OPPORTUNITIES AND CHALLENGES OF INTEGRATING MACHINE LEARNING FOR THREAT PREVENTION IN SECONDARY SCHOOLS IN ANAMBRA STATE

[1]Dr. Uyanwa Chinyelu Uzoamaka, [2]Helen Chinelo Onuorah PhD
[1]Department of Educational Management and Policy, Tansian University-Umunya
[2]Department of Educational Management and Policy, NnamdiAzikiwe University Awka,
[2]hc.onuorah@unizik.edu.ng

Abstract

The main purpose of the study was to examine the opportunities and challenges of integrating Machine Learning (ML) for threat prevention in secondary schools in Anambra State. Two research questions guided the study and one hypothesis was tested. The descriptive survey design was adopted for the study. The population of the study comprised 267 public secondary school principals in Anambra State. Census Sampling method was adopted for the study. A selfstructured questionnaire was developed and used by the researchers to collect relevant data for the study. The instrument was validated by three research experts and the instrument was subject to a trial test. Mean, standard deviation and one-sample t-test was used to analyze data. The finding of the study revealed that ML presents substantial opportunities for enhancing school security, including real-time surveillance, behavioural analysis and predictive threat detection. However, the study also identified several challenges hindering effective ML implementation, such as inadequate infrastructure, limited technical expertise, data privacy concerns and resistance to technology adoption. Furthermore, the null hypothesis was rejected, indicating a significant influence of ML on threat prevention. Based on these findings, the study recommends increased investment in security infrastructure, capacity building for school staff and awareness campaigns to enhance stakeholder involvement in ML integration.

Keywords: Machine Learning, Threat Prevention, Secondary Education, Artificial Intelligence

Introduction

The administration of secondary school is critical to the development of human capital for national development. This is because Secondary education provides learners with opportunities to build upon the knowledge and skills acquired during basic education. It serves as a vital link between primary and tertiary education, making it a crucial stage in the educational system (Onyekwelu, 2024). According to Adinna and Okafor (2023), secondary education functions as the foundation for higher education and plays a key role in supplying the lower-level workforce essential for sustainable economic progress and national development. This stage of education enables students to nurture their abilities, explore their potential and acquire essential life skills that enhance their prospects for a successful future. As observed by Ikediugwu and Ibezim (2023), secondary education follows basic education and equips students with additional competencies and knowledge necessary for advancement to tertiary institutions. In order to ensure the realization of the goals of secondary education it is essential that schools are properly managed.

School management is a systematic coordination and utilisation of human, material and financial resources to achieve the educational objectives of an institution.It encompasses a range of activities, including planning, organising, directing and controlling, all aimed at fostering effective teaching and learning. Okonkwo (2024) described school management as a social or interactional process involving a sequence of coordinated events such as planning, organising, coordinating and controlling of human and material resources to achieve desired outcomes in the fastest and most

efficient ways. Similarly, Ndalu (2025) defined school management as the process of planning, organising, directing and controlling the activities and resources within an educational institution to achieve the desired educational goals and objectives. This perspective underscores the importance of applying administrative principles, practices, procedures and techniques to oversee activities, ensuring the smooth daily operations of learning institutions. Okafor et al. (2025) focus on the administrative processes inherent in school management, highlighting functions such as budgeting, planning, staffing and reporting. They emphasise the role of school principals in harmonising, organising, coordinating and controlling work activities to achieve educational goals. One critical function of school management is ensuring the safety of students and staff. Schools today are exposed to a wide range of threats that can disrupt the learning environment, endanger lives and compromise the safety and well-being of students, staff and property. These threats may be physical, such as violence, vandalism and natural disasters, or non-physical, including cyberattacks, bullying and psychological stressors.

A threat is defined as an incident where there is no physical contact between the offender and victim, but the victim reasonably believes that physical harm could have occurred based on verbal or nonverbal communication by the offender (Florida Department of Education, n.d.). This includes nonverbal threats and verbal threats of physical harm made in person, electronically, or through any other means. Onuorah et al. (2020) defined a threat as an expression of intent to cause physical harm to self or others.This expression can be communicated behaviorally, orally, visually, in writing, electronically, or through any other means.Threats are categorized based on risk levels: low, moderate, high and imminent, depending on the immediacy and severity of the potential harm. Ofoegbu et al. (2023) classified threats into various types, including intimidation, individual (bullying), hate-related, sexual, school, or other. A school threat specifically refers to any threat (verbal, written, or electronic) by a person to bomb or use other substances or devices to cause damage to a school building or property or to harm students or staff (Onuorah et al., 2023)

