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THE UNIVERSITY SCREENING SCORES IN CHEMISTRY AS PREDICTORS OF ACHIEVEMENT IN THREE CHEMISTRY-BASED COURSES IN PUBLIC UNIVERSITIES IN ENUGU-STATE, NIGERIA

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ABSTRACT

The purpose of the study was to ascertain the predictive validity of the University screening scores in Chemistry for admission into Industrial Chemistry, Pharmacy and Agricultural Economics courses in Public Universities in Enugu State. One research question and one hypothesis guided the study. The research design was correlational survey. A total sample of 1480 students were used. 880 students from UNN consisting of (Industrial chemistry = 360, Pharmacy = 180 and Agricultural Economics = 340). 600 students were sampled from ESUT from the following departments: Industrial chemistry = 260, Pharmacy = 120 and Agricultural Economics = 220. The instrument for the study was broadsheet that contained students' post-UME results and students first year results in their different universities. The result showed that for Industrial Chemistry and Agric-Economics, post-UME scores in Chemistry moderately predicted students' first year scores in Federal Universities but post–UME chemistry did not predict students' first year chemistry scores in Pharmacy courses in state University, three recommendations were made at the end of the study.

Keywords: Predictive Validity, Post UTME, Chemistry-based Courses, Chemistry Scores, Public Universities**.**

Introduction

The prediction of academic success of different courses by previous examination results has been very useful in decision makings in academics and other services across the universe (Dike and Garba, 2017). For instance, integrated science score in JSCE can be used to predict results of WAEC scores in chemistry or Biology or physics in secondary schools. SSCE, GCE, NECO and NABTE, examination scores used as predictor variables for UTME scores. UTME can predict post-UTME and achievement in courses in the universities. Webster's dictionary defined chemistry as a science that deals with the composition, structure and properties of substances and with the transformations that they undergo. Chemistry departments through varieties of courses and programme, provide opportunities for students to explore the nature and significance of chemistry for knowledge about ourselves and the whole world (Ferrer-Vincent, Bruehl, Pan, and Jones, (2015). Therefore, Industrial Chemistry is the chemistry relating to industry or factories (Hornby 2010). It is one of the courses offered in the faculty of applied natural sciences in Nigerian Universities. A candidate must obtain credit in chemistry

before getting admission to offer B.Sc Industrial chemistry.

On the other hand, Pharmacy is the science that deals with the art of compounding, preserving, identifying, and dispensing drugs/medicine. The different aspects of drugs and all the processes involved in drug preparation, reactions, activities, effects, administration and proper dispensing are taken care of by different aspects of pharmacy. It is a first-degree course being offered in the Nigerian Universities under the various faculties of pharmaceutical sciences. Before a candidate is offered admission into this department in any Nigerian University, he/she must pass these subjects (Chemistry, Physics, Biology, Mathematics and English Language) at credit level in Senior School Certificate examination (SSCE), sits for UTME and Post-UTME and passed before being considered.

Agricultural Economics is one of the chemistry-based courses studied in Nigerian Universities, under the faculty of Agriculture. This deals with how commodities produced through agricultural practices and other resources are allocated, shared and effectively used by different consumers. Agricultural chemistry, discusses related areas of Agriculture such as milk test, Spray materials, fertilizers, feeds and the likes. This means that chemistry permeates almost every field and used in many subjects and as a pointer in many aspects of Agriculture, Soil, land breeding, dairy industry, animal nutrition etc. For a candidate to gain admission into the department, the person must possess five credit passes in English, mathematics, chemistry, Biology/Agriculture and one of Geography, physics or Economics. For the UTME subjects, the students are required to take four subjects namely, English, Chemistry, Biology/Agriculture, Mathematics/Physics (JAMB Brochure, 2019). All those examinations taken by admission seekers are the basic requirements needed but not an express guarantee for their admission into Nigerian universities. There are still other criteria to be considered, such as: meeting up with merit cut off point, the use of quota system, whether the candidate is from educationally disadvantaged areas and of course political interest. With these, highly unqualified candidates are considered and taken in place of highly qualified ones.

