Anaylsis of Students' Enrollment and Graduation Rates in Gulu University in Uganda. A Case Study of Gulu University

Nabaasa Mark 1, , Mr., Dr Ariyo Gracious Kazaara 2, Tukamuhebwa Deus 3, Dr Arinaitwe Julius 4, Kamugisha Nelson 5, Mutesi Catherine 6, Friday Christopher 7, Isabirye Benefansi 8, Kimaku Alex 9

1 Metropolitan International University, University Secretary metropolitan international university 2, 3 Lecturer Metropolitan international University ,Metropolitan International University 4, Metropolitan International University 5, Lecturer Metropolitan International University 6, Lecturer Metropolitan International University 7, Lecturer Metropolitan International University 8, , Lecturer Metropolitan International University 9

Email: nelson.kamugisha@miu.ac.ug

Abstract: This study's main goal was to examine the enrollment and graduation rates of students at Uganda's Gulu University. A quantitative research methodology was used in this investigation. All students enrolled at Gulu University from 2002/2003 to 2019/2020 made up the study's population. The document from the admissions office that contained the study's secondary data served as the primary tool for data collection. Data needed to manage daily academic practices was obtained from academic management systems. These systems rely on transactional databases, which are often updated and as a result lack the ability to archive histories of data instances, making them unsuitable for study on enrollment prediction and graduation prediction. based on the probability of enrollment based on the fact that departments in charge of recruiting students are left to guess. In the majority of circumstances, this is inappropriate because it causes budget shortages and resource strain. Universities experience difficulty forecasting how many students will graduate from the school of interest in addition to speculating on those who are likely to enroll. There are several reasons why a student doesn't finish their degree of study, including their financial situation and family history. As a result, models for forecasting enrolment and graduation are put forth to help in making projections about how many admitted students will enroll and how many will graduate. The proposed system first works by converting the student data into time series data by adding a time variant to it. It then runs the data through Stata software and performs regression analysis using the appropriate econometric model. The inputs to the proposed prediction system were sourced from student data stored in a worksheet regarding student details. The enrollment and graduation of students will then be forecasted using the set of associated. With a 59% accuracy rate, the model's accuracy was remarkably high. The dataset employed, which was noisy because it was pulled from genuine student transactional databases, resulted in the proposed model having a slightly poorer accuracy in comparison to some of the papers assessed.

Case study: STUDENTS' ENROLLMENT AND GRADUATION RATES

Background

In all countries, public Universities have a measure how they select their students, but both the extent and nature of these measures vary considerably across countries. Understanding a higher education admission system requires both assessing this autonomy and exploring the mechanics of how selection and guidance take place.

In Ugandan universities in the past, the number of admitted students has continuously exceeded the number of students enrolled. Following the recruitment process, admission letters are usually distributed to a large number of students to various schools or faculties with the assumption that a nearly equal number will enroll. However, not every applicant who is approved enrolls for a variety of reasons. The preponderance of Ugandan universities have a high school mean grade as their entry criteria. On the other hand, enrollment takes place when the student pays a certain cost and registers up for a specific number of courses or units that the school is offering, as is the norm in most institutions. Institutional yield is the percentage of enrolled students to those that were accepted (Arcilla, 2012). One of the most dependable measures of an institution's competitiveness and excellence is its institutional yield. This is primarily due to the research on the benefits of a college education for both individuals and society. The institutional yield could seem like a simple rate and a logical metric. However, it is significantly more difficult to calculate and understand than one might imagine, which can eventually lead to misrepresenting the true state of an institution's effectiveness. The success of any academic program mostly rests on the student completion rate, despite the fact that enrollment patterns are crucial (Borena, 2014). For many universities and governments, program completion and on-time graduation have taken on increased importance as policy concerns. The ratio of all students who successfully complete the last year of their program in a given year to all students who receive an official diploma in the population is known as the student completion rate.

Due to the hidden expenses that are always spent by both students and the university, not finishing a program on time raises its cost (Bean & Metzner, 1985). Due to the backlog of assignments, university resources like libraries and research supervisors are overused, and students are charged extension fees.