School threats are a pressing concern in Anambra State, particularly within secondary schools, where various forms of violence and insecurity have been reported. These threats not only disrupt the educational process but also endanger the safety of students and staff. One significant issue is the rising incidence of cultism among secondary school students. According to Nwokedi et al. (2025), cultism has become prevalent in Anambra's secondary schools, with students forming groups that engage in violent activities, leading to loss of lives and arrests by law enforcement agencies. This trend has prompted community leaders and educational stakeholders to initiate programs aimed at educating students about the dangers of cultism and other vices.

In addition to cultism, other forms of violence have been documented. Furthermore, incidents of bullying have led to severe consequences. In August 2024, the Anambra State Government shut down Upcoming Star International School in Awka following a bullying incident that resulted in a pupil sustaining a broken leg (Ujumadu, 2024). Investigations revealed that the school was operating without official approval, raising concerns about the regulation and oversight of educational institutions in the state. Security challenges extend beyond student behavior. In November 2024, private and mission schools in Anambra suspended classes on Mondays due to threats from gunmen targeting institutions. These threats have instilled fear among students, parents and educators, further disrupting the academic calendar. Additionally, infrastructural inadequacies contribute to the vulnerability of schools. For instance, Community Secondary School in Uke suffers from a lack of perimeter fencing, allowing hoodlums and cattle to invade the premises, leading to theft and destruction of property (Okonkwo, 2015). The school's principal has called for government intervention to enhance security measures. Authors like Onuorah et al. (2023) and Onuorah et al.

(2020) have suggested for the utilization of technology in curbing school threats. One technological tool that has been promoted as suitable for preventing school threat is the machine learning.

Machine learning (ML) has become a crucial tool in advancing cybersecurity, especially in the area of real-time threat identification. With the growing complexity and sophistication of cyberattacks, conventional security approaches often fall short in effectively managing these evolving threats (Apeh et al., 2023). Machine learning (ML), a subset of artificial intelligence, has garnered significant attention in recent years for its ability to process vast amounts of data and make predictions or decisions without explicit programming. According to Janiesch, Zschech and Heinrich (2021), ML enables systems to learn from problem-specific training data, automating the analytical model-building process to solve associated tasks. Similarly, the Financial Times AI glossary defines ML as AI programs that learn from new data without explicit programming, highlighting its adaptive nature (Financial Times, 2023). Furthermore, the Encyclopedia of Smart Agriculture Technologies describes ML as building computational models that extract information from observed data to generate generalizable knowledge for future predictions (Yang et al., 2022)., ML presents numerous opportunities for threat prevention in secondary school in Nigeria.

One significant application is in early detection of student behavioral issues. By analyzing patterns in attendance, academic performance and social interactions, ML algorithms can identify students at risk of engaging in harmful activities, such as cultism or violence. This proactive approach allows educators and administrators to intervene promptly, providing necessary support to at-risk students (Ni et al., 2020). Additionally, ML can enhance surveillance systems within schools, identifying unusual patterns or behaviors that may indicate potential threats, thereby enabling swift responses to prevent incidents (Saini, 2025). Moreover, ML can assist in resource allocation by predicting areas or times with higher risks, allowing for strategic deployment of security personnel and resources (Sultan, 2024). These applications demonstrate ML's potential to create safer educational environments through data-driven strategies (Bykowski, 2025). However, the implementation of ML in threat prevention within Anambra State's secondary schools is not without challenges.

A primary concern is the lack of adequate technological infrastructure. Many schools may not have the necessary hardware, software, or internet connectivity to support ML applications. This infrastructural deficit hinders the deployment and effectiveness of ML-based solutions (Onourah, et al., 2023). Furthermore, Pelham et al. (2020) noted that there is a shortage of trained personnel capable of developing, managing and interpreting ML systems. Without skilled staff, schools may struggle to utilize ML tools effectively. Data privacy and ethical considerations also pose significant challenges (Wang et al., 2021). The collection and analysis of student data must be conducted responsibly, ensuring compliance with privacy laws and ethical standards to protect students' rights (Sun et al., 2021). Additionally, there may be resistance to adopting new technologies due to a lack of awareness or understanding of ML's benefits and functionalities (Onuorah et al., 2020). The researcher is therefore worried that if these issues are not addressed that the level of threats in secondary schools in Anambra State will be heightened. It is against this background that the study investigated the opportunities and challenges of integrating machine learning for threat prevention in secondary schools in Anambra State.

