

THE PREDICTIVE VALIDITY OF PUBLIC EXAMINATIONS: A CASE STUDY OF NIGERIA

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ABSTRACT

This study:

- i) determined the extent to which scores in examinations conducted by the West African Examination Council (WASSCE), National Examinations Council (SSCE) and National Business and Technical Examination Board (NBCE/NTCE) in conjunction with the Joint Admissions and Matriculation Board (UME) predict future academic achievement of students in university degree examinations.
- ii) developed structural models for predicting the academic achievement in university degree examinations based on performance in public examinations.

Records on performance in the public examinations of a random sample of 4904 candidates were obtained from 22 Nigerian universities that satisfied certain predetermined criteria. In addition, the candidates' academic records were obtained from these universities in eight core disciplines. The forward inclusion multiple linear regression analysis was used to analyze these data and the postulated hypotheses tested at 0.01 significance level. The study revealed that there was low but positive relationships ($0.118 \leq r \leq 0.298$) between each of the predictor variables under study. Although, generally public examinations poorly predicted students' university academic achievement, when compared individually with other predictors, WASSCE was the best single predictor of the students' Cumulative Grade Point Average (CGPA). Based on candidates' first sitting in public examinations, the following models were obtained for predicting students' academic achievement: $CGPA = 1.402 + 0.04 WASSCE_1 + 0.014 UME$; $CGPA = 1.717 + 0.024 SSCE_1 + 0.015 UME$. The paper concludes with some summary remarks.

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INTRODUCTION

In Nigeria, achievement at any level of education is crowned with certification for those who successfully complete the course of study with good academic records. Thus, at the end of secondary school education, students are expected to sit for public examinations such as the West African Senior School Certificate Examination (WASSCE), conducted by the West African Examinations Council (WAEC), Senior School Certificate Examination (SSCE), conducted by the National Examinations Council (NECO), and the National Technical and Business Certificate Examinations (NTCE/NBCE) also conducted by the National Business and Technical Examination Board (NABTEB). Before proceeding and for the purpose of this paper, public examinations are viewed as external school examinations open to the general public and conducted by these examination bodies using tests that have appropriate psychometric properties. According to Adeyegbe (2004), these tests used by various public examination boards are often better developed than the ones prepared by the teachers in the school setting, university inclusive.

Possession of minimum of five credit passes in any of these public examinations is a pre-requisite for sitting for the University Matriculation Examination (UME) conducted by the Joint Admissions and Matriculation Board. Candidates' admission or placement into Nigerian universities irrespective of whether the university is federal, state or private owned is contingent on meeting the prescribed cut-off mark in the UME. Of recent, the prospective candidates are further required to undergo university screening examinations as a condition for eventual admission. It is believed that these entry qualifications and entrance examinations will positively predict candidates' performance in the university.

However, public examination bodies responsible for the award of certificates and placement of students in the universities have been facing a lot of criticisms due to the poor performance or poor quality of our universities undergraduates. Several professionals and researchers in education have argued that the glorious days of high academic performance and enviable achievement among Nigerian undergraduates have reached a vanishing point and are called for an education summit to rectify the situation (see, for example, Ige (1997), Nwokocha (1997)). It is also disturbing to note that graduates from Nigerian universities who happen to go for further studies abroad are often made to face further examination before being admitted. The foregoing present a gloomy and worrisome picture considering the fact that Nigerian universities had been adjudged to produce world-class graduates who have distinguished themselves in their areas of calling.

As a remedy, there have been persistent calls from different quarters for the re-examination of the present modes of selecting candidates for admission into the various degree programmes in Nigerian universities with a view to determining the credibility of each of the admission criteria. Such calls which are borne out of the observed mismatch between candidates' performance in public examinations and their subsequent achievement in university degree examinations has eventually resulted in the post UME screening exercise.

Investigation into the predictive validity of public examinations on students' future academic achievement in various contexts is well known. Useful summaries of the results of the large number of predictive validity studies that have been undertaken elsewhere over the past several decades can be found in Morgan (1989), Hezlett et. al (2001), Gonnella et. al (2004), Rothstein (2004), Geiser and Santelices (2007), among others. On the local scene, notable individual researches on the subject include Ohuche (1974), Ojerinde (1974), Obeamata (1974, Alonge (1986), Adegboye (1997) and Gbore (2006) to mention but a few. Going by these researches, there is little or no empirical evidence on a national scale in Nigeria on the public examinations as predictors of university students' academic achievement, and this study aims to fill this gap.

