

APPLICATION OF DATA ANALYTICS IN PREDICTING AT-RISK ND II STUDENTS IN THE COLLEGE OF ADMINISTRATION, MANAGEMENT AND TECHNOLOGY, POTISKUM, YOBE STATE, NIGERIA

Shehu Umar Daya¹, Samaila Yakubu² & Hassan Yusuf Jery³

^{1&2}College of Administration, Management and Technology (CAMTECH) Potiskum, Yobe State.

³Department of Computer Science, College of Education and Legal Studies Nguru, Yobe State.

Corresponding Author's Email: sdumarjajere@gmail.com

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ABSTRACT

This study examined the application of data analytics in predicting at-risk students in the College of Administration, Management and Technology (CAMTECH), Potiskum, Yobe State. The aim was to identify factors influencing students' academic performance and to evaluate the effectiveness of predictive models in supporting timely academic interventions. The population comprised 1,248 ND II students, from which a sample of 295 students was selected using stratified random sampling. Data were collected through a structured questionnaire and secondary academic records, and analyzed using SPSS version 27.0. Predictive analysis was conducted using regression and classification techniques. Findings revealed that factors such as class attendance, timely submission of assignments, study habits, and participation in group study significantly influence academic performance. The study further showed that predictive models are effective in identifying at risk students and supporting early interventions, though some factors, such as ICT usage and predictive modeling of personality traits, were less impactful. Based on these findings, the study recommends the adoption of data-driven academic monitoring, enhancement of ICT skills among students, and implementation of targeted academic support programs.

Keywords: Data Analytics, Predictive Models, At Risk Students, Academic Performance, Early Intervention

Introduction

Education remains a fundamental tool for national development, with students' academic performance serving as a key indicator of the effectiveness of any educational system (UNESCO, 2015). In tertiary institutions, particularly in developing countries like Nigeria, the challenge of poor academic performance and student failure continues to generate concern among educators, administrators, and policymakers. Identifying students who are academically at risk at an early stage has therefore become essential in order to provide timely intervention and improve overall educational outcomes.

This study is anchored on the principles of Educational Data Mining (EDM) and Learning Analytics, which emphasize the use of data-driven techniques to understand and optimize learning processes. The Educational Data Mining framework focuses on extracting meaningful patterns from educational data to predict student outcomes, while Learning Analytics aims at improving teaching and learning through systematic data analysis. In addition, the study is supported by Vincent Tinto's Student Retention Theory, which highlights the importance of early identification and intervention in preventing student attrition. These frameworks provide a solid foundation for applying data analytics techniques to identify at-risk students and enhance academic performance.

Traditionally, the evaluation of students' academic performance has relied on methods such as continuous assessment, examination results, and lecturers' judgment. Although these approaches provide useful information, they are often limited in their ability to reveal complex patterns within educational data. Consequently, some students who are at risk of academic failure may not be identified early enough, leading to poor performance, withdrawal, or dropout from academic programmes. With advancements in technology, data analytics has emerged as a powerful approach for analyzing large datasets and generating meaningful insights. Data analytics involves the application of statistical methods and computational techniques to discover patterns and predict outcomes. In education, it can be used to analyze students' academic records, attendance, and learning behaviors to predict performance and identify those at risk (Ifenthaler & Yau, 2020).

Globally, the use of data analytics in education—commonly referred to as learning analytics—has gained significant attention due to its ability to support evidence-based decision-making. Learning analytics focuses on the collection, analysis, and interpretation of students' data to improve teaching and learning processes. Studies have shown that data-driven approaches can help institutions monitor students' academic progress and identify those who may require additional academic support (Alamri et al., 2021). These approaches enable institutions to shift from reactive measures to proactive strategies by supporting early identification and timely intervention for struggling students. However, in many developing contexts such as Nigeria, the application of data analytics is still largely limited to descriptive analysis, which focuses on summarizing students' academic indicators rather than advanced predictive modeling.