Therefore, the question of completion of students relating to the university should be studied with a bifocal lens. Student completion rate in higher education in Uganda should be critically assessed by researchers and higher education providers. Therefore, all related issues that improve the current trends should be identified and worked on. To achieve this, extensive research in this area should be encouraged so as to help gather the needed information.

Problem Statement

In most Ugandan universities, the pace of student admissions has been matched by a corresponding uncertainty in funding allocation. Planning and budgetary challenges have emerged as a result of the uncertainty regarding the number of students who would enroll, as was mentioned previously. It is up to the requirement for admitting students to predict how many will enroll. Most of the time, this is inaccurate because that causes the budgets to be underfunded and the resources to be strained, as was said before. The problem of admitting quality students who can complete their degrees and graduate on time arises from the growth in student enrollment.

The number of students who are likely to enroll in the institution's various academic programs and finish their course of study on time cannot currently be accurately predicted by any higher education institution in Uganda. Instead, academic routines are managed everyday through the use of academic management systems. Transactional databases, which support these systems, are regularly updated and, as a result, lack the ability to archive histories of data instances, making them unsuitable for performing predictive analytics on enrollment and student completion rate. Based on this circumstance, an empirical evaluation was done on data from Uganda's public universities regarding student's attendance and graduation rates.

A case study of Gulu University was the subject matter of this study.

Specific Objectives

1. To examine student's enrollment and completion trends at Gulu University
2. To determine the student completion rate per faculty in Gulu University

Research Questions

1. What are the trends of enrollment and completion rates at Gulu University?
2. What is the student completion rate per faculty?

RESEARCH METHODOLOGY

System analysis

The underpinning for ensuring the confidentiality of research is a high-quality data set. The researcher developed answers that addressed the research questions, systematically collected data from reliable sources, and then evaluated the findings. Filtering the necessary data from a vast data set while ensuring data accuracy, however, was a difficult task. To avoid using false data and to uphold the standard of the research, significant scrutiny is needed for information from secondary sources (Kumar, 2005).

This study acquired a substantial amount of information about student enrollment and graduation and performed a thorough analysis to compile fresh enrollment and graduation statistics for each year. All of the students that attended the university were the subject of the analysis process. The qualitative method and the quantitative approach are the two often used ways to forecasting, according to Albandoz (2001). Qualitative approaches consist on subjective inputs, which typically resist specific numerical models. However, contrasted to their qualitative counterparts, quantitative forecasting techniques are more intensely objective.

Analytical techniques forecast using historical data. They typically steer clear of the personal biases that may taint qualitative methodologies. Understanding how the time series behaved in the past largely depends on the data pattern. If this pattern of behavior persists in the future, selecting a suitable forecasting method is guided by the historical trend. Additionally, the performance of forecasting can be enhanced by bringing together the quantitative and qualitative approaches. A quantitative model alone, which may lag behind real-world facts, can significantly worsen forecasting performance than the management's opinion and judgment about the important political and economic aspects. This study chose an exponential smoothing strategy to create the quantitative forecasting model based on the findings of the data analysis.

Research design

This research design approach followed manipulating pre-existing statistical data using computational techniques. This research design suited this research since data relating to student's admission enrollment graduation was collected. This study involved 17 years of analysis of Gulu university students' enrollment and graduation.

Target Population and Sampling

Students served as the study's analysis unit. This study concentrated primarily on Gulu University students who were enrolled, the next stage of institutional enrollment, and then nearing graduation. The target population was split into two groups for the secondary data for external validation. The staff in the admissions office and the admitted students were the first end users of the proposed models.

Data Collection and Procedure

Secondary sources of data were used in this study. The data used in training the model was collected from secondary sources such as existing databases. Data was collected from staff within the admissions department. Other secondary sources that were used in data collection were written reports and journals regarding existing systems or models or algorithms that were being employed for enrollment prediction by universities in Uganda.

Data analysis.