The overall aim of the present study, therefore, was to examine the extent to which public examinations predict university students' academic achievement in Nigeria. Specifically, the objectives of the study are to:

- i) determine the extent to which scores in public examinations conducted by WAEC, NECO, NABTEB and JAMB could predict future academic achievement of students in university degree examinations.
- ii) develop structural models for prediction the academic achievement in university degree examinations based on performance in public examinations.

This study hopes to assist the government formulate appropriate policies on both the conduct and quality of public examinations as well as admission policies into the Nigerian universities.

To guide the course of investigation in this study, answers were sought to the following questions:

1. To what extent does performance in individual public examination predict academic achievement in university degree examinations?
2. What combination of public examination will best predict academic achievement in university degree examinations?
3. Which models are well suited for predicting university students' academic achievement?

The following null hypothesis was postulated and tested at $\alpha = 0.5$ significance level:
The regression coefficients associated with the prediction of students' academic achievement in university degree examinations based on their performance in public examinations will not be statistically significant.

METHOD

Study Design

Correlation and ex-post facto designs were employed to investigate the relationship that exists between the performance in public examinations (predictor variables) and university students' academic achievement (criterion variable). The latter design was used because both the cause and the effect had already occurred while the data involved in the study were as they were collected from the source without any manipulation.

Population and Sample

The population for this study comprised all students who graduated from the Nigerian universities as at December 2005. From this population, records on performance in public examinations of a random sample of 4904 candidates (2631 males, 2273 females) were obtained from 22 Nigerian universities that satisfied certain predetermined criteria. These universities were spread across the six geopolitical zones that make up the country, namely: South-West, South-East, South-South, North-Central, North-West and North-East. The selected universities are made up of 12 federal, 8 state and 3 private universities. From each of these universities, eight core disciplines were involved in the study and these were Management/Social sciences, Sciences, Engineering/Technology, Arts, Medical sciences, Education, Law and Agricultural science. In each faculty, thirty students' records were randomly selected and examined.

Instrument and Validation

A researcher-designed format for data collection was developed. This instrument took cognizance of the general university information, information on students' academic records, subjects offered with grades in UME, WASSC, SSC and NBC/NTC examinations. The first draft of the instrument was subjected first to expert judgment at a workshop attended by two experts in measurement and evaluation, and the representatives of examination bodies and the university regulatory body, the National Universities Commission. Recommended amendments were duly effected. The revised draft of the instrument was then piloted in three universities and these universities were excluded in the main study. The data from the pilot study were analysed and its results used to mend the instrument accordingly. With these amendments, the instrument was considered suitable and ready for field administration.

Data Collection

Data were collected from the sampled universities with the help of field Research Assistants. The data were collected on the basis of the subgroups involved in the study. The subgroups were male and female candidates that gained admission on the basis of possession of a minimum of five credit passes at one or two sittings in the WASSCE, SSCE and NBCE/NTCE and had completed their university degree programmes as at December 2005.

The students' grades in WAEC, NECO and NABTEB were converted into composite scores. The candidate's composite scores, as used in this study, is the sum of the

grade points in five best relevant subjects to his/her course of study. Thus, the maximum composite score obtainable by a candidate is 45 while his/her minimum is 5. Also, a norm was defined for the UME scores and this was in line with what was obtained for WASSC, SSC, and NTC/NBC examinations. The composite score ranged between 4 and 36.

The criterion was the cumulative Grade Point Average (CGPA) at the end of first and final years of the students' university education. These data, as indicated earlier, were gathered from the official academic records of the students selected for the study. The categorization of the CGPA was uniform for all the universities involved in the study.

Data Analysis

Data were abstractedly coded and entered into the computer by a group of ten data entry clerks and reviewed by an IT Consultant, engaged for this purpose, for logic and accuracy. Data were analysed using the Pearson Product Moment correlation coefficient and forward inclusion stepwise multiple linear regression analyses (see, e.g. Cohen and Cohen (1983)). All analyses were done using SPSS version 13 for windows. Independent sample two-sided t-tests were computed for continuous variables and t-tests as well as analysis of variance (ANOVA) were performed to test the adequacy of the postulated models. The level of significance was set at 0.01 for all statistical tests.

The prediction model for each or combination of entry qualifications was determined by fitting the values of the relevant parameters in the general multiple linear regression model: $Y = a + \sum_{j=1}^k b_j x_j$.

