

DOI: 10.5281/zenodo.18798917

THE GOVERNANCE OF ARTIFICIAL INTELLIGENCE APPLICATION AS ADAPTIVE LEARNING IN THE INSTITUTION OF HIGHER EDUCATION

Andrew Enaifoghe^{1*}

¹Department of Public Administration, University of Zululand, South Africa
EnaifogheA@unizulu.ac.za, <https://orcid.org/0000-0003-4890-9179>

Received: 11/12/2025
Accepted: 02/02/2026

Corresponding Author: Andrew Enaifoghe
(EnaifogheA@unizulu.ac.za)

ABSTRACT

Implementing Artificial Intelligence (AI) as adaptive learning in higher education transforms student interaction with educational material. The rapid expansion of Artificial Intelligence (AI) applications in higher education has accelerated the shift toward adaptive learning systems designed to personalize instruction, enhance learner engagement, and improve academic outcomes. As institutions increasingly rely on these technologies, the need for effective governance frameworks has become critical. This study adopts a desktop research approach to examine existing literature, theoretical models, and policy guidelines surrounding the governance of AI-driven adaptive learning in higher education. The analysis highlights key governance dimensions—including ethical standards, data privacy, algorithmic transparency, institutional accountability, and regulatory compliance—that shape the responsible deployment of AI technologies. Findings indicate that while AI-enhanced adaptive learning offers substantial pedagogical benefits, such as real-time analytics, individualized learning pathways, and predictive student support, it also raises challenges related to bias, equity, intellectual property, and institutional readiness. The paper argues that robust governance mechanisms are essential to balancing innovation with ethical stewardship. It proposes a conceptual governance model that integrates institutional policy, human oversight, technological safeguards, and continuous evaluation to ensure trustworthy, transparent, and equitable AI adoption. The results indicate that with meticulous execution and continuous assessment, AI-driven adaptive learning can substantially improve the educational experience at higher education institutions, rendering learning more personalized, efficient, and effective.

KEYWORDS: AI-Driven Adaptive Learning, Educational Resources, Learning Experience.

1. INTRODUCTION

The accelerated incorporation of Artificial Intelligence (AI) into higher education has revolutionised conventional teaching and learning settings, introducing innovative methods of customised, data-driven instruction. AI-enabled adaptive learning systems have developed as potent instruments that analyse learner behaviour, forecast performance trends, and customise instructional content to meet individual requirements (Dörfler, 2022). As institutions progressively implement new technologies to augment student involvement, increase learning outcomes, and optimise resource allocation, governance issues have become central to academic and policy discourse. Effective governance is crucial for optimising the advantages of adaptive learning technologies and for tackling the ethical, regulatory, and operational difficulties they provide.

The implementation of AI in higher education presents intricate challenges including data protection, equity, algorithmic openness, institutional responsibility, and adherence to evolving digital rules. In the absence of a definitive governance framework, institutions jeopardise students by facilitating data exploitation, perpetuating algorithmic biases, and undermining academic integrity (Davidson & Lockwood, 2019). The digital revolution of education has rapidly intensified in recent years, propelled by technology innovation, evolving student expectations, and the worldwide need for more inclusive and individualized learning experiences.

One of the most promising advancements in this field is the utilization of Artificial Intelligence (AI) through adaptive learning systems—technologies that modify instructional material and paths in response to individual learner requirements, behaviors, and performance (Chan & Hu, 2023). In higher education, where diversity in student backgrounds, learning styles, and academic readiness is increasingly evident, AI-driven adaptive learning presents a persuasive solution to the enduring challenge of providing personalized, scalable, and effective instruction.

This study examines the revolutionary potential of AI-driven adaptive learning in higher education, emphasizing its applicability, advantages, obstacles, and consequences for pedagogy and learning. It contextualizes adaptive learning within the wider conversation on educational innovation and digital pedagogy, while also analyzing the impact of AI technology on the roles of educators, learners, and institutions. In comprehending adaptive learning and artificial intelligence, it denotes educational

systems that employ data-driven algorithms to customize learning experiences according to the individual requirements of each learner (Connor, 2018). These systems perpetually assess learner interactions—such as quiz outcomes, time allocated to activities, and engagement trends—to modify the difficulty, order, and nature of the information delivered.

When augmented by AI, adaptive learning evolves into a more advanced system, utilizing machine learning, natural language processing, and predictive analytics to produce exceptionally responsive and individualized learning environments. AI-augmented adaptive learning solutions may detect knowledge deficiencies, suggest specific resources, and forecast future performance (Davidson & Lockwood, 2019; Davies, 2000). An AI system may identify a student's difficulties with calculus ideas and autonomously offer more practice problems, video lessons, or suggestions for peer discussions. The system progressively enhances its recommendations according to the learner's advancement, establishing a feedback loop that fosters ongoing growth.