Data analysis is the process of critically analysing gathered and organized data in order to identify patterns and relationships between the variables that are related to the object being studied as well as to analyze its characteristics (Kumar, 2005).

The data analysis process used quantitative methodologies. Excel and Stata software were used in this work to enter, purify, and analyze the gathered data.

The model was created using econometric techniques like the semi-log model. A regression analysis will be performed on the output that the model produced.

Data Analysis

The research approach taken in this study was quantitative. The system with which the researcher interacted with was considered to be mostly user friendly and fast enough to be used in data analysis. The accuracy levels were acceptable though it was taken into advisement that the accuracy of the model should improve with time.

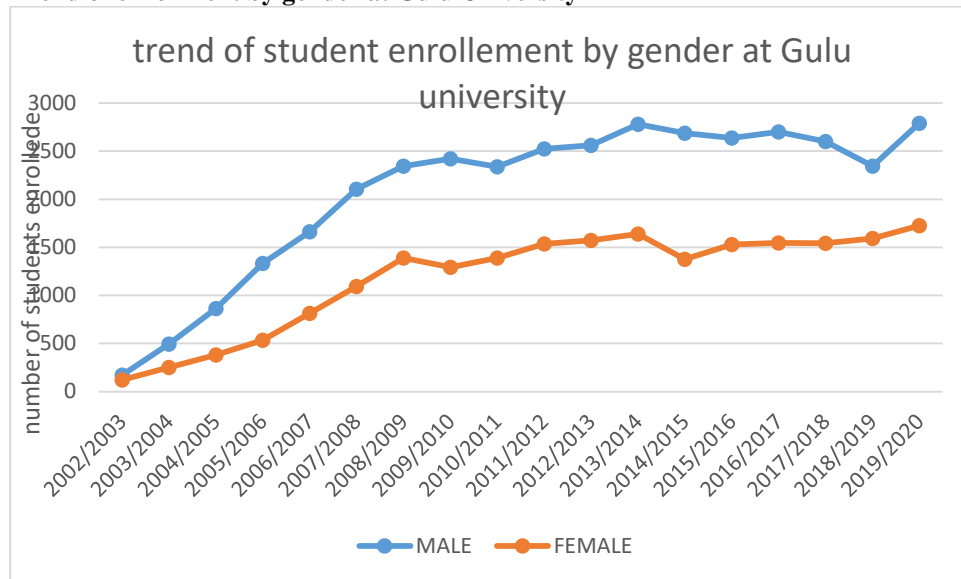**Trend of enrollment by gender at Gulu University**

Figure 1: Trend of enrollment by gender

In the academic year 2002/2003, there were 291 students enrolled, with men making up more than half of that number (58.4%), while women made up 41.8%. The participation climbed steadily from 291 to 744, 1244, 1866, 2476, 3196, and 3735 in the academic years 2003–2004, 2004–2005, 2005–2006, 2006–2007, and 2008–2009, respectively. The enrollment had increased by 11 (or 84%) from the academic year 2002/2003 to the academic year 2008/2009. The percentage contribution of male participation to total enrollment in the academic years 2003–2004, 2004–2005, 2005–2006, 2006–2007, 2007–2008, and 2008–2009 was 66.4%, 69.4%, 71.4%, 67.1%, 65.8%, and 62.8%, respectively. The enrollment in the academic year 2009/2010 declined slightly to 3712. Males enrolled more than females with a percentage of 65.2% of the total enrollment. This was followed by a small increase in enrollment in the academic year2010/2011 with enrollment total of 3729. Still males enrolled more than females contributing 62.7% of the total enrollment. In the academic year 2011/2012, enrollment increased sharply to 4059. The males are still the major contributor to

enrollment with a composition of 62.8% of the total enrollment. The population increased from 4059 in the academic year 2011/2012 to 4136 and 4421, respectively, between the academic years 2012/2013 and 2013/2014. In the academic years 2012–2013 and 2013–2014, respectively, the percentage contribution of male participation was 61.9% and 62.9% compared to the percentage contributions of female enrollment of 39.1% and 27.1%. The number of students enrolled decreased from 4421 in the previous academic year to 4063 in 2014–2015. In comparison to men, who make up 66.2% of the overall membership, fewer women enroll. The enrollment is found to have increased from the academic years 2015–2016 to 2016–2017, reaching 4166 and 4248, respectively. Male enrollment has outperformed female enrollment all throughout course of these two academic years, representing 63.3% and 63.6% of the total enrollment numbers in the academic years 2015–2016 and 2016–2017, respectively.