The predictor variables in the regression analysis were the students' entry qualifications and scores in UME. In this regard, the study considered only the particular entry qualification(s) admitted into the university. Based on this consideration, the following six mutually distinct subgroups with different variants of entry qualification (predictor variables) emerged from the sample; viz:

- i) WASSCE at one sitting plus UME;
- ii) SSCE at one sitting plus UME;
- iii) NBCE/NTCE at one sitting plus UME;
- iv) WASSCE at two sittings plus UME;
- v) SSCE at two sittings plus UME; and
- vi) The combination of WASSCE and SSCE plus UME.

For each subgroup, the set of entry qualifications that applied to it constituted the predictor variables. In effect, there were two predictors while the criterion variables in the study were the first and the final years' CGPA, respectively.

RESULTS AND DISCUSSION

The first research question in this study sought answers about the extent the performance in individual public examination predict academic achievement in university degree examinations. The summary of the findings are presented in Table1.

Table 1.: Summary of correlation coefficients and Percentage of Variance in CGPA explained Individually by UME, WASSCE and SSCE Scores.

Entry Qualification	N	Year one		Final Year	
		R	% of Explained variance	R	% of Explained Variance
WASSCE ₁	2696	0.30	8.9%	0.23	5.3%
SSCE ₁	532	0.21	4.3%	0.21	4.3%
WASSCE ₂	1375	0.04	4.1%	0.04	0.18%
WASSCE/SSCE	276	0.06	3.6%	0.06	3.6%
UME	4904	0.12	1.5%	0.08	0.6%

Considering the predictor variables individually in the first year, WASSCE₁ is the best single predictor of the students' CGPA, accounting for about 8.9% of the explained variance. SSCE₁ scores were the second best single predictor, accounting for about 4.3% of the variance in year one CGPA, while WASSCE₂ ranked third, accounting for about 4.1% of the variance in single-variable prediction equation. WASSCE/SSCE scores ranked fourth, accounting for 3.6% and UME was the least predictor, accounting for 1.5% of the variance in year one CGPA. The reasons for the very low predictive power of UME scores are not entirely clear, further analysis may be required to isolate the factors responsible for the observed phenomenon. Such an investigation is somewhat beyond the scope of the present study. It is also pertinent to mention here that SSCE₂ and NBCE/NTCE were excluded in the analysis due to the scantiness of the sample attached to them.

Because year one grades provide only a short-term indicator of university performance, however, the present study further tracked the final year university cumulative grades for the same sample in order to examine the relative contribution of high – school record and UME in predicting longer-term college performance. The findings indicate that in the final year WASSCE₁ ranked first, followed by SSCE₁, WASSCE₂ WASSCE/SSCE and UME in that order, thus accounting for 5.3%, 4.3%, 3.6%, 0.6% and 0.18% of the explained variance, respectively. These results demonstrate the fact that WASSCE₁ is consistently the strongest predictor while UME is the weakest predictor not only of first year grades in the university but of the final year outcomes as well.

At the same time, the study also demonstrated the limit of prediction based solely on students performance in either WASSCE, SSCE, NBCE/NTCE and UME scores at the point of admission. WASSCE, being the best single variable predictor accounts for only 8.9% in year one and 5.3% in the final year of the total variance in CGPA,

underscoring the need for admission officers to exercise great caution in using these examination scores to predict how individual applicants may perform in the university.

Consistent with admission policy into the Nigerian universities, the prediction variables (WASSCE, SSCE and WASSCE/SSCE) were considered in combination with the students' scores in the UME. The outcome of this investigation is presented in Table 2.

Table 2: Summary of correlation coefficients and percentage of variance in CGPA explained by WASSCE₁, SSCE₁, WASSCE₂ and WASSCE/SSCE in combination with UME scores.

Entry Qualification	N	Year one		Final Year	
		R	% of Explained variance	R	% of Explained Variance
WASSCE ₁ + UME	2696	0.31	9.8%	0.23	5.4%
SSCE ₁ + UME	532	0.24	5.8%	0.21	4.5%
WASSCE ₂ + UME	1375	0.20	4.1%	0.17	3.0%
WASSCE/SSCE+UME	276	0.19	3.6%	0.15	2.2%

By a way of reiteration, the UME is seen as methodologically rigorous, being a selection examination, providing a more uniform and valid yard stick for assessing student ability and achievement. When other predictor variables are combined with UME on individual basis in the prediction equation, a clear picture of the predictive strength of the predictor variables emerges.

The results presented in Table 2 show that WASSCE₁ combined with UME scores has a clear advantage. The two variables put together accounted for 9.8% of the explained variance in year one CGPA compared to 5.8% when SSCE₁ and UME score are combined in the prediction equation. This is followed by the combination of UME and WASSCE₂ and WASSCE/SSCE in that order, thus accounting for 4.1% and 3.6%, respectively. Consistent with our expectations, UME, which entered as a second variable into the regression equation, explained an additional portion of the variance, namely 0.9% and 1.5% for WASSCE₁ and SSCE₁, respectively.