According to Afu and Ukofia, (2017), education is a progressive development of knowledge and skills of examinee through stages of teaching and learning at various levels. Nigerian students just like any other country of the world have been passing through different stages of educational developments of teaching, learning and assessments before procuring admission into higher schools. At post primary education level, they have to go through the following examinations; Junior Secondary Certificate Examination (JSCE), Senior Secondary School Examination (SSCE), General Certificate Examination (GCE) conducted by West African Examination Council (WAEC) and National Examination Council (NECO). When they perform creditably well in the relevant subjects, they therefore qualify for University Tertiary Matriculation Examination (UTME) conducted by Joint Admission and Matriculation Board (JAMB). The candidate is qualified for taking the last examination conducted by different

universities called post-UTME, only if he/she obtains the minimum cut off point according to his or her choice of university. For a candidate to endeavor to get admission into Industrial Chemistry, Agricultural Economics and Pharmacy Courses, he/she must take University Tertiary Matriculation Examination (UTME) administered by JAMB in chemistry and other relevant subjects and obtain the minimum cut off point, before he/she is qualified to sit for post-UME examination conducted by the candidates' choice university. According to Onyekanmi (2012), post-UTME examination is a screening examination carried by various tertiary institutions to all the candidates that have successfully met up with the required cut-off point in UTME. Okogie (2011) pointed out that post-UTME was intended to tackle the problems of fraudulent scores emanating from UTME. The initial purpose of JAMB at inception was to develop machinery for streamlining admissions on a uniform and fair basis (Abdulkareem, and Muraina, 2014), bearing in mind the available vacancies, institutional guidelines as well as candidates' preferences of institution and courses (Popoola, 2016). This task, JAMB has carried on creditably well according to Okotete, (2012) for the past two decades without any serious hitch.

The challenges of JAMB came to the climax, when the federal government of Nigeria introduced the policy of post-UTME screening by universities in 2005, making it mandatory for all tertiary institution to screen candidates after their UTME results and before giving admission Nweze, (2013). The Post-UTME examination scores are supposed to enhance the predictive validity of candidates' scores in universities/tertiary institutions. In other words, high post-UTME scores of candidates in a course are supposed to give rise to high achievement scores in their later courses of study. It is on this account, that the researcher examined the predictive validity indices of post-UTME scores for Industrial Chemistry, Pharmacy and Agricultural Economics courses. Previous literature had reported both favorably and otherwise on how the previous examination scores of students in different examinations were used to predict students' achievement in their later courses. Dike and Garba (2017), found a significant relationship between integrated science scores at Junior Secondary Certificate Examination (JSCE) and Biology scores at SSCE. Aina (2017) in the same vein also found out that post-UTME was beneficial for selection of Candidates into Universities. On the contrary, Eze (2014) and Abisuga, Olarewaju and Oyekanmi (2015) revealed a very poor correlation/prediction between UTME/ public examinations and students' final grade in Health Science/university achievements in university and polytechnics.

Statement of Problem

There has been series of lapses associated with previous selection processes into Nigerian Universities. These necessitated the introduction of post-UTME as a measure of quality control. These ranged from uncoordinated system of admission observed in different Universities, leading to multiple applications and admission before the inception of JAMB down to inefficiency and other corrupt practices, such as impersonation, manipulation of scores, and other examination irregularities leading to

admitting candidates that find it difficult to cope with their first-year studies. These lead to introduction of post-UTME as a measure of quality control in the system. Since the introduction of post-UTME, a lot of criticism has been recorded, including, variation in examination structure, item and content coverage, peculiarities of different Universities, including selection of candidates by recommendation. This has also tried to cast doubt on the validity of the whole exercise and the fear that wrong people may be admitted. These underscores the need for the predictive validity of post-UTME scores used for selection of candidate for admission into chemistry-based courses in Nigerian universities.

Purpose of the Study

The purpose of study was to ascertain the predictive validity of the post-UTME chemistry scores for admission into three chemistry-based courses (Electrical Electronics, pharmacy and Agricultural Economics) in public universities in Enugu State.

Research Questions

One research question guided the research.

1. What are the predictive validity indices of post-UME chemistry courses for Industrial chemistry, Pharmacy and Agricultural Economics in public universities in Enugu state?

Hypothesis

One hypothesis guided the research

1. Students' post-UME mean scores in Chemistry do not significantly predict their mean achievement scores in Industrial chemistry, Pharmacy and Agricultural Economics in public universities in Enugu state.