The enrolment dropped to 4142 and 3939 in the academic years 2017–2018 and 2018–2019, respectively. Although there has been a drop in enrollment, men still represent the majority of graduates. Finally, enrollment grew once more to 4515 in the 2019–2020 school year. According to the data set, Gulu University enrollment are more likely to be male.

Generally, the trend of enrollment from academic year 2002/2003 was seen to be increasing up to academic year 2008/2009. The trend later started fluctuating with decreases in number enrollment followed by increases in number up to the academic year 2019/2020. On average males are more than females on enrollment by 75.16%

```
. ttest enrolledmales== enrolledfemales

Paired t test

Variable        Obs         Mean     Std. Err.    Std. Dev.    [95% Conf. Interval]

e~dmales         18     2075.278     193.5212     821.0411     1666.984    2483.572
e~emales         18     1184.778     123.5667     524.2492     924.0748    1445.481

    diff         18       890.5      77.45618     328.6187     727.0818    1053.918

     mean(diff) = mean(enrolledmales - enrolledfemales)            t =   11.4968
 Ho: mean(diff) = 0                                degrees of freedom =        17

 Ha: mean(diff) < 0              Ha: mean(diff) != 0             Ha: mean(diff) > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000
```

Table 1 analysis of students that enroll by gender at Gulu University.

Over the years, the number of students enrolled have been increasing. The number of males enrolled are more compared to that of females, since the $P=0.0000<0.05$ which is statistically significant. This implies that over the years, less females enroll compared to male students.
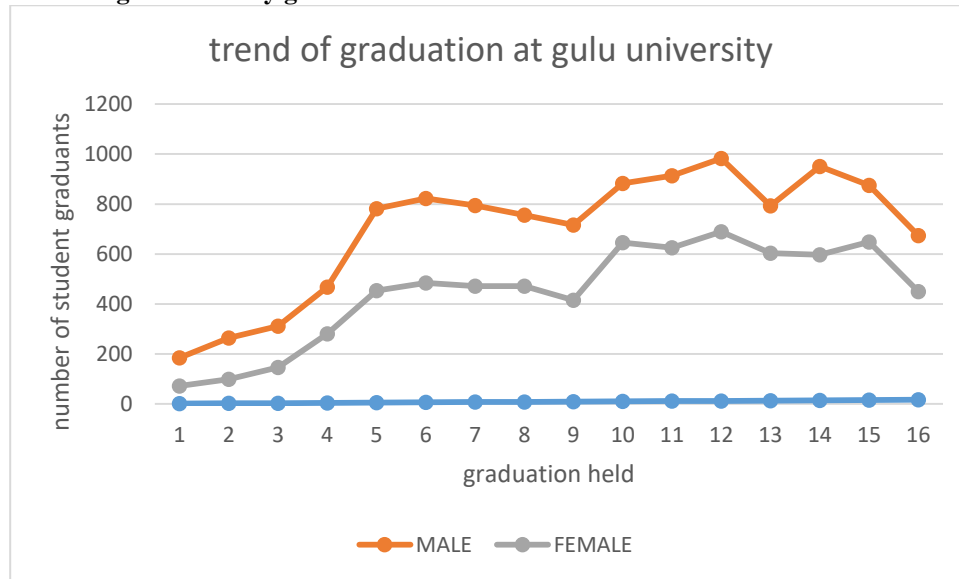
Trend of graduation by gender