1.1. *Adaptive Learning In Tertiary Education*

The argument for adaptive learning in tertiary education is that higher education institutions progressively acknowledge the necessity to transcend uniform instructional methodologies. Conventional lecture-based approaches frequently do not address students' varied learning speeds, preferences, and prior knowledge levels. This is especially apparent in extensive, beginning courses when student attrition and disengagement frequently occur. Adaptive learning presents a formidable alternative (Dörfler, 2022). Personalizing the learning experience can augment student engagement, promote retention, and facilitate mastery-based learning. Furthermore, it offers educators immediate insights on student performance, allowing more precise interventions and informed teaching strategies.

Adaptive learning can significantly contribute to closing educational disparities in African higher education settings, characterized by resource limitations, substantial class sizes, and inconsistent access to quality instruction (Enaifoghe & Zenzile, 2023). Institutions such as the University of Rwanda and the University of Pretoria have begun trials using AI-driven systems to enhance blended and online learning, especially in STEM fields. These efforts illustrate the capacity of adaptive learning to democratize access to superior education and

facilitate student achievement on a large scale.

There are few instances of AI-driven adaptive learning implemented, as numerous adaptive learning systems are now influencing higher education worldwide including in Africa. Carnegie Learning: This technology, first designed for mathematics education, employs AI to deliver immediate feedback and customized learning trajectories. It has been implemented at many African colleges through collaborations designed to enhance mathematical competency (Dörfler, 2022). Knewton Alta: This adaptive learning platform provides customized information in disciplines such as chemistry, finance, and statistics. It employs artificial intelligence to evaluate student reactions and modify material delivery accordingly.

Smart Sparrow: Employed in health sciences and engineering education, Smart Sparrow enables educators to create adaptable classes that react to student inputs. It has been utilized in South African medical colleges to enhance clinical reasoning training. M-Shule (Kenya): Although largely concentrated on elementary and secondary education, M-Shule's AI-driven SMS-based adaptive learning model provides insights into the adaptation of low-bandwidth, mobile-first solutions for higher education in resource-limited environments. These examples demonstrate the adaptability of learning systems and their capacity to meet varied educational requirements across different fields and settings.

AI-driven adaptive learning signifies a substantial advancement in the pursuit of more egalitarian, efficient, and engaging higher education (Davidson & Lockwood, 2019). By customizing training to meet individual learner requirements, these systems has the capacity to revolutionize the delivery and acquisition of information, particularly in scenarios when conventional models are inadequate. Adaptive learning provides African higher education institutions a means to surmount structural obstacles and enhance access to excellent education.

This study prepares for an in-depth examination of adaptive learning technologies, their educational principles, and their practical use in various higher education contexts. In the process of integrating AI, it is crucial to prioritize the human aspect – ensuring that technology functions as a means of empowerment rather than exclusion. The future of higher education depends not only on the adoption of new instruments but also on the redefinition of the learning process.

1.2. *Artificial intelligence in teaching and learning*

The tremendous development of Artificial Intelligence (AI) is revolutionizing multiple areas, including education. The integration of AI in higher education is set to transform teaching and learning methods. The rapidly expanding science of artificial intelligence (AI) has the potential to revolutionise our interactions with technology (Enaifoghe and Zezile, 2023). Although artificial intelligence is a complex topic, understanding the basics will enable you to make well-informed decisions about its application in the workplace. The goal of artificial intelligence (AI) is to create software and devices that can think and behave like people (Ahmad et al. 2023).

Artificial intelligence (AI) systems are designed to learn from their environment and make decisions based on the information they gather. They can therefore be used to detect patterns, automate procedures, and even resolve challenging problems. AI is utilised in various fields, including manufacturing, banking, and healthcare. The findings studies revealed, first, that science teachers were not very aware of the use of artificial intelligence (AI) in science education; second, that their knowledge of how to use AI applications in science education had significantly decreased; and third, that informants and science teachers were not aware of the significance of AI in science education (Al-Husseini, 2023; Aithal & Aithal, 2023; Algohari, 2022).

As indicated by Algohari (2022), a multimedia computer program with adaptive feedback based on artificial intelligence technology gives the ability to learn (90%) in dimensional cognitive achievement". The study suggested the employment of numerous multimedia computer programs based on artificial intelligence technology in teaching computer courses and other courses within the faculties of education, since 90% of respondents supported adaptive regression in posterior achievement. The incorporation of AI in higher education encompasses several applications, including tailored learning environments, intelligent tutoring systems, administrative automation, and data-driven decision-making.

The technologies aim to tackle several educational difficulties, including enhancing student engagement, optimising resource distribution, and promoting inclusive learning environments (Akgun & Greenhow, 2022). As institutions navigate the intricacies of AI adoption, it is essential to assess both the opportunities and ethical implications inherent in this shift. This study seeks to deliver an exhaustive examination of AI's function in higher education, emphasizing significant trends, advantages, and

possible disadvantages. By understanding the implications of AI-driven educational methodologies, stakeholders can more effectively plan for the future of pedagogy, ensuring that AI catalyzes beneficial transformation in academia.

