Assessment Of The Admission Criteria That Predict Students’ Academic Performance in Undergraduate Years in a Nigerian University

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ABSTRACT:

Prior to this era, individual universities in Nigeria conducted concessional examinations for the selection of their prospective students. Other compulsory condition was the possession of five credit passes in the relevant subjects in the ordinary level certificate. The other mode of entry was the direct admission of students into the direct second year level of candidates who possessed either the national diploma certificate or the general certificate of education at the advanced level in the relevant papers. Problem arose, where students had multiple admissions in several universities and those who could not afford to write admission examinations to multiple institutions and the not too brilliant students were deprived the opportunity of admission into the very limited Universities. These reasons caused the Federal Government of Nigeria to establish the Joint admission and Matriculation Board (JAMB) in 1978. Today, studies showed that JAMB and WAEC alone can no more ascertain the best crop of students for admission as there are exam syndicates everywhere in the country to ensure that their candidates/customers make all their papers in one sitting consequently pass their JAMB and get admission as well. This research is therefore proffering an alternative admission paradigm that will go beyond considering only test scores for admission, but will consider aggregate academic records of the prospective students before admission is offered or denied. This alternative method can be actually using Artificial Neural Network techniques.

Keywords: Admission, Artificial Neural Network, Academic Performance, Prediction, Undergraduates, decision support system, etc.

INTRODUCTION:

Irrespective of the end close strategies employed by the Nigeria Ministry of Education to ensure that educational standards are maintained at University level, students who after passing through these tedious examinations still perform poorer than expected. For instance, from the summary of Computer Engineering students’ data, College of Engineering, Michael Okpara University of Agriculture, Umudike Umuahia, Abia State for 2009/2010 session, out of 87 students that were admitted into the programme, only 25 students were able to graduate within the NUC approved number of years for studying the course. None had CGPA above 4.5, 13 had CGPA between 3.5 and 4.49, 11 had CGPA between 2.4 and 3.49, 1 had CGPA between 1.5 and 2.39. At the end 58 students were recorded to have one or two carry-overs and 4 were asked to withdraw (Departmental second semester summary, 2014).

This implies that only 28.74% of the students actually had satisfactory results at the end of their stay of five academic years. This also shows that 71.26% of the students had academic challenges as undergraduate students. The high rate of poor academic achievement among undergraduate is not unconnected with the channel through which they gained entry into the University. Ebiri (2010), observed that using JAMB as a yardstick for admission of students into Nigerian universities has led to the intake of poor caliber of candidates, characterized by high failure rate, increase in examination malpractice, high spillovers and the production of poor quality output that are neither self-reliant nor able to contribute effectively in the employment world.

Ironically, the process of selecting candidates for admission into tertiary institutions has largely depended on some fixed combinations of some subjects taken by applicants in their lower level classes. However, this technique has
never been proved efficient in admitting candidates that may perform well in the chosen courses. Considering the fast growing number of candidates seeking for admission into tertiary institutions, there is a need to use past data for decision support in admitting suitable candidates for a course of study.

Universities are facing the immense and quick growth of the volume of educational data (Schönbrunn and Hilbert, 2006). Intuitively, this large amount of raw stored data contains valuable hidden knowledge, which could be used to improve the decision making process of universities (keshavamurthy et al., 2010). An analysis of the existing transaction data provides the information on students that will allow the definition of the key processes that have to be adapted in order to enhance the efficiency of studying (Mario et al., 2010). This study delves into the problem of finding data patterns in admission datasets and provides a technique to predict the performance of students in the first year in the University based on the admission combination.

2. PROBLEM STATEMENT:

The traditional admission decision paradigm in Higher Academic Institutions of Learning in Nigeria is based solely on UME and Post-UME scores, given that the student has credited the required five subjects in WAEC, NECO, and/or GCE. This traditional admission decision process may not yield the best crop of students in terms of academic performance as it is vulnerable to cheating from undeserving students who can afford to cheat during the WAEC/NECO/GCE and UME/Post-UME exams and tests, respectively. This is especially the case in this era of Organized UME/WAEC/NECO/GCE Syndicates that promise and "ensure" that their customers pass their UTME test and credit all their WAEC/NECO/GCE subjects in one sitting. Also, the freshman admission decision process in Nigeria is complicated by ethnicity, sectionalism, favoritism, influence, catchment area and quota system policies.

3. RESEARCH OBJECTIVES:

The objectives of this study include, but not limited to the following:
1) establishing some relevant factors that affect an undergraduate student’s academic performance,
2) to transform these factors into forms suitable for an adaptive system coding, and
3) to model an Artificial neural network that can be used to predict a candidate’s performance based some historical information and aggregate academic records.