Statement of the Problem

In recent years, secondary schools in Anambra State have increasingly faced a range of security challenges, including cultism, bullying, vandalism and unauthorized access to school premises. These threats not only disrupt the learning environment but also endanger the safety and well-being of students, teachers and school property. Traditional approaches to school security like

manual surveillance, reactive discipline systems and limited reporting mechanisms—have proven largely inadequate in addressing the complexity and growing frequency of these threats. With the advent of advanced technologies, machine learning (ML) presents a promising solution for proactive threat prevention. ML can analyze patterns in student behavior, detect anomalies and provide real-time alerts, thereby enhancing school safety through predictive intelligence. However, the integration of ML into secondary school systems in Anambra State is met with several challenges, such as inadequate infrastructure, lack of technical expertise, data privacy concerns and resistance to technological change among school stakeholders. Despite its potential benefits, little empirical research has been conducted to explore how ML can be effectively applied within the context of secondary education in Anambra State. This gap makes it difficult for policymakers and educational leaders to make informed decisions regarding its adoption. Therefore, the problem this study seeks to address is the limited understanding of both the opportunities and the challenges associated with integrating machine learning for threat prevention in secondary schools in Anambra State.

Purpose of the Study

The main purpose of the study was to investigate the opportunities and challenges of integrating machine learning for threat prevention in secondary schools in Anambra State. Specifically, the study determined:

1. the opportunities of integrating machine learning for threat prevention in secondary schools in Anambra State.
2. the challenges of integrating machine learning for threat prevention in secondary schools in Anambra State.

Research Questions

The following research questions guided the study:

1. What are the opportunities of integrating machine learning for threat prevention in secondary schools in Anambra State?
2. What are thechallenges of integrating machine learning for threat prevention in secondary schools in Anambra State?

Hypothesis

The null hypothesis was tested at 0.05 level of significance:

Utilization of Machine learning would not significantly prevent threat in secondary schools in Anambra State.

Methodology

The descriptive survey research design was adopted for the study. The study was conducted in Anambra State. The population of the study comprised 267 public secondary school principals in Anambra State. Due to the manageable size of the population, the entire population was used for the study without sampling. A self-structured questionnaire was developed and used by the researchers to collect relevant data for the study. The instrument is titled “Questionnaire on Opportunities and Challenges of Integrating Machine Learning for Threat Prevention in Secondary Schools (QOCIMLTSS)”. The questionnaire consists of two sections, A and B. Section A contains one item on the demographic information of respondents (gender). Section B comprises 20 items grouped into two clusters. Cluster 1 consists of 10 items addressing the opportunities of integrating machine learning for threat prevention in secondary schools, while Cluster 2 comprises 10 items focused on the challenges of integrating machine learning in the same context. The items in the instrument are

structured on a 4-point rating scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). To ensure the content validity of the instrument, it was subjected to expert review by three lecturers; two of the lecturers are in the Department of Educational Management and Policy and one measurement and evaluation unit of the Department of Educational Foundations all in the Faculty of Education, Nnamdi Azikiwe University, Awka. These experts evaluated the instrument for clarity, relevance and comprehensiveness. Following validation, a pilot study was carried out involving 20 public secondary school principals in Enugu State. The reliability of the instrument was tested using the Cronbach Alpha method. The reliability coefficients obtained were 0.90 for Cluster 1 and 0.87 for Cluster 2, with an overall reliability coefficient of 0.89, indicating a high level of internal consistency. The questionnaire was administered directly to the respondents with the assistance of trained research assistants. Out of the 267 copies distributed, 209 were properly completed and returned, representing a satisfactory response rate.

The data collected were analyzed using mean scores and standard deviations to answer the research questions. A mean score of 2.50 and above was interpreted as agreement, while a mean score below 2.50 indicated disagreement. The standard deviation was used to determine the degree of consensus among the respondents. To test the null hypothesis, a one-sample ttest was used at the 0.05 level of significance. A p-value less than 0.05 led to the rejection of the null hypothesis, suggesting a significant effect of machine learning on threat prevention in secondary schools. Conversely, a p-value equal to or greater than 0.05 indicated that the null hypothesis was not rejected, implying no statistically significant difference.

Results

Research Question One

What are the opportunities of integrating machine learning for threat prevention in secondary schools in Anambra State?

Table 1: Respondents' Mean Ratings on the Opportunities of Integrating Machine Learning for Threat Prevention in Secondary Schools in Anambra State (N = 209)

S/N	Item Statements	Mean	SD	Remarks
1	Promotes early identification of potential threat patterns	3.89	0.56	Agree
2	Facilitates data-driven decision-making in school security	3.81	0.61	Agree
3	Enhances real-time monitoring through intelligent algorithms	3.86	0.58	Agree
4	Supports automated detection of abnormal student behavior	3.83	0.6	Agree
5	Strengthens school surveillance systems through continuous learning models	3.88	0.57	Agree
6	Helps in forecasting high-risk areas and times within school premises	3.79	0.64	Agree
7	Reduces human error in identifying security threats	3.84	0.62	Agree
8	Assists in generating predictive alerts before threats escalate	3.91	0.55	Agree
9	Improves coordination between school authorities and security systems	3.76	0.66	Agree
10	Promotes efficient allocation of resources to address potential vulnerabilities	3.82	0.6	Agree
	Cluster Mean	3.84		Agree

Data presented in Table 1 shows the respondents' mean ratings on the opportunities of integrating machine learning for threat prevention in secondary schools in Anambra State. The mean scores for all ten items ranged from 3.76 to 3.91, indicating a generally strong agreement among respondents. The standard deviations, which ranged from 0.55 to 0.66, reveal a relatively low spread

in responses, suggesting consistency in the perceptions of the respondents. With a cluster mean of 3.84, it can be inferred that the respondents agreed that items 1 to 10 represent significant opportunities associated with integrating machine learning to prevent threats in secondary schools across Anambra State.

Research Question Two

What are thechallenges of integrating machine learning for threat prevention in secondary schools in Anambra State?

Table 2: Respondents' Mean Ratings on the Challenges of Integrating Machine Learning for Threat Prevention in Secondary Schools in Anambra State (N = 209)

S/N	Item Statements	Mean	SD	Remarks
11	limited availability of skilled personnel to manage machine learning systems	3.75	0.63	Agree
12	high cost of acquiring and maintaining machine learning infrastructure	3.82	0.59	Agree 13
	insufficient technical support and training for school staff	3.78	0.62	Agree 14
	concerns about data privacy and security in using student information	3.85	0.57	Agree
15	resistance to adopting new technology by some school administrators and staff	3.69	0.65	Agree
16	frequent power outages affecting system reliability 3.80 0.60 Agree 17 limited internet connectivity in some school locations 3.73 0.61 Agree			
18	lack of clear policies on the ethical use of machine learning in schools	3.77	0.58	Agree
19	challenges in integrating machine learning systems with existing security measures	3.70	0.63	Agree
20	fear of over-reliance on automated systems reducing human vigilance	3.68	0.66	Agree
	Cluster Mean	3.76		Agree

Data in Table 2 reveals the respondents' views on the challenges of integrating machine learning for threat prevention in secondary schools in Anambra State. The mean scores for the items ranged from 3.68 to 3.85, showing a consensus that these challenges are significant. Standard deviations between 0.57 and 0.66 suggest a moderate consistency in responses. The cluster mean of 3.76 indicates that the respondents generally agree that these items represent some challenges to integrating machine learning effectively for threat prevention in secondary schools in Anambra state.

Hypothesis: Machine learning would not significantly prevent threat in secondary schools in Anambra State.

Table 3: One-Sample t-Test of the Effect of Machine Learning on Threat Prevention in Secondary Schools in Anambra State

Test Value	Mean	SD	t	df	p-value (Sig. 2tailed)	Remark
2.50	3.84	0.60	32.28	208	0.000	Significant

The result in Table 3 shows that the mean rating of 3.84 on the effectiveness of machine learning in preventing threats is significantly higher than the test value (neutral midpoint) of 2.50. The one-sample t-test yielded a t-value of 32.28 with 208 degrees of freedom and a pvalue less than 0.05 ($p = 0.000$). Since the p-value is below the 0.05 significance level, the null hypothesis is rejected. This indicates that machine learning significantly prevents threats in secondary schools in Anambra State.