Research Method

The research utilized the correlation survey design. The area of the study was Enugu state that has two Public Universities – University of Nigeria, Nsukka (UNN) and Enugu State University of Science and Technology, Enugu (ESUT). The population consisted of **2,496** students admitted into Industrial chemistry (1100 students), Medicine and Surgery (560 students), Agricultural Economics (836 students) for two academic sessions in both public universities. The population of UNN students was **1280** students (Industrial chemistry = 580, Medicine and Surgery = 300), Agricultural Economics= 400). The population of ESUT students was **1216** (Industrial chemistry = 520, Medicine and Surgery = 260), Agricultural Economics =400). Multi-stage sampling was carried out in stages beginning from the faculty level through departments to the students. Stratified sampling technique was used because the students were placed in their different faculties and departments. Simple random sampling was used to sample three departments from chemistry-based faculties. Purposive sampling technique was used to sample **1480** students with complete records of post-UTME and first year results, which comprised of **880** students from UNN and distributed as (Industrial chemistry = 360) Medicine and surgery = 180), Agricultural Economics = 340) and **600** students from ESUT being distributed as ((Industrial chemistry = 260, Medicine and Surgery = 120), Agricultural Economics =220). The data for the study was collected

using a worksheet that contained the students' post-UME scores as well as the students' first year results, assessed from the students' records in their different Universities. Both the research question and hypothesis were analyzed using multiple regression analysis technique.

The Regression coefficients showed the degree of relationship between post-UME scores, and first year scores for each of the chemistry-based courses for the two Universities. It usually lies between, -1 and +1. r = 0, indicates no correlation, r=1, means perfect positive correlation. r = -1, shows, perfect negative correlation. If r lies between 0 and 1, it shows positive correlation and if, r lies between 0 and - 1, it shows negative correlation. However, the calculated correlation value for each of the research questions was converted to F-test, using the required table. This was eventually compared with the critical value, at 0.05% level of significance and a degree of freedom of N-1 for inferential decision to be made. In response to the hypothesis, step wise multiple regression analysis tested at 0.05% level of significance was adopted. The summaries of interpretations of level of relationships are given below in table 1.

Table 1: Interpretation of correlation coefficient

Correlation coefficient	Interpretation of relationship
1.00	Perfect positive relationship
0.70-0.99	Strong positive relationship
0.40-0.69	Moderate positive relationship
0.10-0.39	Weak positive relationship
-0.09-0.09	No relationship
-0.39- (-0.10)	Weak negative relationship
-0.69-(-0.40)	Moderate negative relationship
-0.99-(-0.07)	Strong negative relationship
-1.00	Perfect negative relationship

(Hamilton, 1990: 481)

Results:
The results of the study are presented in tables according to the research question and hypothesis. The results for research question 1 are presented in Table 2.

Table 2: Correlation Coefficients (r) of Post-UME Chemistry Scores for Industrial Chemistry, Pharmacy and Agricultural Economics Courses

Departments	Federal University			State University		
	R	N	Intptn	r	N	Intptn
Industrial Chemistry	0.60	360	MR (+)	0.04	260	NR
Medicine and Surgery	0.30	180	WR (+)	0.00	120	NR
Agric-Economics	0.43	340	M.R(+)	0.08	220	NR

Where r = correlation coefficient, Intptn = Interpretation, N = number of cases, MR (+) = moderate (+) relationship, WR (+) = weak (+) relationship and NR = no relationship.

Table 2 shows that, there are moderate positive relationships between post-UME scores in Chemistry and university first year scores in Industrial Chemistry and Agric-Economics in Federal university while there are no relationships between the chemistry post-UME scores and university first year scores in Industrial chemistry and Agric-Economics in State University. For Pharmacy in Federal University, there is weak positive relationship between post-UME scores in chemistry and first year University scores while there is no relationship between post-UME scores in chemistry and first year university scores in the discipline among the students in state University. Table 3 presents the results for hypothesis 2.