2. LITERATURE REVIEW

The integration of Artificial Intelligence (AI) in higher education is a rapidly evolving field, with significant implications for teaching and learning. This review synthesizes key findings from recent studies and reports to provide an overview of the current state of AI adoption in higher education. In higher education, artificial intelligence (AI) is being used more and more to improve teaching and learning by delivering data-driven insights, automating administrative activities, and creating individualized learning experiences.

Although AI has the potential to increase productivity and improve student outcomes, concerns exist about job displacement, ethical issues, and the need for strong pedagogical integration. The fast-developing science of artificial intelligence (AI) has the potential to revolutionise how we use technology. Although artificial intelligence is a complex topic, knowing the basics will help you decide how best to use it at work. The goal of the computer science field of artificial intelligence (AI) is to create devices and software that have human-like thought and behaviour patterns.

Artificial intelligence (AI) systems are designed to learn from their environment and make decisions based on the information they gather. They can therefore be applied to automate procedures, spot patterns, and even resolve challenging problems. AI is utilised in various fields, including manufacturing, banking, and healthcare. The study by Al-Husseini (2023), revealed that scientific teachers were not very aware of the use of artificial intelligence (AI) in science education, second, that their knowledge of how to apply AI applications in science education had significantly decreased.

Informants and science teachers do not well understand the significance of artificial intelligence (AI) in science education. Another study noted that a multimedia computer application with adaptive feedback based on artificial intelligence technology can help people learn (90%) in dimensional cognitive success, according to the findings of the Alghohari (2022) study. The researcher advocated the employment of numerous multimedia computer programs based on artificial intelligence technology in teaching computer courses and other courses within the faculties of education, citing 90% support

for adaptive regression in posterior achievement.

According to the findings of Ali and Ghareeb's (2020) study, incorporating artificial intelligence applications has a statistically significant effect on improving speaking and listening comprehension. AI experiments have shown that a natural language processing-based approach to teaching oral English can improve students' overall proficiency in the language. Additionally, it boosted understanding by 19.7% per year while simultaneously increasing passion for studying the language by 33.3% (Li, 2022). The study by Rajab (2022) was aimed to evaluate the effectiveness of a proposed program based on innovative learning in teaching social studies in schools.

The study by Smith (2022) sought to enhance their capacity for self-learning and awareness of digital issues. The average scores of students in the experimental group and the control group after applying the self-learning skills test were statistically different at the level of significance. Additionally, the experimental group's average scores in the pre- and post-applications of the self-learning skills test were statistically different at the level of significance, favouring the post-application (Rajab, 2022, p. 3).

"...The average scores of students in the experimental and control groups in the post-application of the digital awareness scale showed statistically significant differences at the level of significance (≤ 0.05) in favour of the experimental group

"... the average scores of students in the experimental group in the pre- and post-applications of the digital awareness scale showed statistically significant differences at the level of significance ($0 \leq 0.05$) in favor of the post-application.

"...There was a positive correlation at the level of $\leq (0.05)$ between the digital awareness and the skills acquired by students in the experimental group through self-learning.

Al-Shibl (2022) discovered that while teachers' perceptions of the direction of using the artificial intelligence approach were high in that the combination of sound, image, and movement helps to facilitate and make mathematical skills more enjoyable, their perceptions of teaching mathematics under the entrance to artificial intelligence were medium in each of the two axes of the questionnaire overall. By presenting knowledge to students engagingly and effectively, it enhances their appeal and interest in learning. According to Syed's (2021) findings, there are statistically significant variations in the use of artificial intelligence software.

In addition to finding statistically significant

differences between the two experimental groups' average scores in the post-application of the achievement test and the observation card in favor of the group of teachers with a visual learning style. Al-Najjar and Habib's (2021) study also found that the use of an artificial intelligence program based on chatbots and the learning style in an e-training environment had a positive impact on the cognitive and performance aspects of the skills of using e-learning management systems among teachers of the preparatory cycle.

The review of 353 research papers revealed that AI was successful in meeting the unique learning needs, preferences, and skills of students while directing them down the most efficient learning paths in each of the nations. Furthermore, it is clear from the research that AI enhances instructional content, adapts it to each person's needs, and alerts to potential learning challenges (Almansoori & Abouassar, 2024). For a better learning experience, this reorients the role of teachers and maximizes the teaching-learning environment.

"...I foresee our future generations where the four walls of a classroom will no longer be needed for our children to go to school, to study and have degree certificates. Yet, they will be educated, and others will acquire learned skills through advanced technology in the comfort of their homes. The future is coming tomorrow." Andrew-Yong Enaifoghe (Shared on Facebook, 4th December 2024).

The next generation can now receive individualized education thanks to the increased trend of educational growth brought about by AI, but there are drawbacks as well. According to recent research, the promotion of such technologies for daily use is hampered by concerns about data privacy, the accessibility of digital resources, and financial limitations (Bhutoria, 2022). This literature review provides a snapshot of the current research on AI in higher education. It highlights the transformative potential of AI, while also acknowledging the challenges and ethical considerations that must be addressed.

