CHAPTER ONE

ADOPTION OF AI THE MANAGEMENT OF TIME AND MATERIAL RESOURCES BY SECONDARY SCHOOL ADMINISTRATORS: AN ACADEMIC DISCOURSE.

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Abstract

This study examine the adoption of AI the management of time and material resources by secondary school administrators. This academic discourse investigates how AI-driven tools can enhance efficiency, optimize decision-making, and reduce administrative burdens. The study underline the benefits, challenges, and ethical considerations of AI integration in secondary school administration. It further delves into the areas of AI Integration in School Administration, including; automated scheduling and timetabling, AI-powered administrative assistance and resource management and budget optimization. It also highlights the need for adequate training, infrastructure, and policy frameworks to ensure seamless AI adoption. The study concludes that As AI continues to advance, its role in education will expand, further enhancing the effectiveness of school administration. One of the recommendation was that schools should invest in AI-powered administrative tools such as automated scheduling systems, predictive analytics for resource allocation, and smart inventory management to enhance efficiency.

Keywords: Artificial Intelligence, Time Management, Material Resources, Secondary School Administration, Educational Technology

1. Introduction

The rapid advancement of Artificial Intelligence (AI) has led to its integration across various sectors, including education. AI is increasingly being used by secondary school administrators to optimize the management of time and material resources, improving efficiency, decision-making, and overall school operations. This chapter explores the evolution of AI, its adoption in school administration, and its impact on managing time and material resources.

2. The Evolution of AI

2.1 Defining Artificial Intelligence

AI refers to the simulation of human intelligence in machines that can learn, reason, and perform tasks typically requiring human cognition. AI systems can process vast amounts of data, recognize patterns, make decisions, and even improve over time through machine learning.

2.2 Early Beginnings of AI (1950s–1970s)

The origins of AI can be traced back to the mid-20th century when pioneers such as Alan Turing and John McCarthy laid the foundations for AI research.

- **Alan Turing (1950)** proposed the Turing Test to assess machine intelligence.
- **John McCarthy (1956)** coined the term "Artificial Intelligence" and organized the Dartmouth Conference, marking the birth of AI as a formal discipline.
- Early AI models focused on rule-based systems and symbolic reasoning, but computational limitations hindered progress.

2.3 The Growth of AI (1980s–1990s): Expert Systems and Neural Networks

- The 1980s saw the rise of **expert systems**, which mimicked human decision-making in specific fields.
- The development of **artificial neural networks** in the late 1980s allowed machines to process data more dynamically.
- AI applications remained largely confined to research due to high costs and limited computing power.

2.4 The AI Renaissance (2000s–2010s): Machine Learning and Big Data

- The early 2000s saw significant advancements in **machine learning**, where AI systems could learn from data rather than relying on predefined rules.
- **Big Data technologies** allowed AI systems to analyze vast amounts of information, making AI more practical for real-world applications.
- AI began to impact sectors like finance, healthcare, and education, setting the stage for its role in school administration.

2.5 Modern AI (2020s–Present): Deep Learning and Generative AI

- Recent AI developments, including **deep learning** and **natural language processing (NLP)**, have enabled machines to understand, generate, and interact with human language more effectively.
- **Generative AI**, such as ChatGPT and other large language models, has revolutionized education by providing automation, personalized learning, and administrative support.
- AI is now widely used in educational institutions for resource optimization, scheduling, and data-driven decision-making.

3. AI Adoption in Secondary School Administration

Brief Evolution of AI in Education Management

Secondary school administrators are responsible for ensuring smooth academic operations, teacher coordination, student management, and resource allocation. As such, they face increasing pressure to

balance multiple responsibilities, from academic planning to infrastructure maintenance Effective time and resource management is crucial for ensuring smooth school operations, improving student outcomes, and optimizing resource utilization. Effective time and resource management is critical in achieving educational goals, improving institutional efficiency, and enhancing student learning outcomes (Heppen et al., 2019). Hence, artificial intelligence offers significant potential in addressing common administrative challenges, allowing schools to function more effectively.