Table 3: Regression Analysis Results of Post-UME chemistry on the Academic Achievement of first year students in Industrial chemistry, Pharmacy and Agric-Economics.
Where S=significant, NS = not significant

Dept.	School	Multiple R	R^2	R^2 Change	B	BETA	Std Error	% Variance	F.obs	F.Crit	Df
Ind/Chem.	UNN	0.60	0.36	0.36	0.52	0.63	6.26	36.0	192.1	3.84^{S}	1,360
	ESUT	0.04	0.002	0.01	0.05	-0.40	5.44	1.00	0.29	3.92^{NS}	1,260
Pharmacy	UNN	0.30	0.09	0.06	0.14	0.30	3.38	6.0	12.00	3.84^{S}	1,180
	ESUT	0.002	0.00	0.02	0.00	0.00	6.12	2.00	0.00	4.00^{NS}	1,120
Agri-Econs	UNN	0.43	0.18	0.17	0.40	0.43	6.88	17.00	17.75	3.96^{S}	1,340
	ESUT	0.08	0.01	0.002	0.04	-0.79	4.71	0.20	0.77	3.92^{NS}	1,220

Table 3 shows that for the students in Industrial Chemistry course in Federal university, their post-UME scores in Chemistry had the R^2 change of 0.36. This indicates that the students' post-UME scores in Chemistry had a predictive power of 36% for their achievement in first year Industrial chemistry for the two academic sessions under study. The observed F-value for the post-UME scores in chemistry is shown to be 192.1 while the critical F-value for 1 and 360 degrees of freedom for the numerator and denominator at 0.05% level of significance is 3.84. Since the observed F-value is greater than the Critical F-value, the contribution variance of 36% to the achievements of students in industrial Chemistry is the actual contribution of chemistry and nor due to error. Therefore, the null hypothesis of no significant prediction in respect of performance in industrial chemistry in post-UME chemistry scores is not accepted. This means that the students' post-UME chemistry scores are a significant predictor of their first-year result in industrial chemistry department.

For students in Industrial chemistry in the state university, Table 2 shows that post-UME scores in chemistry had R^2 change of 0.01. This indicates that those post-UME scores in chemistry had a predictive power of 1.00% for their achievement in first year Industrial chemistry course. The observed F-

value for the post-UME scores in chemistry is 0.29 while the critical F-value for 1 and 260 degrees of freedom for the numerator and denominator at 0.05% level of significance is 3.84. Since the observe F-value is less than the critical F-value, the aspect of the null hypothesis is in respect of the prediction performance in Industrial chemistry by post-UME chemistry scores is not rejected. In other words, the post-UME scores in Chemistry do not significantly predict students' performance in Industrial chemistry. This means that the variance contribution of 1.00% of post-UME score to the student score in industrial chemistry is not the actual contribution of chemistry but due to error and other interfering variables.

For Pharmacy in Federal University, Table 3 shows that R^2 change for post-UME scores in chemistry is 0.06. This shows that the post-UME scores in chemistry had a predictive power of 6.00% for their achievement in first year Pharmacy courses for the two academic sessions under study. The observed F-value for the post-UME scores in Chemistry is 12.00 while the critical F-value is 3.84 for 1 and 180 degrees of freedom for the numerator and denominator at 0.05 level of significance. Since the observed F-value is greater than the critical F-value, the contribution variance of 6.00% to the achievement of students in Pharmacy is the actual contribution of chemistry and not due to error. Thus, the null hypothesis of no significant prediction in respect of the performance in Pharmacy by the Post-UME scores in chemistry is not accepted. This means that the post-UME scores in chemistry significantly predict the results of students in Pharmacy department.

In Table 3, for students in Pharmacy department in the state university, the post-UME scores in chemistry had R^2 change of 0.02 with a predictive power of 2.00% for achievement in first year Pharmacy. The observed F-value for the post-UME scores in chemistry is 0.00 and the critical F-value for 1 and 120 degrees of freedom for both the numerator and denominator at 0.05 level of significance is 4.00. Since the observed F-value is less than the critical F-value, the null hypothesis of no significant prediction in respect of their performance in Pharmacy is not rejected. This means that students' post-UME chemistry scores do not significantly predict their result in Pharmacy department. Therefore, the variance contribution of 2.00% of post-UME scores to the students' scores in Pharmacy is not the actual contribution of chemistry but that due to other variables and error variance. Thus, the Post-UME scores in chemistry do not significantly predict students' performance in Pharmacy.

For Agricultural Economics in Federal University, Table 3 shows that R^2 change for post-UME scores in chemistry is 0.17. This shows that the post-UME scores in chemistry had a predictive power of 17% for their achievement in first year Agricultural Economics courses for the two academic sessions under study. The observed F-value for the post-UME scores in Chemistry is 17.75 while the critical F-value is 3.96 for 1 and 340 degrees of freedom for the numerator and denominator at 0.05 level of significance. Since the observed F-value is greater than the critical F-value, the contribution variance of 17% to the achievement of students in Agricultural Economics is the actual

contribution of chemistry and not due to error. Thus, the null hypothesis of no significant prediction in respect of the performance in Agricultural Economics by the Post-UME scores in chemistry is not accepted. This means that the post-UME scores in chemistry significantly predict the results of students in Agricultural Economics department.