Figure 2: Trend of graduation by gender

257 students got diplomas during the first graduation. With a percentage composition of 71.98% of the total graduate population and females at 28.02%, men are perceived to be more numerous than women. Grandaunt numbers rose dramatically from the first graduation to the sixth graduation, reaching 363 for the second graduation, 457 for the third, 1235 for the fourth, and 1307 for the fifth. On these graduations, males still outnumber girls by percentage compositions of 72.7%, 68.05%, 62.57%, 63.32%, and 62.97%, respectively. By the sixth graduation, there were 4 more grandparents, an increase of 8%. The number of graduates fell from 1307 at the sixth graduation to 1265 at the seventh graduation to 1228 at the eighth graduation to 1131 at the ninth graduation. Males largely dominated over females at these graduations, with corresponding percentage percentages of 37.23%, 38.44%, and 36.69% of the total number of grandaunts. The number of graduates at the tenth, eleventh, and twelfth graduations continuously rose to 1529, 1539, and 1672, respectively. With percentage compositions of 57.75, 59.94%, and 58.79% of the total number of grandaunts in these graduations, respectively, the male grandaunts predominate on these graduations.

The number of grandaunts dropped significantly to 1396 at the graduation on the thirteenth. With a percentage composition of 56.81% of the overall number of grandaunts, men are still perceived as being more numerous than women.

The rise to 1548 occurred after the fourteenth graduation. With a percentage composition of 61.43%, men outnumber women. On the fifteenth and sixteenth graduations, it subsequently dropped to 1523 and 1123. These graduations still have a 57.45% and 60.02% male proportion makeup, respectively.

From the first graduation up to the sixth graduation, the trend of graduation was usually observed to be rising. The number of grandaunts has been decreasing and then increasing from the seventh to the sixteenth graduation, according to the trend. On average, men outnumber women who graduate by 56.27%.

```
. ttest graduatedmales== graduatedfemales

Paired t test

------------------------------------------------------------------------------
Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
 g~dmales |      16      698.25    63.14081    252.5633    563.6685    832.8315
 g~emales |      16    446.8125    50.03909    200.1563    340.1567    553.4683
---------+--------------------------------------------------------------------
    diff |      16    251.4375    18.19729    72.78916    212.6509    290.2241
------------------------------------------------------------------------------
    mean(diff) = mean(graduatedmales - graduatedfemales)        t =  13.8173
Ho: mean(diff) = 0                              degrees of freedom =       15

Ha: mean(diff) < 0              Ha: mean(diff) != 0              Ha: mean(diff) > 0
Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000
```

Table 3 analysis of students that graduate by gender at Gulu University

Over the years, the number of students graduating have been increasing. The number of males graduating are more compared to that of females, since the P=0.000 <0.05 which is statistically significant. This implies that over the years, less females graduate compared to male students.

Graduation rates
Students' completion rate is the ratio of the total number of students graduating in faculty in a given year to the total number of students of official graduation in the population. The graduation rates are analyzed per faculty per graduation. Mathematically

$$graduation\ rate = \frac{total\ no.\ of\ students\ graduating\ in\ faculty}{total\ number\ of\ students\ of\ official\ graduation\ in\ the\ population.}$$