Historically, school administration was heavily reliant on manual processes, leading to inefficiencies in scheduling, record-keeping, and decision-making. With the digital transformation of education, AI has emerged as a game-changer by introducing automation, predictive analytics, and smart decision-support systems (García-Peñalvo et al., 2022). The era of manual and paper-based processes was the era of tradition educational administration. This was before the integration of artificial intelligence and digital technologies, educational administration relied on human oversight. This period was characterized by:

1. Paper Based Record Keeping;

   Manual Documentation: students records, attendance sheet and staff files were maintained in physical registers and filing cabinets.

   Updating and retrieving records was time consuming and prone to errors.

   Loss or misplacement of records posed serious data security risk.

2. Human-Managed Scheduling and Timetabling

   School tables were created manually by administrators, often leading to errors, overlaps, and inefficiencies. This process was susceptible to conflicts.

   Adjustment to schedules (accommodating teacher's absences) required significant manual intervention

3. Inefficient Resource Allocation

   School resources such as text books, laboratory equipment, and classrooms were managed using manual inventory systems.

   Poor tracking often led to wastage, shortages, or misallocation of resources

4. Limited Data -Driven Decision-Making

   School leaders made decisions based on intuition, personal experience, or limited data insight.

   The lack of real time data made it difficult to predict students' performance trends, teacher effectiveness, or resource needs

5. Communication and Administrative Bottlenecks

   Parent -teacher communication relied on physical meetings and notices, causing delays in information dissemination.

Administrative processes such as students' admissions, fee payments, and report generation were slow and required excessive paper work.

However, these traditional methods were widely accepted for decades, but they were time-consuming, labor-intensive, and prone to inefficiencies, creating an urgent need for transformation.

The Transition to Artificial Intelligence in Educational Administration

The transition from manual administration to artificial intelligence- powered management has significantly improved efficiency, transparency and decision making in educational institutions, improved communication, saving cost and resources optimization, enhancing security of both staff and student safety.

Areas of AI Integration in School Administration:

1. Automated Scheduling and Timetabling: AI-powered tools optimize class schedules, ensuring efficient use of teachers, classrooms, and learning materials. AI can adapt schedules dynamically, accounting for teacher availability and student needs.

2. AI-Powered Administrative Assistance: Chatbots and virtual assistants handle frequent queries from parents, students, and teachers, reducing administrative workload. AI streamlines document management by automating report generation, attendance tracking, and performance analysis.

3. Data-Driven Decision-Making: AI helps administrators analyze student performance trends, teacher efficiency, and resource utilization. Machine learning models predict potential academic risks, allowing for early interventions.

4. Resource Management and Budget Optimization: AI-driven inventory systems track school assets, ensuring optimal use and preventing wastage or theft. Predictive analytics help schools forecast budgetary needs and optimize expenditure on educational materials and infrastructure.

5. AI-Enabled Security Systems: Schools use facial recognition, biometric authentication, and AI-powered CCTV surveillance to enhance security. AI identifies suspicious activity and ensures only authorized personnel access sensitive areas. These advancements indicate a paradigm shift in education management, where AI enables schools to function more effectively, efficiently, and proactively.

Artificial Intelligence (AI) is revolutionizing education administration by automating routine tasks, enhancing decision-making, and improving efficiency in schools. Traditionally, school administrators were burdened with a lot of responsibilities and would spend a significant time on manual scheduling, resource allocation, student data management, and communication with teachers, students, as well as parents. However, with AI-powered systems, these processes have been streamlined and are becoming are less chaotic, more efficient, data-driven, and less prone to human error. This chapter explores the role of AI in time management time management and material resources management in secondary schools, emphasizing its benefits, challenges, and future implications. Using established conceptual and theoretical frameworks, this discourse critically examines AI adoption and provides recommendations for successful implementation.

Concept of AI in Educational Administration

Artificial Intelligence (AI) could be defined as the simulation of human cognitive functions such as learning, reasoning, and problem-solving by computer systems, enabling them to perform tasks that traditionally required human intelligence with increasing autonomy and adaptability. This definition emphasizes AI's ability to continuously evolve and improve its performance based on experience and data-driven insights. Adegbite et al. (2022), defined AI as "a system of digital algorithms designed to process vast amounts of data, recognize patterns, and execute decision-making processes with minimal human intervention." This definition aligns with the view of Onifade and Adewale (2021), who describe AI as "a disruptive innovation that mimics human intelligence, automates processes, and enhances efficiency in various domains, including education, healthcare, and security."