4. A BRIEF REVIEW OF STUDENT ACADEMIC PERFORMANCE

According to literature, in 1954, the University of New Zealand Council for Educational Research investigated the relationship between academic standards of students on entrance and their first year university work. The study found that the median correlation found among the many sets of variables representing general school performance and general university performance was indicated by a \( \tau \) coefficient of 0.36 for the first year students undertaking their studies on a full time basis (Maidment, 1968). In 1975, Bakare summarized the factors and variables affecting students performance into the intellectual and non-intellectual factors, emphasizing that the intellectual abilities were the best measure (Bakare 1975). He categorized causes of poor academic performance into four major classes as follows:
1) Causes resident in society, where the society is responsible for the poor performance
2) Causes resident in school, where the fate of the students seeking for undergraduate admission is determined by what their previous school equipped them with.
3) Causes resident in the family, where the family is to be blamed for failure due to their failure to shape the student well on time
4) Causes resident in the student, where the student himself fails to work hard.

Studies such as (Lage and Tregelia, 1996) and (Dynan, 1977) looked at a more general aspects of success while Anderson et al., 1994 studied the effect of factors such as gender, student age, and students’ high school scores in mathematics, English, and economics, on the level of university attainment. According to their study, students who received better scores in high school also performed better in university. Another aspect discovered was that men had better grades than women and choose to drop from school less often. Adedeji (2001) sought to find out a correlation between students matriculation exam (UME) scores and their academic performance in Nigerian
universities, using the Faculty of Technology, University of Ibadan, Nigeria as a test case. He investigated the relationship between students’ UME scores, first, second, and final year Grade Points (GP) with the use of a simple correlation and regression analysis. He concluded in his research that there exists a positive relationship between students admission scores and their undergraduate performance. However, recent trends after Adedeji’s study indicates the unreliability of the WAEC and UTME/PUTME scores.

5. ARTIFICIAL NEURAL NETWORK

Artificial Neural Networks are electronic models based on the neural structure of the brain. The brain learns from experience. The most basic element of the human brain is a cell which, unlike the rest of the body, doesn't appear to regenerate. These cells are known as neurons. There are 100 billion of them these cells in the brain and each can connect with up to 200,000 other neurons. There are multiple connections between them.

The individual neurons are complicated. They have a myriad of parts, sub-systems, and control mechanisms. They convey information via a host of electrochemical pathways. Together these neurons and their connections form a process which is not binary, not stable, and not synchronous. The artificial neural networks try to replicate only the most basic elements of this complicated, versatile, and powerful organism. But for the software engineer who is trying to solve problems, neural computing was never about replicating human brains. It is about machines and a new way to solve problems.

![Model of a Biological Neuron](image)

Fig 1: Model of a Biological Neuron
Fig 2: Model of Artificial Neuron

In Figure 2, various inputs to the network are represented by the mathematical symbol, $x_n$. Each of these inputs are multiplied by a connection weight. These weights are represented by $w_n$. In the simplest case, these products are simply summed, fed through a transfer function to generate a result, and then output.

The mathematical representation of a neuron depicted above can be described as:

$$Y = f \left( \sum_{i=1}^{n} x_i w_i + b \right)$$

where $x_1, x_2, ..., x_k$ represent an input vector, and $w_1, w_2, ..., w_k$ represent the weights (or strengths) of the incoming synapses (or interconnections). The bias ($b$) performs an affine transformation of the linearly combined input signals, and the activation function ($f$) applies to produce the final output ($Y$) from the neuron.

6. METHODOLOGY

The study followed a correlation study design that is focused to explore the key variables which recommend or deny students’ admission, as well as predict performance of university students. Primary school, Secondary school average mark, WAEC result scores, UTME and PUTME scores and socioeconomic variables were utilized in predicting students’ academic success (first year, through fourth year CGPA).

The study was conducted at the College of Engineering and Engineering Technology, Michael Okpara University of Agriculture, Umumahia, Abia State of Nigeria. The populations in this study were 1000 students monitored from year one through four. The percentage ratio of girls to boys is 25% is to 75%. The students were admitted through the traditional admission paradigm which considers only the UTME and PUTME test scores with the WAEC grades. The sampling method used was Multi-stage sampling specifically, stratified random sampling was used. There are a total of six departments in the College of Engineering and Engineering Technology, which were treated as strata in this study.

One of the study variables was university entrance exam score that are the basis or criteria for students’ placement at different colleges and departments in the university. For instance, students with relatively low university entrance exam average scores also joined the fields of business, social and applied sciences. On the other hand, students with relatively better university entrance exam average scores were assigned in the fields of studies such as medicine, technology and law based on their choices (Mulu, 2012). 500 were selected in line with (Kurtz, 1983) formula of determining the sample of participants from the target population. The sample size for each department was set proportionally using the target student population of each department.