The import of this finding is that using predictor variables (WASSCE₁, SSCE₁ WASS/SSCE) in combination with UME scores yields better prediction than any one variable alone, although the incremental improvement in prediction for adding UME scores is relatively small. In this setting, UME combining with SSCE₁ produces the largest incremental improvement in prediction over WASSCE₁. Nevertheless, as far as prediction of year one CGPA is concerned, the combination of UME and WASSCE₁ is clearly the superior predictor while the combination of UME and WASSCE/SSCE scores had the least predictive power, accounting for 3.6% of the total variance in Year one CGPA. In the final year, as Table 2 indicates, similar trend was observed.

Another striking observation from the results presented in Tables 1 & 2 is that there was low but positive relationships ($0.118 \leq r \leq 0.298$) between each of the predictors (WASSCE₁, SSCE₁, WASSCE₂, WASSCE/SSCE) combined with UME and

performance on year one and final year CGPA. This result is indicative of the fact that the public achievement examinations (WASSCE, SSCE) and UME to a very large extent measured different abilities.

The prediction of first and final years CGPA is presented in Table 3 below.

Table 3: Relative Contribution of Predictor Variables to CGPA by Year.

Predictor Variable	Outcome Variable	Constant Term	b	Standard Error	t-value	% Explained Variance
WASSCE ₁ + UME	First Year CGPA	1.40	0.04 0.014	0.003	5.23	9.8%
	Final Year CGPA	2.08	0.034 0.004	0.003	1.38	5.4%
SSCE ₁ + UME	First Year CGPA	1.72	0.024 0.015	0.005	2.90	4.3%
	Final Year CGPA	2.20	0.024 0.007	0.006	1.24	4.5%
WASSCE ₂ + UME	First Year CGPA	1.83	0.032 0.001	0.004	0.35	4.1%
	Final Year CGPA	2.37	0.025 0.001	0.003	-0.23	3.0%
WASSCE/SSCE + UME	First Year CGPA	1.89	0.031 0.001	0.004	0.04	3.6%
	Final Year CGPA	2.50	0.020 -0.001	0.003	- 0.47	2.2%

*Dependent variable: CGPA; b represents standardized regression coefficients, $p < 0.01$.

As shown in Table 3, the percentage variance explained by our regression model tends to decline after the first year in university. This is an indication that the strength of prediction of the predictor variables tends to decrease with each year of university education. This finding is consistent in large part with the results of predictive validity studies obtained elsewhere, see, for example, Geiser and Santelices (2007). The only exception is the SSCE₁ where the explained variance by our regression model increased marginally from 4.3 percent in the first year to 4.5 percent in the final year. A further clue to this observed phenomenon is provided in Table 4.

Table 4 shows the “model sum of squares” (the variance explained by the regression model) as compared to the “residual sum of squares” (the variance not explained by the regression model) for both first and final years CGPA. The sample is restricted to the population of students completing the final year of university education and for whom complete data were available.

As Table 4 indicates, the amount of variance accounted for in the regression model for each combination of predictor variables declines sharply from first year to the final year of university education, and is of similar magnitude, although the decline is slightly greater for WASSCE₁ and UME combination. The main differences between the four sets of regression results are evident in the residual sum of squares.

The amount of variance *not explained* by the model shows no discernible pattern. It increases sharply for WASSCE₁ and UME combination while it declines sharply for WASSCE₂ and UME combination as well as for WASSCE/SSCE in combination with UME. This result underscores the need to base admission into the university in Nigeria on the possession of five credit passes obtained at not more than one sitting.

Table 4: Model, Residual and Total Sum Of Squares for CGPA Regressions.

Outcome Variable	N	Model SS	Residual SS	Total SS	F-cal	% Explained Variance
<i>I. WASSCE₁ + UME</i> 1 st Year CGPA	2696	162.2	1496.1	1658.3	146.0	9.8%
Final Year CGPA	2695	95.2	1679.0	1774.2	76.3	5.4%
<i>II. SSCE₁ + UME</i> 1 st Year CGPA	532	17.2	278.5	295.7	16.3	4.3%
Final Year CGPA	532	13.3	278.9	292.2	12.6	4.5%
<i>III. WASSCE₂ + UME</i> 1 st Year CGPA	1375	30.7	724.5	755.2	29.1	4.1%
Final Year CGPA	1375	17.9	581.0	598.9	21.2	3.0%
<i>IV. WASSCE/SSCE + UME</i> 1 st Year CGPA	276	26.8	723.3	750.1	24.9	3.6%
Final Year CGPA	276	11.4	513.4	524.8	14.9	2.2%

Notwithstanding the declining overall variance in cumulative GPA over time, the fact remains that WASSCE₁ in combination with UME accounts for a greater proportion of that variance in the first year than in the final year of university education. Once again, the peculiar power and robustness of WASSCE₁ in combination with UME as the best predictor of university outcomes is also evident.