From a global perspective, Brynjolfsson and McAfee (2020) define AI as "a broad set of computational techniques that allow machines to sense, reason, learn, and act in ways that were previously the exclusive domain of human intelligence." Similarly, Russell and Norvig (2021) highlight AI as "the science and engineering of making intelligent agents that perceive their environment and take actions to maximize the likelihood of achieving specific goals." These definitions collectively emphasize AI's data-driven nature, decision-making capability, and continuous learning process, making it a transformative tool in modern industries, including education administration.

Artificial intelligence (AI) in educational administration refers to the application of intelligent digital systems to automate administrative tasks, enhance decision-making, and optimize resource management within educational institutions. These AI-driven systems analyze large datasets, streamline processes, and support school administrators in planning, communication, and operational efficiency. Ajibola and Ogunleye (2023), posits that AI in school administration is "a structured integration of digital intelligence tools that optimize workflow, reduce inefficiencies, and provide predictive analytics to improve decision-making in educational institutions." This perspective aligns with that of Oyelami et al. (2022), who view AI in educational administration as "an intelligent computational approach that enhances planning, scheduling, and institutional governance in schools through automation and data-driven insights." From an international perspective, Luckin et al. (2020) define AI in education administration as "the deployment of artificial intelligence systems in schools to facilitate automated scheduling, resource management, and performance analysis, thereby reducing administrative workload and improving efficiency." Likewise, Yang and Li (2021) state that AI in education management "leverages machine learning and predictive analytics to assist in decision-making, reduce bureaucracy, and promote data-driven school governance." The integration of AI in educational administration ensures that schools operate more efficiently, reduce manual workload, and improve overall decision-making processes, making education management more responsive and proactive.

3.1 The Need for AI in School Administration

Secondary school administrators face significant challenges in managing time and material resources effectively. Key challenges include:

- **Time Management**: Coordinating schedules, managing staff workloads, and optimizing instructional time.
- **Material Resource Management**: Efficient allocation of classrooms, textbooks, lab equipment, and budgets.

- **Decision-Making**: Data-driven planning for curriculum design, student performance tracking, and institutional growth.

AI offers solutions by automating routine tasks, optimizing resource allocation, and providing data-driven insights. However, the integration of AI in time and resource management has significantly enhanced efficiency, accuracy, and productivity in school administration. AI-powered tools have automated scheduling, improved resource tracking, and optimized budget allocation, reducing administrative burden. AI-based time management has streamlined scheduling, automated attendance tracking, and improved teacher workload distribution (Adegbite et al., 2022). AI-driven resource management has enhanced asset tracking, minimized resource wastage, and optimized inventory control (Fasasi, 2022).

Time Management

Time management is the systematic process of planning, organizing, and controlling the use of time to maximize efficiency and productivity. It involves prioritizing tasks, allocating resources effectively, and ensuring that goals are met within stipulated timeframes. According to Ogunyemi and Akinlabi (2022), time management is "a strategic approach to scheduling and prioritizing tasks to enhance productivity, reduce stress, and achieve set objectives efficiently." Similarly, Eke and Obiora (2023) define time management as "a structured method of allocating time to activities in a manner that ensures optimal results while minimizing wastage." On a broader scale, Covey (2021) describes time management as "the ability to control the sequence and duration of activities in a way that maximizes efficiency and goal attainment." Likewise, Mancini (2020) states that time management "involves making deliberate choices to allocate time effectively between competing priorities to enhance productivity and well-being." In the context of school administration, time management is crucial for optimizing workflow, ensuring proper coordination among staff, and maintaining efficient school operations.

Concept of Adoption of AI in Time Management by School Administrators

The adoption of AI in time management by school administrators refers to the integration of intelligent technologies to automate scheduling, streamline administrative tasks, and enhance time efficiency in educational institutions. AI-driven time management systems analyze historical data, predict workload trends, and optimize schedules for staff and students. According to Nwosu and Adebayo (2023), AI-based time management "enables school administrators to efficiently allocate time for academic and extracurricular activities by utilizing intelligent scheduling and predictive analytics." Similarly, Fasasi (2022) defines AI in time management as "the application of digital intelligence to automate time-sensitive administrative tasks, reducing errors and improving institutional productivity." Internationally, Bryson (2021) states that AI-enhanced time management "leverages data-driven insights and machine learning models to optimize workflows, minimize administrative bottlenecks, and enhance institutional efficiency." García-Peñalvo et al. (2022) further explain that AI tools for time management "reduce manual workload by automating repetitive processes, ensuring that educators and administrators spend more time on strategic decision-making. AI-driven time management ensures better school governance, reduces inefficiencies, and enhances the coordination of academic activities.