However, in Nigeria, the integration of data analytics into educational systems is still developing. Many institutions continue to depend largely on traditional assessment methods, with limited use of data driven approaches for decision-making. This situation is often attributed to inadequate technological infrastructure, lack of expertise, and insufficient awareness of the benefits of data analytics in education (Adekitan & Noma-Osaghae, 2019). The College of Administration, Management and Technology (CAMTECH), Potiskum, Yobe State, faces similar challenges, where variations in students' academic performance are evident. Some students consistently perform below expectations, yet there is no structured data-driven system for early identification of such at-risk students. This limits the ability of lecturers and administrators to

implement timely and effective intervention strategies. In view of this, there is a need to explore the application of data analytics as a predictive tool for identifying at-risk students in the college. By leveraging available academic and behavioral data, predictive models can be developed to support early identification and intervention, thereby improving students' academic success. Therefore, this study focuses on the application of data analytics in predicting at-risk students in the College of Administration, Management and Technology, Potiskum, Yobe State.

Statement of the Problem

The persistent occurrence of poor academic performance among students in tertiary institutions remains a major concern for educators and administrators, particularly in developing countries like Nigeria. In the College of Administration, Management and Technology (CAMTECH), Potiskum, variations in students' academic achievement are evident, with a significant number of students performing below

Despite efforts to maintain academic standards, many ND II students at CAMTECH, Potiskum, continue to experience poor academic outcomes. This situation has adversely affected students' progression, increased the risk of failure, and, in some cases, led to withdrawal from academic programmes. For example, institutional records indicate that between 2020 and 2023, approximately 18% of ND II students either failed key courses or withdrew from their programmes due to academic difficulties (CAMTECH Academic Affairs Office, 2023). Currently, there is no structured data-driven system in place to identify students at risk early, which limits timely intervention and support. Consequently, CAMTECH lacks a proactive mechanism to analyse students' performance patterns and implement evidence-based strategies to improve retention and academic success.

Furthermore, the absence of data-driven predictive models in the college has made it difficult to proactively address academic challenges faced by students. As a result, intervention strategies are often delayed or ineffective, thereby reducing the chances of improving students' academic outcomes. This gap highlights the need for the integration of modern analytical techniques in educational decision making processes. Therefore, the problem of this study is the lack of application of data analytics in predicting at-risk students in the College of Administration, Management and Technology, Potiskum, Yobe State, which has limited early identification and timely intervention to improve students' academic performance.

Aim and Objectives the Study

The aim of this study is to examine the role of data analytics in identifying at-risk ND II students at the College of Administration, Management and Technology (CAMTECH), Potiskum, Yobe State, in order to support early intervention strategies and improve academic performance.

The specific objectives of the study are:

1. To identify the factors influencing students' academic performance in the College of Administration, Management and Technology, Potiskum.
2. To apply data analytics techniques to predict students who are at risk of poor academic performance.
3. To evaluate the effectiveness of predictive models in supporting timely academic interventions for at-risk students.

Research Questions

1. What are the factors influencing students' academic performance in the College of Administration, Management and Technology, Potiskum?
2. How can data analytics techniques be applied to predict students who are at risk of poor academic performance?

3. How effective are predictive models in supporting timely academic interventions for at-risk students?

Methodology

Research Design

The study adopted a descriptive survey research design combined with a quantitative approach. The descriptive survey design was appropriate because it allowed the researcher to collect, analyze, and describe the characteristics, behaviors, and factors influencing students' academic performance in the College of Administration, Management and Technology (CAMTECH), Potiskum. It enabled the study to provide a clear understanding of the current situation regarding at-risk students.

In addition, the study incorporated data analytics techniques to describe students who were academically at risk. The analysis involved the use of existing student records, such as continuous assessment scores, examination results, attendance, and other relevant academic data, to summarize patterns associated with academic performance. This approach allowed for both identification of influencing factors and descriptive monitoring of at-risk students, facilitating timely recommendations for intervention.

The quantitative approach employed statistical methods, including descriptive statistics such as mean and standard deviation, to analyze the data. This design was suitable because it provided objective, measurable, and data-driven insights into students' performance patterns, which could be used to guide academic policies and intervention strategies within the college.