In recent years, the utilization of Artificial Intelligence (AI) has markedly increased across numerous domains, including education (Ali et al., 2024a). AI can transform student engagement in learning and improve their academic achievement. Utilising sophisticated technologies and algorithms, AI can tailor to specific student requirements, deliver customised learning experiences, and monitor progress instantaneously. Another study examined AI's influence on student engagement and performance, focusing on its contribution to

individualized learning, maintaining student interest, enhancing learning outcomes, and monitoring performance (Ali et al., 2024a).

We will examine the challenges and limitations of AI in education, including issues related to data privacy and the deficiency of human engagement. Ultimately, we will examine the future of AI in education, investigating anticipated developments and the possibilities of AI for special needs schooling.

2.1. The Adoption Of Artificial Intelligence Revolutionised The Educational Scene

When John McCarthy and Marvin Minsky organized the Dartmouth Summer Research Project on Artificial Intelligence in 1956, the phrase "artificial intelligence" was created (COMEST, 2019; Haenlein & Kaplan, 2019). The exponential growth of processing power and the emergence of big data have contributed to the adoption of AI (Haenlein & Kaplan, 2019). AI is today defined as robots that mimic some aspects of human intelligence, including perception, learning, reasoning, problem-solving, linguistic interaction, and creative work (COMEST, 2019). This definition has grown and changed over time (Miao et al., 2021).

One area of computer science is called artificial intelligence (AI). AI systems generate "intelligence" through the use of hardware, algorithms, and data to make judgments, identify patterns, and carry out various tasks. Although AI is a broad word, the discipline also uses more specialised names. Artificial intelligence system can be constructed in a variety of methods. However, two main approaches are (1) utilizing human-provided rules (rule-based systems) or (2) using machine learning algorithms (Ruiz & Fusco, 2023). Artificial intelligence is the ability of computers to carry out human-like tasks by employing their cognitive processes.

Artificial intelligence is being utilised at an unprecedented rate and is significantly altering numerous aspects of human life (Dörfler, 2022). Artificial Intelligence (AI) and Learning Analytics (LA) have been successfully implemented in the field of education in recent years (Xue & Wang, 2022a). It is crucial to realize that, just as these technologies are transforming other disciplines, artificial intelligence may assist instructors by offering educational applications (Salas-Pilco et al., 2022).

In 2022, Salas-Pilco et al. (2022), The U.S. Department of Education (2023) proposed Three Reasons to Address AI in Education Now: "The main purpose of developing artificial intelligence is to make computer combined with mechanical equipment competent for some complex work which

usually needs human intelligence and greatly reduce the burden of human beings." First, AI may enable achieving educational priorities in better ways, at scale, and with lower costs (Xue & Wang, 2022b). AI might make learning materials more responsive to the needs and strengths of students. Secondly, there was a worry over possible future threats and awareness of system-level risks give rise to urgency and importance. For instance, students might be more closely watched. Third, the magnitude of potential unforeseen or unintentional repercussions creates urgency.

Teachers may encounter unintended consequences when AI enables the large-scale automation of educational decisions. The job of teaching is notoriously complex, with teachers making thousands of decisions every day. Teachers participate in classroom processes, interactions with students outside of the classroom, work with other teachers, and perform administrative functions. As a simple example, achievement gaps could widen if AI adapts by speeding up the curriculum pace for some students and slowing it down for others (based on incomplete data, poor theories, or biased assumptions about learning). Additionally, they are expected to interact with families and caregivers because they are part of their communities (U.S. Department of Education, 2023).

An artificial intelligence system is defined as software that is created using one or more of the methods and approaches listed below and that can produce outputs like content, recommendations, predictions, or decisions that have an impact on the environments it interacts with for a specific set of human-defined objectives. Machine learning techniques and approaches, including supervised, unsupervised, and reinforcement learning, utilise a wide range of methods, such as deep learning (Ragab, 2022). Knowledge representation, inductive (logic) programming, knowledge bases, inference and deductive engines, (symbolic) reasoning, and expert systems are examples of logic and knowledge-based approaches.

2.2. *Teaching and Artificial Intelligence*

With its ability to automate administrative duties, customize learning, and give teachers data-driven insights, artificial intelligence (AI) is quickly changing education. Although AI has the potential to improve education, bias, false information, and the necessity for cautious integration are some of its drawbacks (Bondie, Dahnke & Zusho, 2019). We can send and receive event alerts and notifications. It used to take several steps to choose the music we

wanted to listen to (even with digital music), but now we can just say the name of the song and it will start playing.

Similarly, choosing a route used to require a laborious study of maps, but cell phones now allow us to select from a variety of transportation options to reach our destination. Teachers have a famously challenging profession because they have to make thousands of judgments every day. Teachers participate in classroom operations, interactions with students outside the classroom, collaboration with other educators, and administrative tasks. Additionally, they are expected to interact with families and caregivers, as they are part of their communities (U.S. Department of Education, 2023, p. 26). A 2020 report by McKinsey (2020) first proposed that the initial benefit of AI could be to improve teaching jobs by reducing low-level burdens in administrative or clerical work.

Additionally, the report recommends that time saved from AI-enabled technology be redirected toward more effective instruction, specifically by reducing the average weekly preparation time from 11 hours to just six. Other studies highlight these and two other opportunities below: Managing low-level details to reduce teaching burdens and improve student focus. A competent teacher needs to be an expert in every area, no matter how tiny (Kreitmayer et al., 2018). The teacher could want to deliver a valuable learning resource to a specific student after working with them.

By classifying introductory voice notes for teachers to review once a class session concludes, a voice assistant or other AI helper could help students stay organised. Going above and beyond what the instructor can do with their kids while still accomplishing their goals. Given the short amount of time before the next school day, teachers nearly always desire to accomplish more with each kid than they can. Emerging products in each small group of students may indicate to the teacher when a student or teacher needs more individualized attention (Connor, 2018). For instance, we observe in the Formative Assessment that teachers are not always able to know what is happening with each individual student.

Enhancing the effectiveness and profitability of teacher professional development. The use of AI in education has evolved in a number of ways, starting with student-facing AI (tools designed to support learning and assessment), moving on to teacher-facing AI (designed to support teaching), and system-facing AI (designed to support the management of educational institutions). Simulators

can incorporate real-world classroom teaching examples while altering the participants' voices and faces, allowing teachers to discuss and share teaching scenarios without disclosing identities (Baker et al., 2019).

The relationship between artificial intelligence (AI) and education actually extends beyond the use of AI in the classroom (learning with AI), as it also involves teaching its methods (learning about AI) and preparing citizens for life in the AI era (learning for human-AI collaboration). In order to automate something, you must first fully understand it (UNESCO, 2021, 13). To assist education systems in addressing these issues, UNESCO, in collaboration with the Chinese Government, organized the International Conference on Artificial Intelligence and Education in Beijing in 2019 with the theme "Planning Education in the AI Era: Lead the Leap."

The introduction of AI into education also brings attention to issues of pedagogy, organizational structures, access, ethics, equity, and sustainability. Over 50 government ministers and vice ministers, as well as approximately 500 international delegates from more than 100 Member States, academic institutions, civil society, and commercial sector groups, participated in the event. The conference's main output was the "Beijing Consensus on AI and Education" (UNESCO, 2019a), which provides policy recommendations on using AI to enhance education, emphasising the importance of leveraging breakthroughs in data use to transform evidence-based policy planning processes.

The conference looked at the system-wide impacts of AI in the context of "SDG 4-Education 2030 and the Future of Education Beyond 2030" (UNESCO, 2019a). To improve data collection and processing and enhance education, consider incorporating or creating AI tools and technologies relevant to updating education management information systems (EMIS). Consider introducing new models for delivering education and training in various learning institutions and settings that can be enabled using AI, to serve various actors such as students, teaching staff, parents, and communities. Management and provision were more open, personalized, equitable, and inclusive (UNESCO, 2019a, p. 5).

2.3. Enhancing Education Using AI

The usage of AI tools to aid or improve learning has increased dramatically during the last ten years (Holmes et al., 2019). Nevertheless, a lack of data remains regarding how AI can enhance learning outcomes and whether it can assist practitioners and

learning scientists in better understanding the factors that contribute to successful learning (Zawacki-Richter et al., 2019). Numerous assertions on AI's transformative potential in education are predicated on speculation, optimism, and conjecture. Nemorin (2021). AI applications designed for education have been previously categorised into three main categories: system-facing, student-facing, and teacher-facing (Baker et al., 2019).

A few examples to illustrate this. One of the main advantages of AI in education is its capacity to customize learning experiences. It is crucial to recognize that each of the above categories are inherently related to one another; applications of AI in education may have the potential to meet demands in several areas (UNESCO, 2021). To customize content and delivery methods to each student's needs and learning preferences, artificial intelligence (AI) can assess student data, including grades, learning habits, and preferences. This makes education more accessible and inclusive by allowing students to learn at their own pace and receiving individualised support. AI can automate time-consuming tasks, such as feedback and grading, freeing up teachers to focus on more important duties, like mentoring and developing relationships with their students (Masero, 2023).

3. RESEARCH METHODOLOGY

To facilitate a qualitative interpretation of current knowledge, the researchers employed a narrative review design (Darlow & Wen, 2016), which involves a comprehensive evaluation of the existing literature. To provide a solid basis for answering the research questions, the study generated data using the literature review procedures outlined by Levy and Ellis (2006). These authors contend that narrative review design entails sequential steps to collect, comprehend, apply, analyse, synthesise, and evaluate high-quality literature.