Artificial intelligence (AI) in educational administration refers to the application of intelligent digital systems to automate administrative tasks, enhance decision-making, and optimize resource management within educational institutions. These AI-driven systems analyze large datasets, streamline processes, and support school administrators in planning, communication, and operational efficiency. Ajibola and Ogunleye

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Why Time Management is Essential in School Administration?

1. Enhancing Administrative Productivity

AI automates repetitive tasks, allowing school administrators to focus on high-priority functions such as curriculum planning and teacher training (Fasel et al., 2020). Smart scheduling tools improve classroom management and optimize teacher workloads.

2. Reducing Workload and Burnout Among Administrators

Manual administrative work can be overwhelming; AI-driven tools streamline workflow and prevent work overload (Yang & Li, 2021). AI-powered reminders and automated alerts keep track of important deadlines and meetings.

3. Data-Driven Decision-Making

AI provides real-time analytics on school performance, helping leaders make evidence-based decisions (García-Peñalvo et al., 2022). Machine learning models analyze attendance records, exam scores, and behavior patterns, offering actionable insights for school improvement.

4. Effective Communication and Coordination

AI-powered chatbots provide instant responses to student and parent queries, reducing response time and administrative workload (Luckin et al., 2020). AI-based school management systems improve collaboration between teachers, administrators, and stakeholders.

Why Time Management Matters in School Administration?

1. Enhances Productivity:

Automating repetitive tasks allows administrators to focus on strategic planning and policy implementation. AI-driven scheduling reduces time spent managing timetables manually.

2. Reduces Administrative Burden:

School leaders often juggle responsibilities such as teacher coordination, parent communication, and student performance tracking. AI tools handle these tasks efficiently, allowing staff to dedicate more time to academic and student engagement.

3. Improves Decision-Making:

AI analyzes large volumes of administrative data to provide accurate insights for school improvement strategies. Predictive analytics help in resource planning, reducing inefficiencies in staffing, budgeting, and facility usage.

Material Resources

Material resources in education refer to the physical and digital assets necessary for effective teaching, learning, and school operations. These resources include classrooms, textbooks, laboratory equipment, computers, infrastructure, and digital learning tools. According to Ogunleye and Adeyemi (2023), material resources are "the tangible and intangible assets required for instructional delivery, administrative functions, and the overall success of an educational institution." Similarly, Olaniyan and Okon (2022) define material resources as "all infrastructural and technological resources that facilitate the smooth operation of a school system. Globally, Qadir et al. (2021) describe material resources as "the combination of physical infrastructure, instructional materials, and technological tools that support learning and school administration." Likewise, Yang and Li (2021) emphasize that material resources "encompass educational tools and assets that directly impact teaching efficiency, student engagement, and institutional effectiveness. Efficient management of material resources ensures that schools remain well-equipped, minimize wastage, and allocate resources optimally for academic success

Concept Adoption of AI in the Management of Material Resources

The adoption of AI in material resource management refers to the use of intelligent systems to track, allocate, and maintain school resources efficiently. AI ensures that educational institutions utilize materials optimally, reducing losses and enhancing productivity. According to Eze and Nwankwo (2023), AI in material resource management "enhances the tracking, allocation, and maintenance of school resources using smart algorithms and predictive analytics." Likewise, Gbadamosi et al. (2022) define AI in material resource management as "a transformative approach to school administration that leverages machine learning to optimize resource utilization and prevent shortages or wastage. On a global scale, Russell and Norvig (2021) state that AI-based resource management "ensures data-driven allocation of school assets, reducing inefficiencies and improving institutional sustainability." Schiff (2021) also emphasizes that AI enables "real-time monitoring and predictive maintenance of school resources, preventing shortages and excesses. AI-driven material resource management improves accountability, reduces waste, and enhances decision-making in educational institutions.

Why Resource Management is Critical?

