based on the findings of this study, it is hereby recommended that:

1. Test writers are advised to use IRT methods of detecting DIF.
2. Examination and Standard examiners should consider piloting the Primary School Leaving Certificate Examination items more than once hence, the issues ofitem functioning differentially can be address.
3. Because of the incidence of sexDIF in the 2016 items of the Primary School Leaving Certificate Examination (PSLCE) of Mathematics multiple choice questions, text book writers are advised to use females for illustrations in order to reduce DIF**.**
4. Test experts and developers should consider the use of Area index measure in determining differential item functioning.

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