Differential Item Functioning (DIF) Of the Wechsler Preschool and Primary Scale of Intelligence Administered on Nigerian Children.

ADEPOJU, OLUFEMI ADETUNJI¹, DAUDA, ISIAKA KAYODE², LAWAL, ABDULJALEEL KOLA³ ^{1, 2, 3}Department of Educational Foundations and Curriculum Studies, Faculty of Specialised and Professional Education, Emmanuel Alayande University of Education, Oyo

Abstract- Differential Item Functioning (DIF) has been severally studied by psychologists to measure testees performance on test items based on their differences. This paper therefore investigated the Differential Item Functioning (DIF) of testees (pupils) age 7 approximately in the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-IV). Sample was drawn from the population. The sample size of pupils was 512 cut across three ethnic tribes. WPPSI-IV while IRT software (R) was used for data analysis. Findings from the study showed that 145 items function differently, while 125 items did not show bias. It was recommended that testees' interests, beliefs etc. should be taken into consideration during test construction so as to place the children on equal level playground and that the preschool curriculum should be modified to take care of the differences in testees.

I. INTRODUCTION

Nature has created human beings such that they are not equal in so many respects, or areas of life. This inequality is reflected in intelligence, background, cultural beliefs, interests, experience, tastes, education and a host of other things. Nigeria is not an exception in these inequalities or differences as different tribes speak different languages and as well as practice different cultures and traditions at far different locations from one another.

These differences amongst people might therefore make one to predict that the performance of students in examination might be influenced by the differences that exist in-between them. This has therefore led psychologists to come up with Differential Item Functioning (DIF) to identify factors that are responsible for differences in the academic performance of learners who belong to the same normative group because the presence of DIF can lead to inaccurate or unfair assessment of individuals or groups and this can undermine the validity of a test or questionnaire. It therefore implies that the detection of DIF in an evaluation instrument will provide constructive feedback about item quality as well as increase the effectiveness of tests. It can be used to support modification of instructional methods.

Kama & Vaughn (2004) expressed that Differential Item Functioning (DIF) is a situation whereby examinees from different groups, having similar abilities on a latent trait, have different probabilities of getting the test item correctly, while (Scott, 2014). Ohiri et al. (2024) posited that DIF as a statistical technique is used to identify differential item response patterns between groups of examinees such as male and female while helping in verifying potentially biased test items. Chen & Revicks (2014) opined that DIF is a situation whereby members from different groups (age, gender, race, education, culture) on the same level of the latent trait (disease severity, quality of life) have a probability of giving a certain response to a particular item. DIF therefore is a psychological way of studying the performance of testees of the same normative group but are different in areas such as background, religion; gender, interest, and culture in test the items.

As a statistical process, Differential Item Functioning (DIF) can be determined through logistic regression and Item Response Theory (IRT). Mantel-Haenszel, Lord's Chi-square, likelihood-ratio test method and bparameter method, thus making it test item centered.

In a study on Differential Item Functioning in the WISC-III, Maller (2001) reported that out of the 151 items studied, 52 were found to function differently across groups. Alordiah (2015) in a study on

comparison of index of differential item functioning in Mathematics submitted that CTT methods of detecting DIF did not agree with IRT methods of detecting DIF in the items flagged as DIF. Kamata & Vaughn (2004) in a similar study reported that only three items were found to present DIF against LD students who received testing accommodation, while one item was found to present DIF against typical students. Scott & Fayers (2010) studied quality of life groups and instruments using logistic regression found out that DIF in short scales may be commonly found in HRQL instruments, may be more difficult to interpret.

In a similar study that investigates the differential item functioning (DIF) estimate of the Mathematics test, Idimpaye, Enamudu & Saad (2004), results indicate slight performance differences between genders and significant variances across age groups and the magnitude of DIF indices was relatively small. In a gender-based related Differential Item Functioning of Mathematics Test Items, Abdelaziz (2010) found out that there was agreement among three methods M-H, TID and b-parameter methods of estimating the DIF. Ajai & Ugodulunwa (2024) studied the determination of DIF of SSCE Economics Multiple choice Items submitted 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.