1. Preventing Wastage and Improving Budget Allocation

Schools often struggle with inefficient spending due to poor resource tracking. AI optimizes resource allocation and reduces waste (Qadir et al., 2021). AI-based inventory systems track library books, lab materials, and classroom supplies, ensuring they are well-distributed and maintained.

2. Enhancing Learning Environments

AI helps maintain adequate stock of learning materials to ensure students have access to quality education resources (Schiff, 2021). Predictive AI models forecast future needs, allowing for proactive resource planning.

3. Strengthening Security and Asset Protection

AI-driven surveillance systems monitor school assets and prevent theft or misuse (Fasel et al., 2020). Biometric authentication systems control access to restricted areas, ensuring only authorized personnel enter sensitive locations. Efficient time and resource management improves school efficiency, teacher effectiveness, and student performance, making AI an indispensable tool for modern school administration (Luckin et al., 2020).

Why Resource Management is Critical?

1. Preventing Wastage and Optimizing Budgets:

Schools operate within budgetary constraints, making efficient resource allocation essential.AI systems predict resource demand, preventing over-purchasing or under-utilization of materials.

2. Enhancing Learning Environments:

Proper resource allocation ensures that students have adequate learning materials, well-maintained classrooms, and access to modern educational tools.

3. Ensuring Security and Asset Protection:

AI-driven surveillance systems monitor school facilities, reducing theft and unauthorized access. Smart resource tracking ensures that critical assets such as textbooks, lab equipment, and digital devices are effectively distributed and maintained. Efficient time and resource management directly impacts student success, teacher effectiveness, and the overall quality of education. AI offers innovative solutions to address these challenges, making it a valuable tool for modern school administration.

3.2 AI Tools in School Administration

Several AI-powered tools are currently being adopted by secondary school administrators, including:

3.2.1 AI in Time Management

- **Automated Scheduling Systems**: AI-powered scheduling tools like Google Calendar, Time Hero, and School Timetable AI optimize class and exam schedules.

- **AI-Powered Attendance Systems**: Facial recognition and biometric systems track student and staff attendance, reducing administrative workload.
- **Smart Task Management**: AI-driven productivity tools, such as Trello and Asana, help administrators prioritize tasks efficiently.

3.2.2 AI in Material Resource Management

- **Inventory Management Systems**: AI tracks and predicts the usage of materials such as books, laboratory equipment, and classroom supplies.
- **AI in Budget Planning**: Machine learning algorithms analyse past expenditure patterns to optimize future budgeting decisions.
- **Smart Energy Management**: AI-driven systems help reduce energy consumption in school facilities through automated climate control and lighting.

3.3 The Benefits of AI Adoption in Schools

The integration of AI in secondary school administration offers numerous benefits, including:

- **Increased Efficiency**: Automation of repetitive tasks saves administrators time and allows them to focus on strategic planning.
- **Data-Driven Decision-Making**: AI analyses large datasets to provide insights that aid in resource allocation and student performance tracking.
- **Cost Savings**: AI-powered predictive analytics help schools reduce wastage and optimize budget allocations.
- **Improved Communication**: AI chatbots and virtual assistants provide quick responses to staff and student queries, enhancing communication.

Challenges in the Adoption of AI in Time Management by School Administrators:

Technical Challenges

1. Infrastructure and Hardware Limitations: Insufficient technology infrastructure, outdated hardware, or inadequate internet connectivity may hinder the adoption of AI-powered time management tools.

2. Data Integration and Interoperability: Integrating AI-powered time management tools with existing school systems, such as student information systems or learning management systems, may be complex and time-consuming.

3. Cybersecurity Concerns: School administrators may be concerned about the security and privacy of sensitive student and staff data when using AI-powered time management tools.

Human and Organizational Challenges

1. Resistance to Change: Some school administrators may resist adopting AI-powered time management tools due to familiarity with traditional methods or concerns about job security.

2. Lack of Technical Expertise: School administrators may require training and support to effectively use AI-powered time management tools, which can be time-consuming and costly.

3. Equity and Access Concerns: School administrators may need to ensure that AI-powered time management tools are accessible and equitable for all students and staff, regardless of their socio-economic background or technological proficiency.

Pedagogical and Ethical Challenges

1. Balancing Technology Use with Human Interaction: School administrators must ensure that AI-powered time management tools do not replace human interaction and socialization, which are essential for student development.