In Table 3, for students in Agricultural Economics department in the state university, the post-UME scores in chemistry had R^2 change of 0.002 with a predictive power of 0.20% for achievement in first year. The observed F-value Agricultural Economics for the Post-UME scores in chemistry is 0.77 and the critical F-value for 1 and 220 degrees of freedom for both the numerator and denominator at 0.05 level of significance is 3.92. Since the observed F-value is less than the critical F-value, the null hypothesis of no significant prediction in respect of their performance in Agricultural Economics is not rejected. This means that students' post-UME chemistry scores do not significantly predict their result in medicine and surgery department. Therefore, the variance contribution of 0.2% of post-UME scores to the students' scores is not the actual contribution of chemistry but that due to other variables and error variance. Thus, the Post-UME scores in chemistry do not significantly predict students' performance in Agricultural Economics.

Discussion of Findings

The findings revealed that, post-UME scores in Chemistry moderately predicted students' first year scores in Industrial Chemistry and Agricultural-Economics in federal university while there were no relationships in state university. Post-UME scores in Chemistry weakly predicted students' first year scores in federal university in Pharmacy courses but did not predict students' first year chemistry scores in Pharmacy courses in state University.

The results in respect of no or poor relationship found between post-UME and first year results of students in Industrial Chemistry, Pharmacy and Agricultural Economics programmes are in agreement with (Ajaja 2010; Faleye, 2015 and Abisuga, et al, 2015). The low and no relationship observed within the departments in state university could be an indication of non-compliance of state universities to all the admission guidelines and regulations as observed by Egbongabsi (2010), who claimed that some state universities have right to admit their state indigenes whose results could not offer them admission without reference to JAMB's policy of admission.

The positive relationships found in Federal University is in agreement with the findings from the following researchers: (Dike and Garba, 2017; Aina, 2017, Obioma, Nwufo, Salau and Omole, 2010) who independently reported a relatively positive relationship between their different pre-entry examination results to subsequent examination results in their different areas, and in different tertiary institutions. Keskula, Sammaronu, & Perrins, (2009) in accordance found that pre-admission grade point average was a significant predictor accounting for 34% of the variance. It was therefore observed that post-UME chemistry scores gave a better

result in Federal University courses than State universities predicting the students' first year results. With all the above, the problem of loss of credibility of these entrance examination results has not been properly addressed.

The inconsistencies observed in this study, is an indication that certain factors might be responsible for that. Some of these factors include: admission of candidates through, quota system, educationally less privileged and political interest, university type and other peculiar conditions applicable to different university examination centers.

Conclusion

Post-UME moderately predicts students first year results in Industrial chemistry and Agricultural Economics courses in federal university but in State University, it does not predict students in Industrial chemistry. Post-UME weakly predicts students' first year results in medicine and surgery in federal University but does not predict students results in Pharmacy in state university. Hence, post-UME has a better predictive validity/quality in Federal university than in State University. This indicates inconsistencies in the conduct of the post-UME, lack of uniformity of standard and differences in the peculiarities of the Universities. Hence, the processes of the post-UME have to be looked into and streamlined across universities starting from the subjects taken, the uniformity of questions and the mode of administering the examination and other factors, so as to maintain, uniformity, credibility, validity, reliability and standardization of the examination.

Recommendations

Based on the result, the following recommendations are made:

1. Frantic effort has to be made by heads of Tertiary institutions in Nigeria to harmonize the activities of post-UTME across the country.
2. A strong committee of curriculum developers from tertiary institutions and from all part of the country, should set up a uniform curriculum for standardization of the post-UTME examination. There should be a kind of cooperative effort of all the stakeholders that are concerned in different subject areas, departments, faculties from various tertiary institutions including experts in test and measurement to examine the activities of post-UME, beginning from test development, reliability and validation down to administration and admission processes.
3. A follow-up policy on the guide lines to follow across the universities, in terms of area of coverage for chemistry questions as well as other subjects involved in post-UTME, the determination of the validities and reliabilities of the test, mode and time of administration across the related departments, faculties and universities.

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