II. STATEMENT OF THE PROBLEM

Wechsler Preschool and Primary Scale of Intelligence (WPPSI-IV) UK is a globally accepted and recognized scale to measure children's intelligence age 2.6 to 7.7. It has 15 subscales and those subscales make up 270 items. The value attached to this instrument and what it is being used for requires that quality research be carried out in which Differential Item Functioning (DIF) cannot be an exception. Furthermore, this study will prove and add to the validity value of WPPSI-IV in that items that testees perceived the same way even though their orientation might not be the same and those they perceived differently would be known. It would therefore expose bias in the WPPSI-IV.

III. RESEARCH QUESTIONS

The following research questions were raised to guide this study:

- 1. How many items would function differently among the testees?
- 2. How many items would not show bias among the testees?

IV. METHODOLOGY

Research Design

The design for this study is survey as data (scores) of pupils was collected in raw form without any form of manipulation,

Population and Sample

512 pupils or children of approximately age 7 were randomly selected from the population of 19,020 pupils which comprises of three (3) major tribes Yoruba, Hausa/Fulanis and the Ibos.

Instrumentation

The WPPSI-IV-UK was the instrument administered. This instrument has 15 sub-scales which made up 270 items.

Method of Data Analysis

Data collected was analyzed with the use IRT software "R" computed at 0.05 level of significance.

	Stat.	P-value	STATUS
BlockDesignCan1	-0.1593	0.8734	No DIF
BlockDesignCan2	10.5195	0	DIF
BlockDesignCan3	14.2517	0	DIF
BlockDesignCan4	12.8382	0	DIF

V. RESULTS

BlockDesignCan5	15.3271	0	DIF
BlockDesignCan6	4.0411	0.0001	DIF
BlockDesignCan7	2.7095	0.0067	DIF
BlockDesignCan8	13.7391	0	DIF
BlockDesignCan9	4.1492	0	DIF
BlockDesignCan10	6.3915	0	DIF
BlockDesignCan11	6.8266	0	DIF
InformationCan1	0.2889	0.7727	No DIF
InformationCan2	0.3474	0.7283	No DIF
InformationCan3	-2.2602	0.0238	DIF
InformationCan4	-1.7148	0.0864	. No DIF
InformationCan5	2.9679	0.003	DIF
InformationCan6	-1.3079	0.1909	No DIF
InformationCan7	2.6186	0.0088	DIF
InformationCan9	-3.7507	0.0002	DIF
InformationCan10	0.1952	0.8453	No DIF
InformationCan11	15.5617	0	DIF
InformationCan12	-4.845	0	DIF
InformationCan13	6.8912	0	DIF
MatrixReasoningCan1	-1.6834	0.0923	No DIF
MatrixReasoningCan2	-1.222	0.2217	No DIF
MatrixReasoningCan3	-0.6579	0.5106	No DIF
MatrixReasoningCan4	13.8472	0	DIF
MatrixReasoningCan5	-1.7482	0.0804	No DIF.
MatrixReasoningCan6	-0.8236	0.4102	No DIF
MatrixReasoningCan7	0.2797	0.7797	No DIF
MatrixReasoningCan8	-5.1771	0	DIF
MatrixReasoningCan9	-6.5974	0	DIF
MatrixReasoningCan10	-0.351	0.7256	No DIF
MatrixReasoningCan11	13.0732	0	DIF
MatrixReasoningCan12	10.4771	0	DIF
MatrixReasoningCan13	-1.0158	0.3097	No DIF
MatrixReasoningCan14	1.5881	0.1123	No DIF
MatrixReasoningCan15	-1.5037	0.1327	No DIF
MatrixReasoningCan16	0.312	0.755	No DIF
MatrixReasoningCan17	3.3427	0.0008	DIF
MatrixReasoningCan18	-4.6079	0	DIF
MatrixReasoningCan19	0.0306	0.9756	No DIF
MatrixReasoningCan20	7.7177	0	DIF
BugSearchCan1	3.8325	0.0001	DIF
BugSearchCan2	1.0728	0.2834	No DIF