The information and records of selected students needed for the research were obtained from the admission files of the college admin officer. In this study, information collected from the college officer was used. The data, which
included primary and secondary school information, were used. UTME, PUTME and undergraduate academic performance were used. The questionnaire was adopted from a new instrument (scale) for measuring the socioeconomic status of families (Aggarwal, Bhasin, Sharma, Chhabra, Aggarwal & Rajoura, 2005). The survey questionnaire was divided into four parts. Part I included department, sex, and student identification number. Part II, dealt with educational background of parents; Part III dealt with items of parents' income and part IV dealt with items on parents' occupation. After the collection of data needed to answer the research questions, both descriptive and inferential statistics were used to analyze the data in this study. Descriptive statistics were computed for predictor and criterion variables. The statistical analyses carried out based on the basic research questions that the study aimed to answer. Correlation matrices were employed depending on the nature of the data and research questions.

7. RESULTS

All the predictor variables were separately checked with the criterion variables for their possible association by standard multiple regression and all of the predictor variables were entered in the stepwise multiple regression analysis to test their combined association on the criterion variable and those variables with p-value <0.05 was selected as possible predictor variables in the final model.

<table>
<thead>
<tr>
<th>Issued questionnaire</th>
<th>500</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answered questionnaire</td>
<td>468</td>
<td>93.6%</td>
</tr>
<tr>
<td>Unanswered questionnaire</td>
<td>32</td>
<td>6.4%</td>
</tr>
</tbody>
</table>

As shown above, the questionnaire was administered to 500 students; the analysis was made using 468 students and the remaining 32 students were unanswered questionnaire.

From the number 468 students studied, 13 persons scored between 4.5 in a scale of 5.0 as average CGPA for 3 years studied. This is 2.78% of the total number.
128 scored between 3.5 to 4.49 and this makes only 27.35%
117 out of this number (128) that fell within this range were admitted with an average admission score less than 60% , and 11 scored above 60%
166 scored between 2.5 to 3.49 which is 35.47%
22 out of this number (166) that fell within this range were admitted with an average admission score above 60% and 44 scored less than 60%
139 scored between 1.5 and 2.49 which is 29.7%
123 out of this number (139) that fell within this range were admitted with an average admission score above than 60%.
22 scored below 1.5 which is 4.70%

8. DISCUSSION OF THE RESULT

The main purpose of this study was to find out the main parameters for predicting academic performance of undergraduate students. The study examined performances of students admitted into the college with their Unified Tertiary Matriculated Examination (UTME), PUTME and Senior School Certificate Examination results. It was found out from the study that 9 people out of the 13 people scoring 4.5 CGPA and above (First Class) had admission point less than 60%. And the majority of people scoring CGPA of 3.49 and below is having admission point of 60% and above. This therefore shows that basing admission on the corruptible admission examination scores will not yield the best crop of students for admission. It was also found out that some people who scored between 40% to 48% admission score and were offered admission based on quota systems and other form of favoritism still had CGPA of less than 2.5 in the scale of 5.0.
Therefore, entrance scores should be combined with other parameters such as family background, parents educational status, parental income, type of primary and secondary school attended, family size, etc in recommending or denying admission for students.
Studies have shown that students who come from high income and educated families have significantly predicted high college success than students from low socioeconomic status. Some potential explanations were parents in such settings reported lower educational expectations, less monitoring of children’s school work and less overall supervision of social activities compared to students from high socioeconomic and intact families (Jacob and Harvey, 2005).

9. CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study, it is possible to come up with the following conclusions. For any admission test the validity of the test for its intended purpose should be the primary consideration for the admission decision-makers. Previous education records, parents’ income and UTME/PUTME scores are commonly used in predicting future academic performance. Secondary School performance reflects students’ performance in the SSCE results in a variety of subjects. Parents’ income reflects to support their children in providing reading materials like books and dictionaries and paying school fees create differences between children in their academic achievement. UTME are based on subjects that university faculty regard as essential prerequisites for university level learning and that has shown to be positively correlated with university outcomes. Therefore all these predictor variables examined should be considered in offering/denying admission to students.

The study also indicated that students’ academic performance is influenced by the socioeconomic background of their parents; as parents that earn high income can take better responsibilities of their children’s education compared to parents that earn low incomes. Students whose parents have better jobs and higher levels of educational attainment and who are exposed to more educational and cultural resources at home tend to perform better than their counterparts without such opportunities. Thus, based on the findings and conclusions of this study, I recommend an in-depth study on the reliability and validity of the UTME/PUTME and SSCE result that is used as a major criterion to university admission in the country. I also recommend the design of a more sophisticated intelligent decision support system that will harness the strength of Artificial Neural Network and Fuzzy Logic for admission recommendation and academic prediction in Nigeria.

REFERENCES:


