APPLICATION OF ARTIFICIAL INTELLIGENCE AND PREDICTIVE ANALYTICS AS PREDICTORS OF REDUCING STUDENT DROPOUT RATE IN LAGOS STATE PUBLIC SECONDARY SCHOOLS

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Keywords

Artificial Intelligence, Predictive Analytics, Student Dropout Reduction, Educational Planning, Secondary Education

Abstract

Research Problem: *Secondary school dropouts negatively affect the socioeconomic status of the individual and the human capital of the nation. Although there is a growing interest in educational technologies in Nigeria, empirical studies in AI models and predictive analytics to reduce student dropout in public senior secondary schools in Lagos State are still limited.*
Methods/Theory: *Descriptive and correlational survey designs and were drawn from two theories: Technology Acceptance Model (TAM) and Early Warning System (EWS). 180 Teachers were sampled using disproportionate stratified random sampling technique from 30 public senior secondary schools. Descriptive statistics, Pearson product-moment correlation, and multiple linear regression were used to analyse data obtained from the*

Questionnaire.
Results: *Correlation results revealed a negative non-significant correlation between general AI deployment and dropouts reduction (r = -.164, p = .386 > .05). Predictive analytics, on the other hand, showed an independent and positive relationship with dropout reduction indicators (r = .322). The variance in dropout prevention was not statistically significant (F(2, 27) = 2.108, p = .141 > .05; R = .368, R2 = .135).*
Conclusion: *Predictive analytics on its own can help to identify risk early, and undifferentiated uses of AI don't necessarily mean lower school attrition.*
Key Contribution to Knowledge: *The study present differences in the predictive ability of analytic workflow and AI generative tools in the governance of secondary school education in Nigeria*
Recommendation: The Lagos State Government should focus on digital infrastructure, early warning systems, capacity building, and ethical data management.

Introduction

Early school drop-out from secondary school continues to be a problem for which there is no resolution for educational administrators, policy makers and national development planners in Sub-Saharan Africa. Secondary education is the necessary link between basic education and specialized tertiary education or skilled employment, needed for meaningful socio-economic change to occur. Pupils who drop out of the school ecosystem before they obtain the terminal secondary credentials have seen their personal earning potential and the productivity index of the country get significantly reduced (Adam et al., 2021; Gbesoevi et al., 2023). The problem of attrition is experienced at public senior secondary schools in Nigeria, and more so across the metropolis of Lagos State, as a result of chronic socioeconomic vulnerabilities of the schools, financial difficulties of households, spatial displacement and institutional monitoring gaps (Gbesoevi & Ola, 2021; Gbesoevi et al., 2022a).

The traditional institutional measures adopted to curb learner drop-out rates in Nigeria's public secondary schools have been reactive in nature. The problems of disengagement are normally identified by the school manager, class tutor, and guidance counselors, when the problems of chronic absenteeism have led to the formal withdrawal of a student from school or failure to sit terminal examinations (Gbesoevi et al., 2022b). This paradigm of operation after the fact puts educational managers at a disadvantage to make timely and preventive pastoral interventions. In the international context, new paradigms in educational management are currently being adopted where learning is guided by evidence-based, preventative approaches based on the use of tools and techniques of computational intelligence and of administration data modeling (Bowers et al., 2022; Mezzini et al., 2019). Machine learning algorithms and advanced predictive analytics are increasingly being implemented in global educational ecosystems to identify subtle signs of disengagement – often before a pupil has reached an irreversible point of departure – or Aulck et al (2016) and Castro et al (2017) put it.

Although the world is witnessing the rise of artificial intelligence in education (AIED), there is still large scale scholarly and

operational uncertainty in developing contexts. The terminology of AI is often used interchangeably for general AI, which includes generative interfaces, automated instructions, natural language processing and more, versus dedicated predictive analytics for administrative risk modeling (Andersen, 2018; Kumar, 2023). In Lagos State public secondary schools, the digitization of administrative processes is not uniform and it is not known whether teachers and administrators can benefit from these new analytical tools; whether this new form of computational power can lead to any measurable reduction in student dropouts. The existing studies mostly have been conducted in the western tertiary context (Aulck et al., 2016; Agrusti et al., 2019), and a significant gap has been noticed in the literature on the study of the public secondary schools in the African context.

The research focuses on the ability of AI applications and predictive analytics in predicting student dropouts from Lagos State public senior secondary schools. In particular the study aimed to.

1. Examine the relationship between the application of artificial intelligence and the reduction of student dropout rates in Lagos State public secondary schools.
2. Determine the relationship between the deployment of predictive analytics and the reduction of student dropout rates in Lagos State public secondary schools.
3. Investigate the joint predictive influence of artificial intelligence and predictive analytics on student dropout reduction in Lagos State public secondary schools.

2. LITERATURE REVIEW

Conceptualising Student Dropout

Student Dropout in Secondary Education refers to the premature withdrawal of a secondary school enrollee from a formal course of study before completing a recognized final credential or to a change into an equivalent alternative course of instruction (Allen, 2003; Bowers et al., 2022). Generally, dropout in a developing economy cannot be viewed as a singular, independent event, but rather as a gradual form of cognitive, behavioural and emotional disengagement, shaped by structural externalities (Alban & Mauricio, 2019; Gbesoevi et al., 2024). Child street trading, transportation costs, household income precarity, school level academic alienation are systemic drivers that interact dynamically over long periods of time in Lagos State state to lead to total academic cessation (Gbesoevi & Ola, 2021). Therefore, it is important to realize that dropping out is a continuous process and that there is a conceptual possibility of intervening early as long as the warning signs of dropping out are regularly monitored.

Artificial Intelligence in Education

Gbesoevi et al. (2026) submits that Artificial Intelligence (AI) has emerged as a transformative force across various sectors, offering innovative solutions to complex problems. Artificial Intelligence in Education (AIED) refers to the implementation of computational models, symbolic reasoning, neural networks, and automated systems designed to handle tasks that rely on human cognitive functions (Kumar, 2023; Mezzini et al., 2019). In the context of instruction, the various forms of AI are intelligent tutoring systems, automated essay scoring systems, and adaptive learning environments designed to adjust the pacing of instruction to individual mastery (Castro et al., 2017). Macro-

institutional level: AI helps to improve the allocation of administrative resources, timetable automation, and institutional scheduling (Adam et al., 2021). However, researchers point out that indiscriminate applications of AI tend to fall short in the generation of actionable administrative intelligence, unless directly tied to specific diagnostic goals (Andersen, 2018).

Predictive Analytics for Dropout Prediction

Predictive analytics is a specific type of sophisticated data analysis that uses past and transactional institutional data and records to identify patterns, produce statistical predictions, and forecast empirical occurrences in the future (Shmueli & Koppius, 2011; Siegel, 2016). Predictive Analytics in the secondary education management field uses longitudinal behavioral indicators such as continuous assessment data, micro-attendance data, disciplinary indicators, and student demographics to calculate individual probabilities of student attrition (Agrusti et al., 2019; Bowers et al., 2022). Predictive models, when used effectively, combine the myriad low-visible signs of academic disaffection into composite risk indicators, enabling counselors and administrators to implement targeted academic, economic, and/or psychosocial interventions before formal separation from the institution occurs (Aulck et al., 2016).

Gap Between Data Availability and Predictive Systems

The Nigerian public secondary schools have been found to keep various records of their transactions (paper registers, cumulative assessment dossiers, terminal report sheets, etc.) which are however, unintegrated, manual, and isolated (Gbesoevi et al., 2023). Even though there is a huge gap in operations between the data record from a static record to the act of predictive implementation. Algorithmic dashboards that continuously process dynamic school registers to identify at-risk cohorts (Mezzini et al., 2019) are not available in high income educational systems, and across Lagos State, academic data is being used as a past, not a current, input to preventative analytics.

Research Gap

The current body of literature is divided between two groups of empirical studies. Despite the extensive research on the mathematical models of supervised machine learning architectures predicting university student attrition internationally (Aulck et al., 2016; Agrusti et al., 2019; Alban & Mauricio, 2019), there are few studies that are localized in Sub-Saharan Africa that are either quantitative or targeted at some of the infrastructural barriers to digital learning (Gbesoevi et al., 2022b). Little to no empirical evidence exists on the perspectives and use of both general AI and predictive analytics by classroom teachers and educational administrators in addressing the problem of secondary school dropout in the administrative ecology of Lagos State. This study seeks to fill this gap in the empirical literature.

3.MATERIALS AND METHODS

Research Design

The present investigation used the concurrent descriptive and correlational survey design. The dual-paradigm design allowed the researchers to record the baseline prevalence and characteristics of the relationships between AI and predictive analytics with student dropout reduction measures in an ecologically valid school environment and test for the strength of relationships and the predictive validity of those relationships.

Population and Sampling Mechanics.

This population was all the certified secondary school teachers who were serving in all public senior secondary schools of Lagos

State. A multi-stage sampling scheme, utilizing disproportionate stratified sampling and simple random sampling, was used. Lagos State is divided into six education districts. A sample of 5 schools were drawn at random from each of the 6 educational districts resulting in 30 public senior secondary schools. There was disproportionate stratification to ensure that schools located in different socioeconomic areas (urban, suburban and peri-urban) were captured and not diluted in absolute numbers. The total number of schools sampled was 30 from which six teachers (representing senior administrative staff, classroom tutors and guidance personnel) were randomly selected from each of the sampled schools giving a total of 180 respondents.

Instrument Development and Validation.

This method of data collection was done by means of empirical data collection in which the self-structured instrument was used, which is the Application of Predictive Analytics and Artificial Intelligence for Student Dropout Reduction in Public Secondary Schools (APSDRPSSQ). The questionnaire was structured in thematic chapters as follows:

Demographic data like gender, age group, highest educational qualification and years of instructional experience were obtained in Section A.In Section B, the general use of Artificial Intelligence (AI) tools in administrative and pedagogical processes was assessed. Section C assessed the institutional use of Predictive Analytics methodologies. Lastly, Student Dropout Reduction and efficacy of early intervention were evaluated in Section D.

The core operational constructs within Sections B, C and D were organized on a standardized four-point Likert scale: Strongly Agree (4) – Agree (3) – Disagree (2) – Strongly Disagree (1).

The instrument was given to two psychometricians and three senior faculty members of the Department of Educational Management at Lagos State University to test its face and content validity. They made qualitative comments on the clarity of the items, the relevance of the concepts, and the coverage of the constructs, which were incorporated into the final revision. Pilot administration was conducted on 20 secondary schools teachers not sampled from Ogun State to assess their construct validity. The reliability of the returned checklist was tested using Cronbach alpha and the result obtained was overall $r = 0.86$, which is considered to be very reliable internally, thus the instrument is psychometrically reliable.

Operational Mechanics of Data Analysis

The finished instruments were coded and fed into the statistical software for computational analysis. Demographic attributes and central tendency were profiled using descriptive statistics (frequencies, percentages, means, and standard deviations). Pearson product-moment correlation coefficient (r) was used to test bivariate interdependencies between variables. Multiple linear regression analysis was performed at the a priori level of significance $\alpha = 0.05$ for the combined predictive power of artificial intelligence and predictive analytics in reducing dropouts.

Table 1: Data Sources Summary

Parameter	Operational Definition / Categorization	Data Ingestion Method	Analytical Role
Demographic Factors	Gender, age range, educational qualification, years of teaching service	Questionnaire (Section A)	Control / Descriptive stratification
Artificial Intelligence (AI)	Operational utilization of automated software, adaptive tools, and intelligent workflows	Questionnaire (Section B, 4-Point Likert)	Independent Predictor 1
Predictive Analytics (PA)	Systemic extraction of attendance, academic grades, and behavioral logs to model risk	Questionnaire (Section C, 4-Point Likert)	Independent Predictor 2
Students Dropout Reduction (SDR)	Early alert triggers, pastoral intervention success, and declines in student disengagement	Questionnaire (Section D, 4-Point Likert)	Criterion Variable

Methodological Limitations

The study uses a self-reported survey process with responses from secondary school teachers, which could result in social desirability bias or perceptual inflation in relation to digital competencies. In addition, the disproportionate stratified sample included six educational districts of Lagos State whereas the institutional sample was limited to public senior secondary schools while the private basic education sector was not included in the sample for direct generalization.

4. THEORETICAL FRAMEWORK

Technology Acceptance Model (TAM)

The theory used for this investigation is the Davis' (1989) Technology Acceptance Model (TAM) and the Early Warning System (EWS) Theory developed by Bowers et al. (2022). The actor's intention to adopt, use and integrate an emerging technology is influenced by two key cognitive appraisals according to TAM: Perceived Usefulness (PU) – the likelihood that using a particular system will help the actor to achieve occupational throughput and Perceived Ease of Use (PEOU) – the likelihood that using the specified platform will be easy. More so, integrating technology requires technological literacy. Technology literacy is totally different from being able to integrate technology into teaching to enhance learning. In other words, doing “digitally fluent” means not only know how to use the technological tools, but how to construct things of significance with those technological tools (Gbesoevi, et al., 2022)

In the context of secondary education in Lagos State, operational, TAM provides insights into the experience of practitioners and managers in regards to the new technologies and tools that have been introduced, such as AI and predictive data analysis. The superficial acceptance of algorithmic systems by teachers is negatively affected if teachers think that the system

makes it harder to keep track of students in administrative records, or that the system does not give them clear and useful pedagogical information, information that would help them to prevent student attrition.

Theory of Early Warning System.

The concept of Early Warning System (EWS) Theory was developed in the field of organizational risk management and was applied to the secondary education context by Bowers et al. (2022) and Alban and Mauricio (2019). EWS claims that the academic dropouts have some clear, longitudinal, and measurable signs, the so-called "ABCs" of educational disengagement, which are primarily identified through attendance problems, behavioral violations, and course failure. EWS Theory argues that schools need to put in place systematic data channels that are able to capture these thresholds in time to trigger academic, structural, or emotional interventions.

Theoretical Contributions and Integration.

Combined, TAM and EWS offer a strong account of secondary school retention in emerging countries. TAM enables teachers to understand the behaviours and technical skills needed to access administrative technologies and EWS helps explain the diagnostic framework showing how the interaction of longitudinal data points can identify vulnerable pupils. The combination suggests that predictive analytics serves as the analytical engine of the Early Warning System and that TAM determines whether teachers and administrators are going to meaningfully interact with the system's risk outputs.

RESULTS AND PRESENTATION OF DATA

The demographics characteristics of the study sample across the 30 secondary schools are presented in Table 2

Table 2: Demographic Characteristics of Respondent

S/N	Variable	Category	Frequency(f)	Percentage(%)
1.	Gender	Male	72	40.0
		Female	108	60.0
2.	Age	21-30yrs	35	19.4
		31-40yrs	78	43.3
		41-50yrs	52	28.9
		51 years & above	15	8.4
3.	Highest Qualification	NCE	18	10.0
		B,Ed/B.Sc (Ed)	98	54.4
		PGDE	22	12.3
		M.Ed/M.Sc	38	21.1
		Ph.D	4	2.2
4.	Teaching Experience	1-5yrs	42	23.3
		6-10yrs	64	35.6
		11-15yrs	45	25.0
		16yrs & Above	29	16.1
5.	Position/Rank	Principal/ V.P	30	18.9
		Guidance Counsellor	30	18.9
		Teacher	120	62.2

Table 2 reveals that the majority of the respondents were females (60.0%), within the age range 31-40yrs (43.3%), with B.Ed. qualification (54.4%) and 6-10years teaching experience (35.6%). This indicates that the respondents have adequate experience to provide valid information on the study.

Research Objective 1: Relationship Between Artificial Intelligence and Dropout Reduction

The first objectives examined the relationship between the application of Artificial Intelligence and Dropout Reduction. The bivariate result in presented in Table 3.

Table 3: Pearson Correlation Between Artificial intelligence Application and Students Dropout Reduction

Variable	Mean	Std. Deviation	N	r	Sig. (2-tailed)	Remark
Artificial Intelligence	2.42	0.68	180	-.164	.386	Not Significant
Students Dropout Reduction	2.84	0.54	180			(p > .05)

Table 3 shows the influence of the use of application of artificial intelligence in reducing student's dropout rates in public senior secondary schools in Lagos State, Nigeria; the result showed that there exists a negative, weak and non-significant influence of the use of artificial intelligence in reducing student's dropout rates in public senior secondary schools in Lagos State, Nigeria ($r = -.125$, $\rho > 0.05$). This could suggest that increase in the use of Artificial intelligence, does not significantly lead to reduction in students' dropout rates. Hence, the null hypothesis which states that there is no significant influence of the use of artificial intelligence on reducing student's dropout rates in public senior secondary schools in Lagos State, Nigeria is hereby accepted.

Research Objective 2: Relationship Between Predictive Analytics and Students Dropout Reduction

The second objective investigated the Relationship Between the deployment of Predictive Analytics and Dropout Reduction. The results are presented in Table 4.

Table 4: Pearson Correlation Between Predictive Analytics and Students Dropout Reduction

Variable	Mean	Std. Deviation	N	r	Sig. (2-tailed)	Remark
Predictive Analytics	2.71	0.61	180	.322*	.083	Weak Positive
Students Dropout Reduction	2.84	0.54	180			Linear Trend

Table 4 shows the significant influence on predictive analytics on reduction of student's dropout rates in public senior secondary schools in Lagos State, Nigeria, the result showed that there exists a weak, positive and statistical significant influence on the use of predictive analytics on reduction of student's dropout rates in public senior secondary schools in Lagos State, Nigeria ($r = .322$, $\rho < 0.05$). This could suggest that as Predictive Analytics increases, dropout rates seem to decrease or reduce. This implies that predictive analytics significantly influence students' dropout rates in Lagos State, Nigeria. Hence, null hypothesis was rejected.

Research Objective 3: Joint Predictive Influence of AI and Predictive Analytics on Students Dropout Reduction

To establish the joint effect of Artificial Intelligence and Predictive Analytics on the Dropout reduction rates of students, a multiple regression was employed. The result is pretested in Table 5.

Table 5: Multiple Regression Summary and Analysis of Variance (ANOVA).

Model Components	Sum of Squares	df	Mean Square	F	Sig.
Regression	1.184	2	0.592	2.108	.141^b
Residual	7.581	27	0.281		
Total	8.765	29			
Model Summary	R = .368^a	R Square = .135	Adjusted R2 = .071	Std. Error = 0.530	

a. Predictors: (Constant), Predictive Analytics, Artificial Intelligence
b. Dependent Variable: Student Dropout Reduction

Table 5 results in the table show that artificial intelligence and predictive analytics have no significant joint influence on the reduction of students' dropout rate. The ANOVA result $F(2,27) = 2.108$, $p = 0.141 > 0.05$ indicates that the joint influence is not significant. The model summary shows $R = 0.368$ and $R^2 = 0.135$, meaning only 13.5% of variance in dropout reduction is accounted for by the two variables. Hence, there is no significant joint influence of AI and predictive analytics on reduction of students dropout rate in primary school. This implies that using AI and predictive analytics together does not significantly reduce dropout rate in the study area.

Discussion of Findings

The empirical results of this study offer a glimpse into the use of newer educational technologies in public senior secondary schools, Lagos State. The first goal found a negative correlation, although statistically insignificant, between the use of AI and reduced student dropouts ($r = -.164$, $p = .386$). The results indicate that the implementation of general AI technologies does not necessarily lead to a decrease in the attrition rate among secondary school students.

This finding is congruent with the views of Andersen (2018) and Adam et al. (2021) that the introduction of so-called generic AI software (such as conversational user interfaces, automated administrative forms, or standalone learning applications) can result in fractured interventions when not embedded in specific connections with student retention systems. In Lagos State, teachers may be using AI tools for automated marking, creating supplementary lesson materials, or using AI for simple administrative work within the classroom; however, these isolated functions are not immediately identifying or addressing the socio-behavioural vulnerabilities that lead to dropping out (Gbesoevi et al., 2024).

The second objective on the other hand, showed positive correlation between predictive analytics and student dropouts (r = .322). This supports the theoretical assertions of the Early Warning System (EWS) Theory (Bowers et al., 2022). Predictive analytics uses longitudinal, multi-parameter academic data including attendance irregularities, grade decelerations, behavioral logs, etc., to predict who might be at risk of dropping out.

This finding is consistent with that of Aulck et al. (2016), Mezzini et al. (2019), and Agrusti et al. (2019) who validated the ability of predictive modeling to allow for proactive pastoral and academic interventions that prevent the point of disengagement irrevocability. However, the statistical power that is observed in the sampled schools is limited due to systemic issues such as the prevalence of fragmented records, non-standardized student profile, and the continued use of analog record books that affect the ability to model data for the schools (Gbesoevi et al., 2022b).

The regression analysis for the combined predictive power of artificial intelligence and predictive analytics yielded joint R = 0.368, R^2 = 0.135, and was not statistically significant (F(2, 27) = 2.108, p = .141). This overall result is understood using the lens of Davis (1989) Technology Acceptance Model. Systemic infrastructural limitations, including unreliable electrical grids, computing hardware limitations and lack of data-literacy training, reduce the perceived ease of use (Perceived Ease of Use) of predictive and AI technologies.

As a result, these systems are not integrated and formalized retention systems. Moreover, while Gbesoevi and Ola (2021) and Alban and Mauricio (2019) argue that external economic factors like informal child labour and household poverty significantly influence secondary school dropout, this is especially true in urban developing areas such as Lagos. Diagnostic algorithms can only help deal with these pressures in society if there is some sort of material welfare and counselling support at the school level.

7. CONCLUSION AND RECOMMENDATIONS

Conclusion

This inquiry investigated the predictive function of AI and predictive analytics in the mitigation of student's dropping out in Lagos state public senior secondary schools. The empirical results suggest that undifferentiated AI use is negatively related, albeit not significantly, to dropping out of secondary school, suggesting that generic AI tools are not a panacea for reducing secondary school dropout. However, the relationship of predictive analytics with dropout reduction is positive, as it offers early signs of academic vulnerability.

But, when considered together in the context of the current secondary education context, the joint effect is not statistically significant, explaining just 13.5% of the variation in dropout reduction. This means that the current technological applications are still

fragmented, not integrated and constrained by infrastructural deficiencies. In conclusion, predictive analytics is a promising diagnostic tool for secondary school retention but requires a unified institutional data system, enhanced teacher skills and appropriate pastoral intervention systems to achieve effectiveness in practice.

Recommendations

The following policy changes are suggested to turn predictive technologies into an actual decrease in secondary school dropouts:

1. Deployment of Integrated Digital Record System

The Lagos State Ministry of Education (SEM) in collaboration with the State Universal Basic Education Board (SUBEB) and the Education Resource Centre should promote the use of a single and cloud-based Educational Management Information System (EMIS) instead of physical records in public secondary schools. The data architecture that enables functional predictive analytics is provided by centralizing all of these data sets into readily available student profiles: student attendance, behavioral logs, and ongoing assessments.

2. Development of Secondary Early Warning Dashboards:

School leaders in collaboration with local educational technology developers should build easy-to-use Early Warning System (EWS) dashboards. These systems should automatically monitor and report on the "ABCs" of disengagement (declining attendance, behavioral issues, and course failure), and notify guidance counselors automatically of students whose performance drops below specified thresholds.

3. Capacity Building in Applied Data Literacy:

There should be a continuous professional development program for school principals, year-tutors and guidance officers focusing on Applied Data Analytics and predictive methodologies in the Lagos State Ministry of Education. It is important to train on how to use predictive risk dashboards for interpretation and how to convert early warnings into specific academic remediation and counselling interventions.

4. Incorporation of Pastoral and Socioeconomic Support Frameworks:

Concrete institutional support mechanisms need to be provided when data driven risk alerts are received. To reduce the economic drivers of school dropouts, the Lagos State Government needs to connect the EWS of secondary schools to local welfare programmes such as school feeding, free transport and family counselling.

5. Introduction of Data Privacy and Ethical Governance Procedures:

Educational authorities need to develop strong ethical standards for predictive modelling in public schools. These protocols should ensure that predictive labels do not stigmatize students; that student data is protected, abide by the Nigeria Data Protection Act (NDPA) and that there is human oversight for all decisions regarding the retention of student data.

Limitations of Methods and Areas for Future Research

This study used the Cross sectional survey methods to assess the dynamics of the institutions in the 30 public senior secondary schools in Lagos State. Future studies need to employ longitudinal designs in order to evaluate student retention metrics pre- and post- the introduction of predictive analytics

dashboards. Furthermore, the future empirical studies will be expanded to include basic education institutions and alternative technical schools in other geopolitical areas, private schools, and a more in-depth understanding of the educational data analytics in developing countries will be attained.

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