The study examined the primary applications of AI in education and learning. The study examines the question of how these applications differ across various disciplines. The question should establish a thorough framework for examining the complex effects of AI on higher education. As stated in the study's purpose, this qualitative approach facilitated the integration of data from various sources and the synthesis of existing literature on the difficulties history teachers encounter in demonstrating the value of teacher education programs for history teachers (Darlow & Wen, 2016; Levy & Ellis, 2006). Adoption of Artificial Intelligence and the Future of Teaching and Learning in the Institution of Higher

Education.

To provide definitive answers, the researcher utilised databases and search engines, including Scopus, Web of Science, ERIC, JSTOR, ScienceDirect, and others, to locate publicly available literature that was believed to contain pertinent information that would help clarify the study's focus. Several search phrases, individual text words, or combinations of them as necessary were used in the search (Davies, 2000; Levy & Ellis, 2006).

Using the topic descriptor "Artificial Intelligence, AI Adoption, the Future of Teaching and Learning, technology in the Institution of Higher Education," the electronic databases were searched for peer-reviewed papers in order to generate data. In addition to these resources, we searched Google Scholar using the same topic description. Eight of the 21 entries from the initial search were eliminated due to differences in the stated results and a general sense of publishing bias, which included articles authored by particular academics at universities (Guyatt et al., 2008).

Based on the evaluation of the abstracts and comparison to the study's purpose, only twenty-three (23) studies was kept and consulted after eliminating those that were irrelevant. After that, the researcher went over the remaining twenty-three studies and eliminated two more and left with twenty-one (21).

3.1. Criteria for Inclusion and Exclusion

The criteria for inclusion and exclusion for the study to determine whether a person or study is eligible to take part or be included in the research. While exclusion criteria were to determine the traits that would exclude potential participants, even if they match the inclusion criteria, inclusion criteria are qualities that potential participants must have to be included. In this case therefore, a study was considered if it;

1. addressed Artificial Intelligence, AI Adoption, teaching and learning, technology in the institution of higher education.
2. was a research publication authored in English between 2014 and 2025;
3. was a comparative analysis, qualitative/quantitative, historical survey, or descriptive/case study.

To ensure that the researcher understood the issues, patterns in the data were identified after multiple readings of the papers, which involved integrating various datasets, coding key concepts and themes, and reading the material aloud (Mais-Thompson et al., 2025). According to Brown et al.

(2023), these methods adhered to the conventions of qualitative research.

The researcher independently assessed each of the retrieved publications to determine their eligibility and extract relevant study data, thereby ensuring the reliability of the study. Although the survey was based on existing literature, every author was given credit through citations to maintain academic integrity. Below are the conclusions and discussions.

3.2. Justification for Selecting a Narrative Review.

A narrative study was chosen over a systematic review since the research topic, "Application of Artificial Intelligence as Adaptive Learning in Higher Education," is exploratory and conceptual by nature. The goal is to synthesise many views, theoretical frameworks, and emerging trends rather than assessing the efficacy of a specific intervention or quantifying outcomes. Narrative reviews provide for a more comprehensive, integrative examination of diverse sources, such as conceptual papers, case studies, and technology breakthroughs that may not meet the strict inclusion/exclusion criteria of systematic reviews. This approach improves methodological transparency by clearly expressing the scope, topic organisation, and justification for source selection, which is consistent with the goal of giving a thorough understanding of AI-driven adaptive learning in higher education.

4. FINDINGS AND DISCUSSION

The study addresses several research questions related to the current incorporation of AI into higher education institutions. The themes and their corresponding subthemes emerged from the study, as shown in the table below.

Table 1: Themes and Subthemes of Findings.

Themes	Subthemes
Theme 1	The Potential Challenges of AI in education
Theme 2	The AI applications in teaching.
Theme 3	Artificial intelligence enhances student engagement.

The table (Table 1) above presents the generated themes from the data collected and analysed. Below are the findings and their discussion

- Data Presentation
- The Potential Challenges of AI in Education
- Data privacy issues

Data privacy is a critical issue in the integration of AI within education. Consider the following crucial aspects. Data privacy is a persistent issue that

necessitates constant oversight and enhancement. Institutions must periodically assess their data privacy protocols and revise them as needed to keep pace with emerging threats and technological advancements. AI in education has both significant obstacles and possible advantages (Davidson &

Lockwood, 2019). Data privacy, algorithmic bias, excessive reliance on technology, less human interaction, and the possibility of dehumanizing educational experiences are among the main issues. Below are few significant possible challenges:

Table 2: The Potential Challenges of AI in Education.