The table below show the graduation rates in percentages that are computed using the above formula. The figures are not the exact figures but are rounded up to the nearest whole number where applicable or to one decimal place.
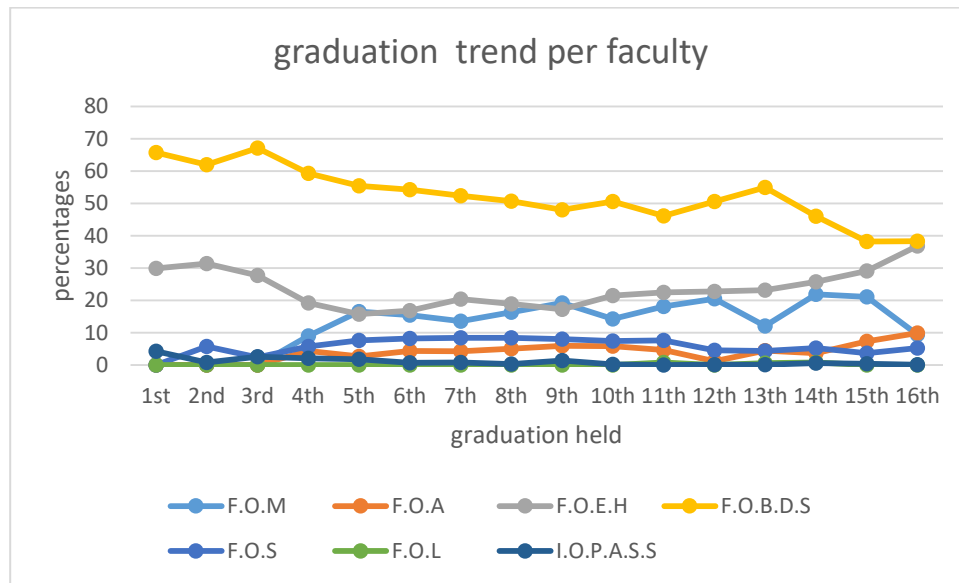
Figure 3: Graduation rates in percentages

F.O.M	-	Faculty of medicine
F.O.A	-	Faculty of Agriculture
F.O.E.H	-	Faculty of Education and Humanities
F.O.B.D.S	-	Faculty of Business and Development Studies
F.O.S	-	Faculty of Science

F.O.L   -Faculty of Law   I.O.P.A.S.S   -institute of peace and strategic studies

On the first graduation none of students graduated from F.OM, F.O.A, F.O.S and F.O.L. Therefore the graduation rate in these faculties is 0%. 29.9611% of the grandaunts were from F.O.E.H, 65.7588% from F.O.B.D.S and 4.2802% from I.O.P.A.S.S.

On the second graduation, 65.7588% of the students graduating were from F.O.B.D.S, 31.405% were from F.O.E.H, 5.7851% from F.O.S and 0.8264% from I.O.P.A.S.S. other faculties that is F.O.L, F.O.M and F.O.A had 0%.

On the third graduation, F.O.M, F.O.A and F.O.L had 0% implying that no one from these faculties graduated. 27.7899%, 67.1772%, 2.407% and2.6258% were from F.O.E.H, F.O.B.D.S, F.OS and I.O.P.A.S.S respectively

On the forth graduation, F.O.L had a graduation rate of 0% while F.O.M, F.O.A, F.O.E.H, F.B.D.S, F.O.S and I.O.P.A.S.S had graduation rates of 9.0909%, 4.4118%, 19.2513%, 59.3583%, 5.7487% and2.139% respectively.

On the fifth graduation, the graduation rates were 16.5992%, 2.6721%, 15.7895%, 55.4656%, 7.6923%, 0% and 1.7814% from F.O.M, F.O.A, F.O.E.H, F.B.D.S, F.O.S, F.OL and I.O.P.A.S.S respectively.

On the sixth graduation, the graduation rates were 15.4552%, 4.3611%, 16.909%, 54.2464%, 8.2632%, 0% and 0.7651% from F.O.M, F.O.A, F.O.E.H, F.B.D.S, F.O.S, F.OL and I.O.P.A.S.S respectively

On the seventh graduation, the graduation rates were 13.5968%, 4.3478%, 20.3953%, 52.4111%, 8.4585%, 0% and 0.7905% from F.O.M, F.O.A, F.O.E.H, F.B.D.S, F.O.S, F.OL and I.O.P.A.S.S respectively.