The t-test results shown in Table 3 indicates that regression coefficient associated with the joint prediction of first and final years CGPA by UME in combination with each respective predictors were significant beyond 0.01. Similarly, the analysis of variance (ANOVA) results also show that the regression model in each case was significant beyond 0.01. Thus, based on candidates' first sitting in public examinations, the following models were obtained for predicting students' academic achievement in the first year (see Table 3):

$$CGPA = 1.40 + 0.04 WASSCE_1 + 0.014 UME;$$

$$CGPA = 1.72 + 0.024 SSCE_1 + 0.015 UME.$$

The models for predicting the achievement of students who sat for public examinations at two sittings or combined results to make a minimum of five credit passes required for admission were obtained as follows:

$$\text{CGPA} = 1.83 + 0.032 \text{ WASSCE}_2 + 0.001 \text{ UME};$$

$$\text{CGPA} = 1.89 + 0.031 \text{ WASSCE/SSCE} + 0.01 \text{ UME}.$$

As we have indicated earlier, these latter results are of suggestive value only and they are presented here for completeness. They are therefore not recommended for predicting students' academic achievement at the university level due to their very low predictive power.

CONCLUSION AND POLICY IMPLICATIONS

The result of this study revealed that even though public examinations were statistically significant, but were not of much practical importance in predicting the achievement of university students. However, it was established that the first year university examination results accounted for about 48.2% of the final year examination results. This is an indication that formative evaluation plays a significant role in predicting the achievement of university undergraduates.

The policy implications that arose from this study are captured under the following sub-headings:

(a) Examination System Policy

- i) The very low inter-correlations that existed among the public examinations implies that there was no redundancy in what the different public examinations measured or assessed. In other words, that different public examination bodies have different mandates that should be sustained.
- ii) That public examinations poorly predicted university achievement suggests that they may not be good indices for determining or selecting those who are likely to succeed in university education.
- iii) The four public examinations employed achievement tests. This may be considered adequate for the certificate examinations being conducted by WAEC, NECO or NABTEB that are designed to measure achievement but for UME designed as a selection examination to employ achievement test is technically flawed. For selection purposes, aptitude tests are preferred to achievement test. To this end, there is need for a paradigm shift from achievement test to aptitude test for UME.
- iv) The poor prediction might also be a reflection of the quality of assessment instrument used in both public and university examinations. Hence, there may be the need for a study to address the psychometric properties of the test instruments used in national assessment.

(b) **Admission Policy**

- (i) The findings of this study suggest that admission of candidates into the universities should be strictly based on merit.
- (ii) The low correlation between CGPA and the predictor variables lends credence to the post-UME screening exercise going on in our universities.

(c) **Quality Teaching Assurance**

School teachers and university lecturers need to maintain the integrity of their examinations

Recommendations

In the light of the above findings and conclusion, the following recommendations are proffered for improved operation of the Nigeria's educational system.

- (i) The examination bodies should continue to improve on the quality of the development and administration of their examinations.
- (ii) Aptitude test should replace achievement test in the conduct of UME.
- (iii) There is an urgent need for a national policy that will strengthen the post-UME screening exercise in the following ways:
 - Use of uniform guidelines as well as valid and reliable instruments in post-UME screening exercise.
 - Mandatory inclusion of experts in measurement and evaluation in the post-UME screening Committee.
- (iv) The university authorities should strive to improve the integrity of its examinations.

CONCLUDING REMARKS

The results of this study have led to some positive findings. Given the limited ability of public examinations to predict university outcomes, it is essential that admissions criteria exhibit "content" and "face validity" as well as "predictive validity", that is, that the criteria bear a direct and transparent relationship to university work as has been previously advocated elsewhere in the literature, see, e.g. JAMB (2002). Insofar as university matriculation examination (UME) or its variants will continue to be used as a criteria for admission, a strong case is made here for curriculum-based, aptitude-type tests, since those tests not only have predictive value but also measure knowledge and skills that are unquestionably important in university work.

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