META-ANALYSIS OF STUDIES ON PSYCHOMETRIC PROPERTIES OF WAEC AND NECO EXAMINATIONS IN NIGERIA

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Abstract

This study investigated the factors responsible for variation in the findings of studies conducted on the psychometric properties of WAEC and NECO examinations in the last 20 years by meta-analyzing such like studies. The study examined some of the study characteristic such as sample size, year of examination question as it influences the effect size generated for each study. The descriptive research of the survey design was used in this study. The population however consisted of all studies that examined the psychometric properties of WAEC and NECO examinations from year 2000 to 2019. Meanwhile, 45 relevant studies were used as sample for the study out of which useful 65 hypotheses were extracted for meta-analysis. Comprehensive meta-analysis was used to generate effect and test for heterogeneity while hypotheses were tested using the statistics. Findings from the study established a significant heterogeneity and difference in the effect size of the studies while it was ascertained that the year of examination questions used by different studies was said to significantly influence the effect size of the studies. It was therefore recommended that the two examination bodies (WAEC and NECO) should put in more effort in ensuring that their examination questions are of standard and that such culture is maintained at all times. The general public should be rest assured that the two examinations are indeed parallel in terms of their psychometric properties (qualities), only that the questions of the examinations do vary from one examination year to the other.

Keywords: *WAEC, NECO, Psychometric Properties, Meta-analysis, Heterogeneity, Effect Size*

INTRODUCTION

In educational research, the conceptual and geographical scope are very important as to know where the research work actually covers from which inference can be drawn, many researchers from different parts of the world, continent or country can therefore work on the same content or area and it is expected that their findings are related as long as the sample used has some common characteristics and the instrument in question is unique to the concept being researched into.

A meta-analysis is the statistical process of analyzing and combining different results from several similar studies basically to ascertain the factors responsible for variation their outcomes. It is essential to ensure that the different studies present data that can be combined. If the studies contain data on the same topic that can be combined, a meta-analysis can even be performed using data from only two studies. A meta-analysis differs from a systematic review in that it uses statistical methods on estimates from two or more different studies to form a pooled estimate (Ahn and Kang, 2018).

A test has to do with systematic method of gathering data for the purpose of making an intra and inter comparisons between individuals within a class or a school system (Omirin, 1999). It

is an instrument designed and used to elicit sample of behaviour, a set of well- constructed stimuli presented to a testee to find out whether learning has already taken place (Adebule and Olwatayo, 2011). A test is said to be of acceptable quality if it is valid, reliable, and moderately difficult, discriminates between brilliant and dull students, usable and has a good distractor index. WAEC and NECO examination, beingstandardized and parallel examinations are therefore expected to possess the above qualities and most importantly have the same difficulty index and discriminating power. Meanwhile there has always been a disparity in the percentage of students who passed the two examinations with five credits including Mathematics and English language which is the benchmark for securing admission into universities in Nigeria. The summary of the results from the two examination bodies for the year 2018 reveals that 71.48 % passed NECO examination and 49.98% passed WAEC examination with five credits including Mathematics and English Language which is not close at all.

Researchers on this note have been interested in knowing whether one of the examination is more difficult compared to the other or whether one discriminate better between brilliant and dull students than the other, many researchers has therefore on different occasion, time and location compared the difficulty and discriminating power of WAEC and NECO examination using the same or different subject. Their findings however has brought confusion as to what exactly the position of the situation should be as researchers continue to come out with different findings and drawing different conclusions.

Some ascertained that WAEC is more difficult compare to NECO while some opined that NECO is more difficult compare to WAEC. Daniel (2005) stated that NECO was inferior in terms of quality of question papers set and credibility of grades awarded to candidates. According to Peters (2012), the substandard nature of NECO made some federal universities from 2002 to 2012 to have rejected NECO results. Ahmed (2014) stated that NECO questions from 2011 to 2014 were of higher standard than that of WAEC. Ojerinde and Faleye (2005) stated that there was no difference between NECO and WAEC examination, when they were compared. Bandele and Adewale (2013) opined that NECO examination is more difficult than WAEC.