On the eighth graduation, the graduation rates were 16.3681%, 5.1303%, 18.9739%, 50.7329%, 8.4691%, 0% and 0.3257% from F.O.M, F.O.A, F.O.E.H, F.B.D.S, F.O.S, F.OL and I.O.P.A.S.S respectively

On the ninth graduation, the graduation rates were 19.2718%, 5.9503%, 17.2291%, 48.0462%, 8.0817%, 0% and 1.421% from F.O.M, F.O.A, F.O.E.H, F.B.D.S, F.O.S, F.OL and I.O.P.A.S.S respectively

On the tenth graduation, the graduation rates were 14.3139%, 5.9094%, 21.4708%, 50.6238%, 7.4852%, 0% and 0.197% from F.O.M, F.O.A, F.O.E.H, F.B.D.S, F.O.S, F.OL and I.O.P.A.S.S respectively

On the eleventh graduation, the graduation rates were 18.1522%, 4.6845%, 22.5114%, 46.1288%, 7.6773%, 0% and 0.8447% from F.O.M, F.O.A, F.O.E.H, F.B.D.S, F.O.S, F.OL and I.O.P.A.S.S respectively

On the twelfth graduation, the graduation rates were 20.5776%, 1.2034%, 22.8039%, 50.6619%, 4.633%, 0% and 0.1203% from F.O.M, F.O.A, F.O.E.H, F.B.D.S, F.O.S, F.OL and I.O.P.A.S.S respectively

On the thirteen graduation, the graduation rates were 12.0863%, 4.5324%, 23.2374%, 54.964%, 4.3885%, 0.6447% and 0.1439%, from F.O.M, F.O.A, F.O.E.H, F.B.D.S, F.O.S, F.OL and I.O.P.A.S.S respectively

On the fourteenth graduation, the graduation rates were 21.9579%, 3.739%, 25.7648%, 46.0911%, 5.3025%, 0.8398% and 0.6118% from F.O.M, F.O.A, F.O.E.H, F.B.D.S, F.O.S, F.OL and I.O.P.A.S.S respectively

On the fifth graduation, the graduation rates were 16.5992%, 2.6721%, 15.7895%, 55.4656%, 7.6923%, 0% and 1.7814% from F.O.M, F.O.A, F.O.E.H, F.B.D.S, F.O.S, F.OL and I.O.P.A.S.S respectively.

On the sixteenth graduation, the graduation rates were 9.4086%, 9.9462%, 36.828%, 38.3513%, 5.2867%, 0% and 0.1792% from F.O.M, F.O.A, F.O.E.H, F.B.D.S, F.O.S, F.OL and I.O.P.A.S.S respectively

The overall graduation rate is 15.41%, 4.54%, 22.79%, 49.95%, 6.25%, 0.19% and 0.63% for F.O.M, F.O.A, F.O.E.H, F.B.D.S, F.O.S, F.OL and I.O.P.A.S.S respectively.

```
. ttest totalenrolled== totalgraduants

Paired t test

Variable       Obs        Mean     Std. Err.    Std. Dev.    [95% Conf. Interval]

totale~d        16     3139.25     342.5485     1370.194     2409.125     3869.375
totalg~s        16    1145.063     112.4731     449.8925     905.3317     1384.793

    diff        16    1994.188      239.142     956.5682     1484.468     2503.907

     mean(diff) = mean(totalenrolled - totalgraduants)            t =    8.3389
Ho: mean(diff) = 0                                 degrees of freedom =        15

Ha: mean(diff) < 0              Ha: mean(diff) != 0              Ha: mean(diff) > 0
Pr(T < t) = 1.0000       Pr(|T| > |t|) = 0.0000       Pr(T > t) = 0.0000
```

Table 4.2.3. 1 analysis of total students enrolled and those that graduate at Gulu University

over the years ,the number of students enrolled have been increasing but the number of students graduating have been decreasing .since the P=0.0000< 0.05 which is statistically significant .This implies that over the years less students graduate compared to those that enrolled.

Shortfalls of the Models

The suggested models only work with dimensional data. Therefore, the proposed approach would not scale or perform well on data from highly normalized relations found in everyday transactional databases.

The successful ones provide a solution that addresses the classification issue, but not the grouping or regression issues. As a result, it is only possible to predict whether a student or group of students will enroll using the recommended models. The proposed models are not intended to be used to explain the classification results by outlining the traits that students who are enrolled or not share in common or the specific trait that might be keeping them from enrolling.