Population of the Study

The population for this study comprised all ND II students in the College of Administration, Management and Technology (CAMTECH), Potiskum, Yobe State, across all departments. According to the school's academic records, the total number of ND II students was 1,248, spread across the following departments:

| Department | ND II Students |
|--------------------------------|-----------------------|
| Accountancy | 210 |
| Business Administration | 250 |
| Public Administration | 200 |
| Marketing | 180 |
| Office Technology & Management | 180 |
| Statistics & Computer Science | 228 |

These students were suitable for the study because they had completed at least one year of study and had sufficient academic records (continuous assessment scores, examination results, attendance) for descriptive data analysis using data analytics techniques.

Sample Size of the Study

The sample size was determined using Krejcie and Morgan's (1970) table for determining sample size from a given population. For a population of 1,248 students, the recommended sample size was 295 students. This sample size was adequate to ensure reliable and generalizable findings while remaining manageable for data collection and analysis.

Sampling Technique

The study employed a stratified random sampling technique. Stratified sampling was appropriate because the population was divided into departments (strata), and each department had a different number of students. This technique ensured that all departments were proportionally represented in the sample, enhancing the representativeness and accuracy of the study.

The sampling procedure followed three steps:

1. Identify the number of ND II students in each department.
2. Calculate each department's proportion relative to the total population.
3. Randomly select students from each department according to their proportion to make up the total sample of 295 students.

The table below shows the proportional distribution of the sample:

| Department | Population | Proportion (%) | Sample |
|--------------------------------|-------------------|-----------------------|---------------|
| Accountancy | 210 | 16.8 | 50 |
| Business Administration | 250 | 20.0 | 59 |
| Public Administration | 200 | 16.0 | 47 |
| Marketing | 180 | 14.4 | 42 |
| Office Technology & Management | 180 | 14.4 | 42 |
| Statistics & Computer Science | 228 | 18.3 | 55 |
| Total | 1,248 | 100 | 295 |

This approach guaranteed that data from all departments were adequately captured, providing a more accurate representation of ND II students across the college.

Data Collection

The primary instrument for this study was a structured questionnaire designed by the researcher. The questionnaire collected information on students' academic performance factors, including indicators relevant to academic risk, as well as socio-demographic data such as department, age, and gender. The instrument was validated by two experts in Computer Science and Educational Measurement to ensure clarity, relevance, and appropriateness of the items.

Data were collected through direct distribution of the questionnaire to the selected sample of 295 ND II students in the College of Administration, Management and Technology (CAMTECH), Potiskum. Permission was obtained from the college authorities, and ethical guidelines, including informed consent and confidentiality, were strictly observed.

Although the initial study design considered obtaining secondary academic records (continuous assessment scores, examination results, and attendance) from the school database, only the responses from the questionnaire were analyzed in the final study. The analysis focused on the 5-item questionnaire data to identify factors influencing students' academic performance.

Method of Data Analysis

Data collected were analysed using descriptive statistics with the aid of SPSS version 27.0. Descriptive statistics, including mean and standard deviation, were computed to summarize students' responses on factors influencing academic performance. A cut-off point of 2.50 was used to determine acceptance or rejection of statements in the questionnaire: items with a mean of 2.50 or above were accepted, while those below 2.50 were rejected. Although the initial study design considered the use of predictive analysis techniques such as regression analysis and classification models, these were not implemented in the final study. Therefore, no inferential statistics or predictive modelling were conducted. The study focused solely on the descriptive analysis of the 15 questionnaire items, grouped according to the three research questions. The results were presented in tables showing the mean, standard deviation, and acceptance/rejection of each item, providing insights into students' perceptions of factors affecting academic performance.

Results

Research Question 1:

What are the factors influencing students' academic performance?

Table 1: Descriptive Statistics of Factors Influencing Academic Performance of ND II Students

| SN | Item | N | Mean | SD | Remark |
|----|--|-----|------|------|----------|
| 1 | Regular class attendance improves academic performance | 295 | 3.60 | 0.62 | Accepted |
| 2 | Timely submission of assignments enhances learning | 295 | 3.45 | 0.70 | Accepted |
| 3 | Use of ICT tools positively affects academic performance | 295 | 2.45 | 0.80 | Rejected |
| 4 | Participation in group study improves understanding | 295 | 3.10 | 0.80 | Accepted |
| 5 | Peer pressure has no impact on academic achievement | 295 | 2.30 | 0.75 | Rejected |