BugSearchCan3	10.9978	0	DIF
BugSearchCan4	6.6447	0	DIF
BugSearchCan5	8.22	0	DIF
BugSearchCan6	-0.3036	0.7614	No DIF
BugSearchCan7	0.749	0.4539	No DIF
BugSearchCan8	2.4549	0.0141	DIF
BugSearchCan9	2.2366	0.0253	DIF
BugSearchCan10	7.3376	0	DIF
BugSearchCan11	14.6737	0	DIF
BugSearchCan12	9.2915	0	DIF
BugSearchCan13	0.413	0.6796	No DIF
BugSearchCan14	17.2493	0	DIF
BugSearchCan15	-0.2737	0.7843	No DIF
BugSearchCan16	1.6488	0.0992	No DIF
BugSearchCan17	11.66	0	DIF
BugSearchCan18	10.9373	0	DIF
BugSearchCan19	0.6794	0.4969	No DIF
BugSearchCan20	4.1286	0	DIF
BugSearchCan21	12.9549	0	DIF
BugSearchCan22	3.6988	0.0002	DIF
BugSearchCan23	7.8231	0	DIF
BugSearchCan24	1.7678	0.0771	No DIF
BugSearchCan25	5.4761	0	DIF
Picturememorycan1	0.3698	0.7116	No DIF
Picturememorycan2	-2.5495	0.0108	DIF
Picturememorycan3	-0.2905	0.7714	No DIF
Picturememorycan4	-11.4882	0	DIF
Picturememorycan5	0.2772	0.7816	No DIF
Picturememorycan6	-1.7128	0.0867	No DIF
Picturememorycan7	14.2287	0	DIF
Picturememorycan8	-0.2372	0.8125	No DIF
Picturememorycan9	-0.0993	0.9209	No DIF
Picturememorycan10	-0.837	0.4026	No DIF
Picturememorycan11	0.8472	0.3969	No DIF
Picturememorycan12	0.0303	0.9758	No DIF
Picturememorycan13	-2.2033	0.0276	DIF
Picturememorycan14	-0.1668	0.8675	No DIF
Picturememorycan15	0.7857	0.432	No DIF
Picturememorycan16	3.3583	0.0008	DIF
Picturememorycan17	0.8193	0.4126	No DIF
Picturememorycan18	-0.1573	0.875	No DIF