Data Privacy and Security	AI systems frequently necessitate access to extensive student data, prompting apprehensions around the methods of data collection, storage, and utilization. Implementing stringent data privacy and security protocols is essential for safeguarding sensitive information.
Prejudice and Equity	AI algorithms can unintentionally reinforce biases inherent in their training data. This may result in inequitable treatment of specific student demographics. Mitigating prejudice and guaranteeing equity in AI applications presents a considerable challenge.
Ethical Considerations	The ethical ramifications of AI in education encompass concerns around transparency, accountability, and the possibility of AI supplanting human judgment. Institutions must establish ethical frameworks to regulate AI utilization.
Technical Difficulties	Deploying AI technologies necessitates considerable technological infrastructure and proficiency. Numerous institutions may encounter challenges in implementing AI systems due to constrained resources or insufficient technological expertise.
Opposition to Transformation	Educators and administrators may exhibit reluctance to embrace AI technology due to apprehensions around job displacement or doubt about the efficacy of AI. Delivering sufficient training and assistance is crucial to surmount this opposition.
Equity and Accessibility	Facilitating equal access to AI technologies poses a problem, especially for organizations with constrained resources. AI poses a risk of intensifying pre-existing disparities in schooling.
Expense	The financial investment necessary for the development, implementation, and maintenance of AI systems can be considerable. Institutions must evaluate the cost-benefit ratio and pursue sustainable funding solutions.
Reliance on Technology	An excessive dependence on AI may diminish pupils' critical thinking and problem-solving abilities. Integrating AI with conventional teaching approaches is essential for preserving a comprehensive educational framework.

Practical obstacles also include the requirement for teacher training and implementation expenditures. Artificial intelligence in education presents numerous advantages; yet, it also entails certain obstacles that institutions must address. Scholars argued that education was delayed by the shift to online study, which revealed that many colleges lacked adequate IT infrastructure (Chan & Hu, 2023; Bondie, Dahnke & Zusho, 2019). School

closures also harmed the capacity of parents to work and vital community services. Prioritizing education continuity, governments frequently used ICT and online instruction, accelerating an existing tendency. Confronting these problems requires a collaborative effort among educators, administrators, policymakers, and technologists to ensure the responsible and effective use of AI in education.

Addressing these data privacy concerns is crucial

to guarantee the responsible and ethical utilization of AI technologies in education. The use of AI enhances teaching and learning, and can enhance collaborative learning by linking students with peers and educators via intelligent platforms (Du Boulay et al., 2018). These systems can suggest study groups, discussion forums, and collaborative projects according to student interests and requirements. By utilizing these AI capabilities, educational institutions may develop more engaging and effective student learning experiences.

4.1. The AI Applications in Teaching.

The learning process needs to be innovative and

creative in order to meet the evolving demands of education. The advancement of artificial intelligence (AI) in education has aided in the processing of everyday tasks, such as instruction and learning. Investigating artificial intelligence (AI) in education, particularly in the teaching and learning process, is the aim of this study. Library research is used in this study. Prior to entering the workforce, students must acquire the necessary skills. With the recent surge in big data, machine learning, robotics, and artificial intelligence, new competencies such as computational thinking, data literacy, and AI literacy have emerged. In recent months, the education sector has been filled with concern due to the advent of artificial intelligence, particularly AI-generated tools.

Table 3: AI Applications in Education.

Customized Educational Aides	
Intelligent Tutoring Systems	AI-driven teaching systems offer sequential supervision and immediate feedback, akin to a personal instructor. These techniques assist students in comprehending intricate ideas and efficiently practicing exercises.
Automated Assessment	Artificial intelligence can automate the evaluation of assignments, quizzes, and examinations, delivering uniform and impartial assessments. Tools such as Gradescope optimize the grading process, conserving educators' time and assuring equity.
Assistive Learning Technologies	AI aids students with disabilities with tools such as speech-to-text software, which converts spoken language into text for hearing-impaired individuals, along with various assistive technologies that improve accessibility.
Intelligent Content Generation	Artificial intelligence can provide instructional materials, including quizzes, summaries, and lessons, derived from textbooks or subjects. This enables educators to rapidly produce engaging and pertinent resources.
	AI systems analyze student engagement and behavior through video or platform data, detecting patterns that enable educators to intervene and assist students more efficiently.
Predictive Analytics	Artificial intelligence analyses educational data to predict student achievement and identify areas that require additional support. This enables educators to address learning deficiencies proactively.
Digital Learning Environments	Artificial intelligence generates immersive three-dimensional and virtual educational environments that enable students to engage with subjects in an interactive manner. These spaces augment engagement and facilitate experiential learning opportunities.
Conversational Agents and Digital Assistants	AI-driven chatbots and virtual assistants respond to inquiries from students and staff 24/7, assisting with academic tasks and administrative matters.
Gamification and Educational Entertainment	AI incorporates gamification elements into educational materials to maintain student engagement and motivation. Applications such as Kahoot! and Minecraft: Education Edition employ artificial intelligence to generate interactive quizzes and simulations.