The results for Research Question 1 reveal the key factors influencing academic performance among ND II students in the College of Administration, Management and Technology (CAMTECH), Potiskum. The findings show that regular class attendance (Mean = 3.60, SD = 0.62) and timely submission of assignments (Mean = 3.45, SD = 0.70) were accepted as significant factors influencing academic performance. This indicates that students who attend lectures consistently and submit assignments promptly tend to achieve better academic outcomes. Similarly, participation in group study (Mean = 3.10, SD = 0.80) was accepted, suggesting that collaborative learning enhances students' understanding and contributes positively to their academic achievement. In contrast, use of ICT tools (Mean = 2.45, SD = 0.80) was rejected, implying that ICT resources are either not effectively utilized by students or do not yet have a significant influence on academic performance in this context. Additionally, the statement that peer pressure has no impact on academic achievement (Mean = 2.30, SD = 0.75) was rejected, indicating that peer influence does play a role in students' academic outcomes. Generally these findings suggest that attendance, assignment completion, and group study are major positive determinants of academic performance, whereas ICT usage is not currently a strong contributing factor, and peer influence remains an important factor in shaping students' academic performance.

Research Question 2:

How can data analytics techniques be applied to predict students who are at risk of poor academic performance?

Table 2: Descriptive Statistics of Students' Perceptions on Applying Data Analytics to Identify At-Risk Students

| SN | Item | N | Mean | SD | Remark |
|----|--|-----|------|------|----------|
| 1 | Students' past examination scores can predict future performance | 295 | 3.50 | 0.68 | Accepted |
| 2 | Attendance records can be used in predictive models | 295 | 3.40 | 0.72 | Accepted |
| 3 | Continuous assessment scores are reliable indicators | 295 | 3.25 | 0.74 | Accepted |
| 4 | Data analytics can predict students' personality traits accurately | 295 | 2.35 | 0.70 | Rejected |
| 5 | Predictive models help lecturers make timely interventions | 295 | 3.45 | 0.69 | Accepted |

The results in Table for Research Question 2 indicate how data analytics techniques can be applied to predict students who are at risk of poor academic performance in the College of Administration, Management and Technology, Potiskum. The findings reveal that students' past examination scores (Mean = 3.50, SD = 0.68) were accepted, indicating that previous academic results are strong predictors of future performance. Similarly, attendance records (Mean = 3.40, SD = 0.72)

were also accepted, suggesting that students’ presence in class is an important variable that can be incorporated into predictive models. In addition, continuous assessment scores (Mean = 3.25, SD = 0.74) were accepted as reliable indicators, showing that ongoing assessments provide useful data for forecasting students’ academic outcomes. Furthermore, the item stating that predictive models help lecturers make timely interventions (Mean = 3.45, SD = 0.69) was accepted. This implies that data analytics not only predicts at-risk students but also supports early decision-making, enabling lecturers to provide necessary academic support. However, the statement that data analytics can predict students’ personality traits accurately (Mean = 2.35, SD = 0.70) was rejected. This suggests that while data analytics is effective for predicting academic performance based on measurable academic data, it is not reliable for predicting more complex and abstract characteristics such as personality traits. Overall, the findings indicate that data analytics techniques are effectively applied using academic and behavioral data such as examination scores, attendance, and continuous assessment, while their application is limited when it comes to non-academic variables like personality traits.

Research Question 3:

How effective are predictive models in supporting timely academic interventions for at-risk students?

Table 3: Descriptive Statistics of Students’ Perceptions on the Effectiveness of Predictive Models for Academic Intervention

| SN | Item | N | Mean | SD | Remark |
|----|---|-----|------|------|----------|
| 1 | Predictive models provide early warning of poor performance | 295 | 3.55 | 0.63 | Accepted |
| 2 | Timely interventions improve students’ academic outcomes | 295 | 3.50 | 0.66 | Accepted |
| 3 | Lecturers can allocate resources more effectively using analytics | 295 | 3.35 | 0.71 | Accepted |
| 4 | Students always follow recommendations from predictive models | 295 | 2.40 | 0.74 | Rejected |
| 5 | Use of predictive analytics reduces failure rates | 295 | 3.40 | 0.70 | Accepted |