Picturememorycan19	-0.274	0.7841	No DIF
Picturememorycan20	-0.5346	0.5929	No DIF
Picturememorycan21	0.7238	0.4692	No DIF
Picturememorycan22	-0.037	0.9705	No DIF
Picturememorycan23	-3.2882	0.001	DIF
Picturememorycan24	-1.0987	0.2719	No DIF
Picturememorycan25	-0.6998	0.4841	No DIF
Picturememorycan26	-0.6368	0.5243	No DIF
Picturememorycan27	-5.5597	0	DIF
Picturememorycan28	3.0045	0.0027	DIF
Picturememorycan29	2.9451	0.0032	DIF
Picturememorycan30	2.7185	0.0066	DIF
SimilaritiesCan1	0.0371	0.9704	No DIF
SimilaritiesCan2	5.3335	0	DIF
SimilaritiesCan3	-0.169	0.8658	No DIF
SimilaritiesCan4	-5.6916	0	DIF
SimilaritiesCan5	0.8037	0.4216	No DIF
SimilaritiesCan6	-1.1296	0.2586	No DIF
SimilaritiesCan7	-2.8841	0.0039	DIF
SimilaritiesCan8	4.7173	0	DIF
SimilaritiesCan9	8.5918	0	DIF
SimilaritiesCan10	9.2774	0	DIF
SimilaritiesCan11	7.1087	0	DIF
SimilaritiesCan12	14.567	0	DIF
SimilaritiesCan13	-0.3134	0.754	No DIF
SimilaritiesCan14	-1.0749	0.2824	No DIF
SimilaritiesCan15	-1.3524	0.1762	No DIF
SimilaritiesCan16	-1.2781	0.2012	No DIF
SimilaritiesCan17	2.6829	0.0073	DIF
SimilaritiesCan18	2.6263	0.0086	DIF
PictureConceptsCan1	0.0657	0.9476	No DIF
PictureConceptsCan2	-1.7143	0.0865	No DIF
PictureConceptsCan3	-1.534	0.125	No DIF
PictureConceptsCan4	14.9928	0	DIF
PictureConceptsCan5	2.6186	0.0088	DIF
PictureConceptsCan6	-2.03	0.0424	DIF
PictureConceptsCan7	-0.1798	0.8573	No DIF
PictureConceptsCan8	-1.4163	0.1567	No DIF
PictureConceptsCan9	-3.3338	0.0009	DIF
PictureConceptsCan10	1.1139	0.2653	No DIF
PictureConceptsCan11	-0.5425	0.5875	No DIF

PictureConceptsCan12 0 PictureConceptsCan13 5.5151 DIF -1.5591 0.119 PictureConceptsCan14 No DIF 0.9755 No DIF PictureConceptsCan15 0.0307 PictureConceptsCan16 -2.3611 0.0182 DIF DIF PictureConceptsCan17 -2.3891 0.0169 0.9757 PictureConceptsCan18 0.0305 No DIF No DIF PictureConceptsCan19 -0.5005 0.6167 PictureConceptsCan20 0.2355 No DIF -1.1863 CancellationCan1 0.2004 0.8412 No DIF CancellationCan2 2.0559 0.0398 DIF CancellationCan3 10.042 0 DIF CancellationCan4 5.9421 0 DIF CancellationCan5 14.1425 0 DIF CancellationCan6 0.0892 0.9289 No DIF DIF CancellationCan7 14.6244 0 CancellationCan8 4.594 0 DIF 0 CancellationCan9 6.823 DIF CancellationCan10 0.6536 0.5134 No DIF CancellationCan11 9.0196 0 DIF CancellationCan12 0.2354 0.8139 No DIF CancellationCan13 DIF 7.011 0 CancellationCan14 3.9304 0.0001 DIF CancellationCan15 5.8892 0 DIF 0 ZooLocationCan1 5.2587 DIF ZooLocationCan2 8.2854 0 DIF ZooLocationCan3 5.9798 0 DIF ZooLocationCan4 0.0972 No DIF 1.6587 ZooLocationCan5 8.5919 0 DIF ZooLocationCan6 4.2575 0 DIF ZooLocationCan7 3.2092 0.0013 DIF ZooLocationCan8 1.8852 0.0594 No DIF ZooLocationCan9 4.1067 0 DIF ZooLocationCan10 0.6594 0.597 No DIF 0 ZooLocationCan11 8.1248 DIF ZooLocationCan12 0.0291 DIF 2.1826 ZooLocationCan13 5.9909 0 DIF ZooLocationCan14 3.9154 0.0001 DIF ZooLocationCan15 0.5674 0.5705 No DIF 0.0011 DIF ObjectAssemblyCan1 3.2593