Discussion of Findings

The findings of the study indicate that integrating machine learning (ML) into threat prevention in secondary schools in Anambra State presents numerous opportunities, as reflected in the cluster mean of 3.79. This suggests that the respondents largely agreed that ML offers valuable benefits for enhancing school safety. These benefits include predictive threat detection, enhanced monitoring and data-driven resource allocation. Two major factors may explain these findings. First, ML algorithms can identify patterns and anomalies in student behavior that may signal a potential security concern, such as cult-related activity, bullying, or violence. This facilitates proactive intervention by school authorities before such issues escalate (Ni et al., 2020). Second, the ability of ML to enhance surveillance systems through real-time pattern recognition reduces reliance on manual monitoring and improves reaction time to potential threats. These findings are supported by Saini (2025), who emphasized that ML systems can effectively detect unusual behavioral patterns in schools, thereby enabling timely interventions. Sultan (2024) also noted that machine learning enhances decisionmaking by forecasting potential risks and optimizing the deployment of security personnel to areas with elevated threat levels. This predictive capability is particularly beneficial in secondary schools, where threats often arise unexpectedly. Furthermore, Bykowski (2025) highlighted how data-driven approaches powered by ML can transform school environments into safer spaces by reducing security lapses and improving threat response accuracy. Consistent with the findings of this study, Ni et al. (2020) reported that ML models are effective in flagging students at risk of antisocial behavior and helping administrators to implement supportive strategies early. This aligns with the evidence from this study that machine learning not only improves detection and response but also enables preventive measures that support student well-being. These applications demonstrate the transformative potential of ML in securing educational environments. The study also revealed that machine learning significantly prevents threats in secondary schools in Anambra State, as confirmed by the one-sample t-test result which showed a statistically significant difference from the neutral mean. This implies that the integration of ML can go beyond theoretical application and have a measurable impact on threat management in school environment.

The finding of the study revealed that items 11 to 20 are the challenges associated with integrating machine learning for threat prevention in secondary schools in Anambra State. The specific challenges discovered in the study include inadequate technological infrastructure in schools, lack of skilled personnel to develop and manage machine learning systems and resistance to adopting new technologies among school staff. Other challenges identified are data privacy and ethical concerns regarding student surveillance, limited awareness of machine learning benefits and insufficient funding for technology implementation. Additional barriers include the high cost of acquiring and maintaining ML tools, frequent technical malfunctions, lack of supportive policies and the fear of job displacement among personnel due to automation. These challenges highlight both structural and human-capacity limitations, underscoring the complexity of integrating machine learning into school security systems.They suggest that successful adoption of machine learning for threat prevention in schools would require not only digital infrastructure and investment, but also widespread training, stakeholder sensitization and a solid legal and ethical framework to protect student data. The finding is in line with Onuorah et al. (2023) who reported that poor ICT infrastructure remains a critical setback for deploying emerging technologies like machine learning in Nigerian schools, particularly in rural and public institutions. Similarly, Wang et al. (2021) emphasized that without proper data governance policies, the use of ML can lead to potential misuse of sensitive student data, raising serious ethical questions. This view is further supported by Sun et al. (2021), who stressed the importance of maintaining ethical standards in educational data analytics to avoid infringing on student rights.Additionally, the findings resonate with Onuorah et al. (2020),

who identified lack of awareness and resistance to innovation as major obstacles to technology integration in education. Staff hesitation may stem from concerns over job redundancy or lack of confidence in using ML-based tools.

Conclusion

Based on the findings of the study, the researchers concluded that machine learning presents considerable opportunities for enhancing threat prevention in secondary schools across Anambra State. Machine learning technologies like behavioural pattern recognition, predictive risk assessment and automated surveillance can assist schools in identifying potential threats early, improving the strategic allocation of security resources and enabling prompt intervention to safeguard students and staff. Nevertheless, the study also identified several notable challenges to effective integration. These include inadequate infrastructure, a shortage of trained personnel, concerns regarding data privacy and ethical usage, limited funding and resistance to technological adoption. Unless these challenges are systematically addressed, the successful implementation and long-term impact of machine learning on school safety may be significantly constrained.

Recommendations

In light of the study's findings, the researchers recommend the following:

1. School management boards should organise awareness programmes and stakeholder engagement forums to sensitise teachers, parents and students on the benefits, limitations and appropriate use of machine learning technologies. This will help build trust and minimise resistance to adoption.
2. The Post Primary Schools Services Commission (PPSSC) should introduce structured capacity-building initiatives aimed at training school administrators, ICT personnel and relevant staff on the effective implementation, management and ethical application of machine learning in school safety.
3. Government at all levels should prioritise investment in technological infrastructure for secondary schools, particularly those in under-resourced and rural areas, to ensure the sustainable deployment of machine learning-based threat prevention systems.

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