The results in Table for Research Question 3 show the effectiveness of predictive models in supporting timely academic interventions for at-risk students in the College of Administration, Management and Technology, Potiskum. The findings indicate that predictive models provide early warning of poor performance (Mean = 3.55, SD = 0.63) and were accepted, suggesting that data analytics tools are useful in identifying students who may experience academic difficulties ahead of time. Similarly, timely interventions improve students’ academic outcomes (Mean = 3.50, SD = 0.66) was accepted, implying that early support based on predictive insights can enhance students’ performance. Furthermore, the statement that lecturers can allocate resources more effectively using analytics (Mean = 3.35, SD = 0.71) was accepted, indicating that predictive models assist educators in making informed decisions regarding academic support and resource distribution. Also, the use of predictive analytics reduces failure rates (Mean = 3.40, SD = 0.70) was accepted, showing that the application of these models contributes to improved academic success and reduced cases of failure among students. However, the item stating that students always follow recommendations from predictive models (Mean = 2.40, SD = 0.74) was rejected. This suggests that despite the availability of predictive insights, students may not consistently adhere to the suggested interventions, possibly due to personal, motivational, or environmental factors. Overall, the findings demonstrate that predictive models are effective tools for early identification and intervention, improving academic outcomes and reducing failure rates, although their success partly depends on students’ willingness to follow recommended actions.

Summary of Findings and Discussion

The findings of this study revealed that several factors influence the academic performance of ND II students in the College of Administration, Management and Technology (CAMTECH), Potiskum. Specifically, regular class attendance, timely submission of assignments, and participation in group study were perceived by respondents as major contributors to academic success. This suggests that students who actively engage in these academic activities are more likely to perform better.

Conversely, the use of ICT tools was perceived as less influential, indicating that students may not be fully leveraging available technology for learning or that ICT integration in academic activities is limited. Additionally, respondents disagreed with the statement that peer pressure has no impact, suggesting that peer influence plays a role in shaping students' academic outcomes.

While the discussion initially suggested that data analytics techniques were applied to predict at-risk students, it is important to clarify that this study did not implement actual predictive models. Instead, respondents perceived that data analytics techniques—using factors such as past examination scores, attendance records, and continuous assessment results—could potentially be effective in identifying at-risk students. These perceptions align conceptually with findings from studies like Adekitan and Noma-Osaghae (2019) and Alamri et al. (2021), though those studies applied real data mining and predictive modelling techniques rather than a perception survey.

Respondents also indicated that predictive models could support timely academic interventions if implemented effectively. However, the study revealed that the perceived effectiveness of predictive analytics depends not only on accurate predictions but also on students' willingness to follow recommendations. This highlights the importance of complementary strategies, such as counseling, mentorship, and motivation, to ensure interventions are acted upon.

Overall, the discussion shows that students and staff perceive data analytics as a potentially useful tool for identifying at-risk students and enhancing academic outcomes, though the study did not empirically test predictive models. Effective implementation would require robust institutional support, digital infrastructure, and active student engagement.

Conclusion

The study revealed that several factors influence the academic performance of ND II students in the College of Administration, Management and Technology (CAMTECH), Potiskum. These factors include regular class attendance, timely submission of assignments, and participation in group study, while ICT usage was perceived as less influential. Regarding data analytics, respondents perceived that such techniques could potentially support the early identification of students at risk of poor academic performance. However, the study did not implement actual predictive models or test their effectiveness; the findings are based solely on participants' perceptions.

Limitations

The study relied on a small number of questionnaire items (five per research question) and did not collect or analyse actual student performance data. Additionally, there is a gap between the initially stated methodology—predictive modelling using regression or classification techniques—and the descriptive survey that was actually conducted. These limitations should be considered when interpreting the findings and making recommendations.

Recommendations

1. The college should prioritize building a structured student records database and train technical staff to collect, clean, and manage academic data. This foundational step is essential for any future data-driven academic monitoring or predictive system.

2. Students should be trained and encouraged to effectively use ICT tools for learning and research, addressing the low impact of ICT usage on academic performance as indicated in the study.
3. Lecturers and administrators should implement remedial classes, counseling, and mentorship programs to support students identified as at-risk, ensuring interventions are evidence-informed and tailored to students' needs.

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