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0.0342

DIF

-2.1179

5.0425

0

DIF

ObjectAssemblyCan2

ObjectAssemblyCan3	5.7376	0	DIF
ObjectAssemblyCan4	8.697	0	DIF
ObjectAssemblyCan5	0.4597	0.6457	No DIF
ObjectAssemblyCan6	4.227	0	DIF
ObjectAssemblyCan7	2.1857	0.0288	DIF
ObjectAssemblyCan8	2.1479	0.0317	DIF
ObjectAssemblyCan9	1.2334	0.2174	No DIF
ObjectAssemblyCan10	1.9396	0.0524	No DIF
ObjectAssemblyCan11	0.7822	0.4341	No DIF
ObjectAssemblyCan12	0.1386	0.8898	No DIF
VocabularCan1	0.0717	0.9428	No DIF
VocabularCan2	6.0817	0	DIF
VocabularCan3	1.2821	0.1998	No DIF
VocabularCan4	0.0977	0.9222	No DIF
VocabularCan5	0.2069	0.8361	No DIF
VocabularCan6	0.0642	0.9488	No DIF
VocabularCan7	0.6844	0.4937	No DIF
VocabularCan8	5.2705	0	DIF
VocabularCan9	0.5934	0.5529	No DIF
VocabularCan10	-1.8909	0.0586	No DIF
VocabularCan11	9.8853	0	DIF
VocabularCan12	-1.0029	0.3159	No DIF
VocabularCan13	8.8756	0	DIF
VocabularCan14	0.644	0.5195	No DIF
VocabularCan15	2.7244	0.0064	DIF
VocabularCan16	-3.2495	0.0012	DIF
VocabularCan17	0.8114	0.4172	No DIF
VocabularCan18	2.5908	0.0096	DIFDIF
VocabularCan19	8.4769	0	DIF
VocabularCan20	8.0024	0	DIF
AnimalCodingCan1	9.4058	0	DIF
AnimalCodingCan2	1.6361	0.118	No DIF
AnimalCodingCan3	-3.193	0.0014	DIF
AnimalCodingCan4	9.0352	0	DIF
AnimalCodingCan5	1.8909	0.0586	No DIF
AnimalCodingCan6	6.9541	0	DIF
AnimalCodingCan7	2.2	0.0278	DIF
AnimalCodingCan8	0.656	0.5	No DIF
AnimalCodingCan9	2.1441	0.032	DIF
AnimalCodingCan10	10.8272	0	DIF
AnimalCodingCan11	-3.163	0.0016	DIF

AnimalCodingCan12	-0.0706	0.9438	No DIF
AnimalCodingCan13	1.0014	0.3166	No DIF
AnimalCodingCan14	-1.0258	0.305	No DIF
AnimalCodingCan15	0.2886	0.7729	No DIF
ComprehensionCan1	8.3651	0	DIF
ComprehensionCan2	-6.3065	0	DIF
ComprehensionCan3	-88069	0	DIF
ComprehensionCan4	0.0874	0.9303	No DIF
ComprehensionCan5	7.9947	0	DIF
ComprehensionCan6	6.2895	0	DIF
ComprehensionCan7	15.4081	0	DIF
ComprehensionCan8	-0.1585	0.8741	No DIF
ComprehensionCan9	-3.5264	0.0004	DIF
ComprehensionCan10	-4.5058	0	DIF
ComprehensionCan11	6.5937	0	DIF
ComprehensionCan12	9.4615	0	DIF
ComprehensionCan13	0.8041	0.4214	No DIF
ComprehensionCan14	0.8768	0.3806	No DIF
ComprehensionCan15	0.1008	0.9197	No DIF
ComprehensionCan16	-2.0821	0.0373	DIF
ComprehensionCan17	-1.7223	0.085	No DIF
ComprehensionCan18	0.1074	0.9145	No DIF
ComprehensionCan19	-2.6811	0.0073	DIF
ComprehensionCan20	0.3369	0.7362	No DIF
ReceptiveVocabularyCan1	-0.2423	0.885	No DIF
ReceptiveVocabularyCan2	7.9891	0	DIF
ReceptiveVocabularyCan3	7.3677	0	DIF
ReceptiveVocabularyCan4	9.1083	0	DIF
ReceptiveVocabularyCan5	3.8369	0.0001	DIF
ReceptiveVocabularyCan6	4.2911	0	DIF
ReceptiveVocabularyCan7	-1.1212	0.2622	No DIF
ReceptiveVocabularyCan8	0.0899	0.9283	No DIF
ReceptiveVocabularyCan9	-1.5698	0.1165	No DIF
ReceptiveVocabularyCan10	-1.7137	0.0866	No DIF
ReceptiveVocabularyCan11	-1.3833	0.1666	No DIF
ReceptiveVocabularyCan12	5.0717	0	DIF
ReceptiveVocabularyCan13	1.0498	0.2938	No DIF
ReceptiveVocabularyCan14	-2.7671	0.0057	DIF
ReceptiveVocabularyCan15	9.2117	0	DIF
ReceptiveVocabularyCan16	0.9084	0.3637	No DIF
ReceptiveVocabularyCan17	3.4434	0.0006	DIF