2. Addressing Bias and Fairness: School administrators must consider the potential biases in AI-powered time management tools and ensure that they are fair and transparent in their decision-making processes.

3. Ensuring Transparency and Accountability: School administrators must ensure that AI-powered time management tools are transparent in their decision-making processes and that they are accountable for any errors or biases

By acknowledging and addressing these challenges, school administrators can effectively adopt and implement AI-powered time management tools to enhance productivity, efficiency, and student outcomes.

Potential Challenges in the Adoption of AI in the Management of Material Resources by School Administrators: Technical Challenges

1. Inventory Management System Integration: Integrating AI-powered material resource management tools with existing inventory management systems can be complex and time-consuming.

2. Data Quality and Standardization: Ensuring accurate and standardized data on material resources, such as textbooks, equipment, and supplies, can be a challenge.
3. Hardware and Infrastructure Requirements: Implementing AI-powered material resource management tools may require additional hardware and infrastructure, such as RFID tags, sensors, or mobile devices.

Financial Challenges

1. Initial Investment Costs: Implementing AI-powered material resource management tools may require significant upfront investment costs, including software licenses, hardware, and training.
2. Ongoing Maintenance and Support Costs: School administrators must consider ongoing costs for maintaining and supporting AI-powered material resource management tools.

3. Return on Investment (ROI) Uncertainty: School administrators may be uncertain about the potential ROI of AI-powered material resource management tools.

Human and Organizational Challenges

1. Resistance to Change: School administrators and staff may resist adopting AI-powered material resource management tools due to familiarity with traditional methods or concerns about job security.

2. Training and Support Needs: School administrators and staff may require training and support to effectively use AI-powered material resource management tools.

3. Change Management: Implementing AI-powered material resource management tools may require significant changes to existing business processes and workflows.

Security and Compliance Challenges

1. Data Security and Privacy: School administrators must ensure that AI-powered material resource management tools comply with data security and privacy regulations.
2. Compliance with Procurement Regulations: School administrators must ensure that AI-powered material resource management tools comply with procurement regulations and policies.

Other Challenges and Ethical Considerations in AI Adoption

While AI presents significant advantages, its adoption in school administration also comes with challenges, including:

4.1 Data Privacy and Security Risks

- Schools must ensure compliance with **data protection regulations** such as GDPR to protect student and staff information.
- Cybersecurity measures must be implemented to prevent data breaches.

4.2 Resistance to Change

- Teachers and administrators may be hesitant to adopt AI due to fears of job displacement or lack of technical knowledge.
- Training programs are necessary to facilitate AI adoption.

4.3 Bias and Fairness in AI Decision-Making

- AI systems must be designed to ensure fairness and eliminate biases in decision-making, such as student grading or disciplinary actions.

4.4 Ethical Use of AI

Ethical frameworks must be developed to ensure AI enhances education without replacing human judgment.

5. Future Prospects of AI in School Administration

As AI continues to evolve, future developments could enhance its role in school administration:

- **AI-Driven Personalized Learning**: Adaptive learning systems that cater to individual student needs.
- **Advanced Predictive Analytics**: AI could forecast student performance trends and dropout risks.
- **Virtual Reality (VR) and AI Integration**: AI-powered VR environments for immersive learning and administrative simulations.
- **AI for Sustainable Schools**: Green AI technologies could help schools reduce their environmental footprint.

By acknowledging and addressing these challenges, school administrators can effectively adopt and implement AI-powered material resource management tools to enhance efficiency, reduce costs, and improve resource allocation.

6. Conclusion

The evolution of AI has transformed various sectors, including secondary school administration. AI-driven tools help school administrators manage time and material resources more efficiently, leading to better decision-making, cost savings, and improved educational outcomes. However, ethical considerations, data security, and resistance to change must be addressed to maximize AI's potential in education. As AI continues to advance, its role in education will expand, further enhancing the effectiveness of school administration.

Recommendations

1. Schools should invest in AI-powered administrative tools such as automated scheduling systems, predictive analytics for resource allocation, and smart inventory management to enhance efficiency.
2. Administrators, teachers, and support staff should undergo continuous training on AI tools and their applications in educational management to ensure effective implementation.
3. Educational policymakers should establish clear guidelines for the ethical and responsible use of AI in schools, ensuring data privacy, security, and fairness in decision-making.

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