Finally, the suggested models rely heavily on data that has been through extensive pre-processing. Since the data must be extensively pre-processed, scaled, and turned into dimensional data before being run through the models, running it continuously could be quite expensive. Currently, an automated Crony job completely reliant on the Linux operating systems appears to resolve this problem; however, this is not a long-term fix since data preprocessing as a necessary step would need to be automated in any other operating system for the prototype to be adopted into production scale.

Recommendations

In consideration of the results obtained from the implementation and testing of the proposed model, the following recommendations were made

1. To reduce the levels of uncertainty as pertains to knowing the number of admitted students likely to get enrolled, an enrollment prediction model is recommended to reduce the uncertainty
2. To improve the data quality needed for prediction, an Institutional Warehouse is proposed for purposes of keeping historical snapshots of the transactional database instances which are important for increasing the dimensionality of student data. This is crucial in ensuring the models are fed with dimensional data and not just transactional data that is noisy
3. Satisfactory index data should also be included in institutional data warehouses detailing not only how the University is ranked but also various ranking indexes on how the students feel about various programs and resources this is to help in enriching the data set required for making enrollment predictions
4. To ease the use of the proposed models, a web application should be adapted to interact with the models for purposes of increasing the model's performance and aiding quick availability of prediction results.

References

Abdul Fattah Mashat. (2012). A Decision Tree Classification Model for University Admission System. 17-21.

Albandoz, P. L. (2001). Population and sample. Sampling techniques. Management Mathematics for European Schools. 4-16.

Arcilla, R. Q. (2012). Enrollment Forecasting for School Management System. 563-566.

Bean, J., & Metzner, B . (1985). A Conceptual Model of Nontraditional Undergraduate .

Bean, J., & Metzner, B. (1985). A Conceptual Model of Nontraditional Undergraduate .

Bontrager, B. (2004). Enrollment Management: An Introduction to Concepts and Structures. College and University Journal.

Borena, M. (2014). Higher Education Students' Enrollment Forecasting System Using Data Mining Application in Africa. 36-43.

Cabrera, A. F. (1994). Logistic Regression Analysis in Higher Education:An Applied Perspective.

Chau-Kuang Chen. (2008). An Intergrated Enrollment Forecast Model. Association For Institutional Research.

Creswell, J. (2003). Qualitative, quantitative and mixed methods approaches (2nd ed.). Sage Publishers.

Delen, D. (2010). A comparative analysis of machine learning techniques for student retention management. ELSEVIER.

Furlow, G. (2001). The Case for Building a Data Warehouse. IEEE.

Golafshani, N. (2003). Understanding Reliability and Validity in Research: The Qualitative Report. Nova SouthEastern University.

Gor, D. R. (2002). Industrial Statistics and Operational Management. Delhi.

Harvard University. (2016). Harvard Admitted Students Profile. Retrieved September 13, 2016, from https://college.harvard.edu/admissions/admissions-statistics

Kalekar, P. S. (2004). Time series forecasting using Holt-Winters Exponential Smoothing.

Ken Peffers, T. . (2007). A Design Science Research Methodology for Information Systems Research. 45-78.

Kennedy and Powell. (2001). Factors Effecting Retention and Satisfaction among Accounting and Marketing' Major Students at Dammam Community College.

Khalifat, A., & Algodhah, M. (2010). Educational Attrition at Mutah University.

Kimball Group. (2005). Proceedings of the Eighteenth International Conference on Machine Learning. (pp. 577-584). Kimball Dimensional Modelling.

Kumar, R. (2005). Research Methodology: A step-by-step guide for beginners.

McIntyre, C. (2007). Performance-Based Enrollment Management. Orlando: Annual Forum of the Association for Institutional Research.

Ministry of Education, Science and Technology - Kenya . (2015). Education For All-2015 National Review: Ministry of Education Press. Nairobi.

Orwig. P. K. (2000). Enrollment Projection Models For Institutional Planning: Act Research Report.