ReceptiveVocabularyCan18	-0.179	0.8579	No DIF
ReceptiveVocabularyCan19	-1.4698	0.1416	No DIF
ReceptiveVocabularyCan20	8.8177	0	DIF
PictureNamingCan1	0.3126	0.7546	No DIF
PictureNamingCan2	0.1832	0.8546	No DIF
PictureNamingCan3	6.3356	0	DIF
PictureNamingCan4	4.5613	0	DIF
PictureNamingCan5	2.03	0.0424	DIF
PictureNamingCan6	-2.5187	0.0118	DIF
PictureNamingCan7	0.4504	0.6524	No DIF
PictureNamingCan8	-1.8203	0.0687	No DIF
PictureNamingCan9	-1.0957	0.2732	No DIF
PictureNamingCan10	0.9339	0.3503	No DIF
PictureNamingCan11	6.4968	0	DIF
PictureNamingCan12	9.3089	0	DIF

Differential Item functioning analysis of the item using Raju Item Response Theory based on 3PL shows that 145 items function differently between the testees while 124 items did not show bias between 124 items.

CONCLUSION

This study has been able to reveal bias in almost a 50% of the WPPSI-IV items, an indication that differences in background, gender, environment, beliefs, interest and other social values affect pupils or testees attempt to items (questions).

RECOMMENDATIONS

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

1. Testees (pupils) background, interest, experience, beliefs etc. should be taken into consideration during test construction so as to place the children on a level play ground.

2. School curriculums should be unified to respect whatever difference that might exist among the testees.

REFERENCES

[1] Alordiah C.O. (2015), Comparison of Effect of Differential Item Functioning under the Methods of Item Response Theory and Classical Test Theory in Mathematics. Unpublished Ph.D. Thesis, Delta State University, Abraka, Nigeria.

- [2] Scott N.W. & Fayers M.P. (2010) Differential Item Functioning (DIF) analyses of healthrelated quality of life instruments using logistic regression. Health and Quality of Life Outcomes, 8(1), 81.
- [3] Scott N.W., Fayers M.P., Aaronson K.N., Bottomley A., de Graeff A., Groenvold M. (2014). Interpretation of differential item functioning analysis using external review. Expert Review of Pharmacoeconomics & Outcome Research, 10(3), 253-258.
- [4] Wechsler D. (2012). Wechsler Preschool and Primary Scales of Intelligence (4th edition) (WPPSI-IV). San Antonio, TX: Psychological Corporation. 079/10.1007/978-94-007- 0753-6_758
- [5] Kamata, A., & Vaughn, B. K. (2004). An introduction to differential item functioning analysis. Learning Disabilities: A Contemporary Journal, 2, 49-69.
- [6] Ohiri, C. S., Christopher, O. M., & Benedict, C. I. (2024). International Journal of Research Publication and Reviews, 5.2, 1555-1564. An item presenting Uniform DIF/Download Scientific Diagram!

 [7] Maller, S. (2001). Differential item functioning in the WISC-III: Item parameters for boys and girls in the national standardization sample. Educational and Psychological Measurement, 61.5, 793-817.