As research seems to be the only way to justify the diverse claim and positions on the qualities of the two examinations, it is therefore essential to validate the factors responsible for the variation in the findings of different researchers that focus on same area of interest.

STATEMENT OF THE PROBLEM

Despite the fact that researchers continue to devote their time and resources to establish possible relationship or difference in the qualities of WAEC and NECO Examinations, the position of the general public, scholars and researchers on the standard of the two examinations which is supposed to be parallel in all standard is yet to be established or defined. While different notions about the two examinations which could be wrong or right still persist and yet the outcomes of studies in this areas are of diverse claims.

PURPOSE OF THE STUDY

The purpose of this study is to integrate studies that worked on the psychometric properties of WAEC and NECO Examination with the sole aim of ascertaining or validating the qualities of the two examinations majorly in terms of their psychometric properties. However the study also intends to establish the factors responsible for the inconsistency in the findings of past research

works.

RESEARCH HYPOTHESES

The following hypotheses were formulated and tested at 0.05 level of significance

1. There exists no significant heterogeneity between studies on the psychometric properties of WAEC and NECO examinations
2. The selected studies are not significantly different in terms of their effect sizes based on findings.
3. Year of examination question will not significantly influence studies effect sizes

RESEARCH DESIGN

This study employed descriptive research of a case study type. The descriptive research is the type in which one situation or event is being described without manipulation. This study, being a meta-analytical research aimed at gathering and integrating the previous findings of different researchers on psychometric properties of WAEC and NECO Examinations in Nigeria and works with already existing data (research results) which entertains no manipulation, hence the justification for adopting descriptive research. Meanwhile the case study design was employed simply because of the uniqueness and limitation of the study to Nigeria alone, even as it considered only past studies that compares the psychometric properties of WAEC and NECO Examinations alone.

POPULATION

The population for the study consisted of all studies that have been conducted on WAEC and NECO Examinations since the inception of NECO in the year 2000 as reported through local and international journals, published and unpublished Master's and Ph.D. thesis, conference and seminar papers.

SAMPLE AND SAMPLING TECHNIQUES

A total of 45 studies that compared the psychometric properties of WAEC and NECO Examinations in terms of difficulty and discriminating indices, in local and international journals, published and unpublished Master's and Ph.D. thesis, conference and seminar papers were selected.

RESEARCH INSTRUMENTS

The research instruments used for this study were past studies that compared the difficulty and discriminating indices of WAEC and NECO Examinations in Nigeria from year 2000 to 2019.

DATA SOURCES AND SEARCH STRATEGIES

Relevant studies were identified through a comprehensive search of publicly available literature published from 2000 through to 2019. Some unpublished theses identified through references were tracked down to the various university sources and a search through the library and post graduate school resource rooms were of help in such universities. The international journal of Africa, the Education Resources Information Center (ERIC), Google scholar and Elsevier science direct online among others were selected as data sources, because they provide a wide multidisciplinary lens.

INCLUSION AND EXCLUSION CRITERIA

only studies that examined the psychometric properties of WAEC and NECO examinations in terms of their psychometric properties such as validity, reliability, difficulty index, discriminating power, distractor index, guessing parameter and differential item functioning were considered. Some studies that did not adopt the WAEC and NECO Examination Questions or lacked sufficient information for calculating effect size were excluded.

DATA ANALYSIS

Comprehensive Meta-Analysis (CMA) was used to generate effect size and test for heterogeneity, while research questions wereanwered descriptively while hypothesis were tested using inferential statistics at 0.05 level of significance.

RESULTS
HYPOTHESIS 1

There exists no significant heterogeneity between studies on the psychometric properties of WAEC and NECO examinations

Comprehensive Meta-Analysis was used to test this hypothesis and the output of the tested heterogeneity was presented in the table below.

Table 3: Comprehensive Meta-Analysis for test of significant existence of heterogeneity between studies on psychometric properties of WAEC and NECO examinations

N	Model	Q-value	Df	P-value	
65	Random Effect	2714.168	64	0.000	**Significant**

P<0.05

Table 3 above present the result of a test of heterogeneity between studies that examined the psychometric properties of the examination administered by WAEC and NECO in Nigeria, using comprehensive meta-analysis to test the hypothesis under random effect model, the result was significant.

The 65 studies or hypotheses considered had a Q-value of 2714.168, Degree of freedom of 64 and Probability level of 0.000 which is less than the maximum significant level of 0.05. This implies that the null hypothesis is rejected with an indication that there exist a significant heterogeneity among the examined studies.

This therefore connotes that there is a significant variation in the effect size of the various studies that examined the compared or examined the psychometric properties of the two examination, with the evidence that the outcomes of those various studies and their study parameters or characteristics varies among the studies.

HYPOTHESIS 2

The selected studies are not significantly different in terms of their effect sizes based on findings.

The independent sample t-test was used to test this hypothesis and the result was presented in the table below.

Table 4: test of difference in the effect size of selected studies base on the findings

Findings	N	Mean	S.D	Df	t	p	
The same Level of Psychometric Properties	39	0.2299	0.2106				
Different Level of Psychometric Properties	26	0.5958	0.70204	63	3.066	0.003	**Significant**

P<0.05

The table above presents the test of difference it the effect of 65 studies that examined the psychometric properties of WAEC and NECO Examinations based on the two different categories of findings. The studies with the findings that the two examinations are the same in terms of their psychometric properties recorded a N (39), Mean (0.2299), S.D (0.2106) while studies with a contrary findings recorded N (26), Mean (0.5958) and S.D (0.70204). 63, 3.066 and 0.003 where recorded as the value for the degree of freedom, standard deviation and probability level respectively.

With the P-value of 0.003 which is considered less as compared to 0.05 level of significant and certified the rejection of the null hypothesis, it is evident that the effect size of studies in the two different categories of finding differs in terms of the effect size.

HYPOTHESIS 3

Year of examination question will not significantly influence studies effect sizes.

Analysis of variance (ANOVA) was used to test this hypothesis and the result was presented in the table below.

Table 5: Analysis of variance of the influence of the year of examination questions on the effect size of selected studies

Source of Variation	SS	Df	MS	F	Sig.	
Between groups	7.633	5	1.527	8.187	0.000	
Within groups	11.002	59	0.186			**Significant**
Total	18.636	64				

P< 0.05

The table above reveals the possible influence of the years of examination questions on the effect size of the selected studies. The examination questions by years were categorized into six different categories; category 1(2000 – 2002), category 2 (2005-2009), category 3 (2011-2012), category 4 (2013), category 5 (2014-2015) and category 6 (2017-2019). The effect of the coded categories on the effect size of corresponding selected studies were analyzed using one way ANOVA while the result reveals that the year of examination significantly influences the effect size of the studies in question at F (8.187), Df (5,59) and Sig. value (0.000).

This however implies that the year of the examination question of WAEC and NECO examinations used in the various studies has to do with the corresponding effect size generated from the studies characteristics. This however leads to the application of post hoc analysis to determine where significant difference actually lies across the categories of the examination years using Scheffe's post hoc.

Table 6:Scheffe's multiple comparison of the influence of year examination question on the effect size of selected studies.

Year of examination (Category)	Mean	2000-2002	2005-2009	2011-2012	2013 - 2014	2015-2016	2017-2019
2000-2002	0.26346			*			*
2005-2009	0.40880						

2011-2012	0.96883	*			*	*	
2013	0.28692			*			*
2014-2015	0.14275			*			*
2017-2019	1.0000	*			*	*	

The above table shows the multiple comparisons the mean difference across the six categories of different years of examination question used in different studies on psychometric properties of WAEC and NECO examinations in Nigeria. Following the significant result established by the analysis of variance of the influence of the year of examination question on the effect size of studies which necessitate the quest to verify where significant difference in the mean effect of the various categories of the examination years actually lies taking a partial comparison of two categories at a time.

This was revealed in the above table, made it clear that 2017-2019 categories had the highest mean followed by 2011-2012, 2005-2009, 2013- 2014, 2000-2002 and 2015-2016 respectively. The table further established that there exists a significant difference in the mean of 2011-2012 and 2017-2019 examination year categories as against 2000-2002, 2013 -2014 and 2015-2016 categories. This therefore signifies that the standard of the two examinations varies by year.

DISCUSSION

The study tested the significance existence of heterogeneity in the effect size of the studies selected for meta-analysis as touching the psychometric properties of the WAEC and NECO examinations. The result from the hypothesis tested using Comprehensive Meta-Analysis (CMA) shows that the existence of heterogeneity in the effect size of the studies in question was significant. This is however the evidence of the 95% variation in the effect size of the studies as earlier pointed using descriptive statistics and the illustration of the statistical tools used by different studies.

This study further examined the difference in the effect size of the selected studies base on the finding category (the same level of psychometric properties and different level of psychometric properties). The result made it clear that the effect size is different across the category with the studies which found out a different level of psychometric properties between the two examinations having the highest effect size. This is because the average sample size of the category with the highest effect size coupled with other measure is better compared to the other group.

This study in another vein examined the possible influence the year of examination questions used by the different studies could have on their effect sizes. It was found that the years of examinations questions used do influence the effect sizes generated in the studies. This implies that the variation in the findings of the various studies on the psychometric properties of WAEC and NECO examination can be allotted to the year of examination question used in verifying the psychometric properties.

This in a clear term indicates that the qualities of the two examinations in terms of their psychometric properties vary by year. This in accordance with the studies conducted by Kolawole in the year 2002 and 20007. He submitted in reference to his research in 2002 that a given X grade in NECO mathematics test is equal to X+1 grade in WAEC meaning that WAEC is more difficulty than NECO and also found out in year 2007 that both WAEC and NECO examinations are the same in terms of their psychometric properties and that they should be

treated as parallel examinations in all standard.

In another study conducted by Obinne (2008) where he made used of three different examination years in comparing the psychometric properties of WAEC and NECO examinations. Looking at the validity of the two examinations, he found out a significant difference using year 2000 and 2002 questions but a non-significant difference using the year 2001 question. In verifying the difficulty index of the two examinations as well, he found out a significant difference comparing the WAEC and NECO examinations for year 2000 and 2002 but a non-significant difference for year 2001. He as well examined the guessing parameter of the two examinations and found out a significant difference in using year 2000 and 2002 examinations questions but a non-significant difference in that of year 2001. The same were recorded in all the psychometric properties examined by Obinne (2008) across the tree different year of examination questions except for that of discriminating power.

Femi (2014) also verified the difficulty index of WAEC and NECO examinations using year 2009, 2011 and 2013 examination questions respectively. He found out that the two examinations were not significantly different in terms of difficulty index using year 2011 and 2013 question while a significant difference was established using year 2009 examination question. He as well recorded a significant difference in the discriminating power of the two examinations across the three different years of examinations. This can also be likened to that of Obinne (2008) as touching discriminating power.

CONCLUSION

The outcome of the studies that examined the psychometric properties of the WAEC and NECO examinations varies across the studies. 35% variation was recorded between studies outcomes that indicate the same level of quality and those ones that indicate different level of quality while a 95% variation and 50% variation was recorded in the effect sizeof the selected studies. It is therefore concluded that the outcomes of studies and their effect sizes actually varies and that these as established, is as a result of the variation in the quality of the WAEC and NECO examinations questions from year to year.

RECOMMENDATIONS

The following recommendation were made base on the findings of this study.

1. The two examination bodies (WAEC and NECO) should put in more effort in ensuring that their examination questions are of adequate standard and that such culture is maintained at all times.
2. The general public should be rest assured that the two examinations are indeed parallel in terms of their psychometric properties (qualities), only that the questions of the examinations can vary from one examination year to the other.
3. The general public, policy maker and end users should continue to treat the two examinations as parallel ones.

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