The table presented few example of AI applications in education. With the help of

organizations like the World Bank, which offered advice on adjusting to new platforms, online learning emerged as the new norm. By abandoning conventional, one-size-fits-all teaching strategies, this change fosters 21st-century abilities including communication, teamwork, creativity, and critical thinking (Bondie et al., 2019). Additionally, as the twenty-first century dawns, a person's critical thinking skills and literacy level must be taken into consideration for effective functioning and employment in society where algorithmic thinking and computing literacy have been introduced. These tools include Padlet, Canva, and student-centered learning approaches like Problem-Based Learning

(PBL) and flipped classrooms (Coleman, 2020). These examples demonstrate how AI is revolutionizing education by enhancing personalization, efficiency, and engagement in teaching and learning.

4.2. Artificial Intelligence to Enhance Student Engagement

The Use of Artificial intelligence to enhances student engagement. Artificial intelligence markedly enhances student engagement via diverse, effective strategies:

Table 4: Artificial Intelligence to Enhance Student Engagement.

Tailored Education	
Prompt Evaluation	Artificial intelligence provides instantaneous feedback on assignments, examinations, and activities. This fast feedback assists students in identifying their mistakes and accelerates learning, maintaining their engagement and fostering continuous improvement.
Gamification	Artificial intelligence integrates gamified elements into educational platforms, such as badges, levels, and challenges. These features augment the interactivity and enjoyment of learning, hence elevating student motivation and engagement.
	Artificial intelligence can transform static educational materials into dynamic, interactive content. AI-driven chatbots can emulate historical figures in history courses or create immersive scenarios in literature lessons, hence augmenting engagement and retention in learning
Adaptive Learning Environments	AI systems may adjust task complexity based on student performance, ensuring that learners are neither disinterested nor overwhelmed. This adaptive system sustains student interest by offering appropriate challenges.
Untimely Intervention	Artificial intelligence can identify early signs of student disengagement by analysing behavioural and performance patterns. Educators can take proactive measures to address issues and support students before their academic deterioration.
Support for Diverse Learning Modalities	AI accommodates various learning styles by offering multiple modalities for information engagement, including visual assistance, interactive simulations, and auditory feedback. This inclusion ensures that all students can identify a learning method that corresponds with their preferences.
Enhanced Collaboration	Artificial intelligence improves collaborative learning by connecting students with peers and educators through advanced platforms. These systems can recommend study groups, discussion forums, and collaborative projects tailored to students' interests and needs.

As seen in the above table, Artificial intelligence to enhance student engagement, so by leveraging these AI capabilities, educational institutions may

provide more engaging and effective learning experiences for students. Institutions are primarily concerned that the use of AI will threaten the

continued existence of important academic paradigms like assessment, course design, activities, and so forth. According to the Straits Times, Malaysia's Minister of Education, Fadhlina Sidek, has suggested that starting in 2027, elementary school pupils receive instruction on the principles of artificial intelligence (AI). This could make them more adaptive and prepared to take advantage of opportunities and solve new problems with the aid of intelligent technologies like AI (Harun & Sallehuddin, 2024).

4.3. Findings

The study discovered that the applications and technologies of artificial intelligence (AI) are extensively utilized in the field of education, and students use them as a component of their educational journey. AI is being objectively incorporated into educational systems to enhance the teaching and learning processes for both teachers and students, thereby attaining the intended learning outcomes. It might, however, lessen students' motivation and their educational experiences. Jie and Kamrozzaman (2024) researched the challenges that higher education students face in using artificial intelligence (AI) in their learning experiences.

The research aimed to identify the relationship of challenges higher education students face on using AI to their learning experiences. The findings of the research have shown that there is a significant relationship between challenges (privacy & security, ethical considerations, over-reliance on AI and lack of awareness and understanding) faced by students in UNITAR International University on using AI applications to their learning experiences. Furthermore, Education Minister Fadhlina Sidek announced several initiatives in May 2024, the majority of which aimed to enhance teachers' use of digital technologies.

One of the programs, which has a RM1 million budget and aims to reach 500 chosen teachers countrywide, gives educators the chance to improve their abilities by taking courses on technological empowerment, with an emphasis on artificial intelligence.

She mentioned that MOE would collaborate with Apple Professional Learning Specialist Malaysia to train 100,000 teachers to become certified as "Apple Teachers." Additionally, 1000 educators will be chosen to take courses leading to accreditation as digital specialists and recognition as MOE's Guru Jauhari Digital to honor educators who demonstrate exceptional proficiency in integrating digital technology (Mail, 2024a).

4.4. The Applications of AI in the Institution of Higher Education

AI is revolutionizing higher education through bettering student support, automating administrative work, and boosting individualized learning. AI-powered solutions may automate scheduling and grading, tailor learning experiences, and offer round-the-clock assistance via chatbots. AI can also evaluate big data sets to find kids who are at risk, increase retention rates, and guide data-driven choices. AI technologies are being utilized in various ways to enhance educational practices. Typical applications include intelligent tutoring systems, personalized learning environments, automated grading systems, and administrative automation. These technologies aim to enhance student engagement, offer personalised learning experiences, and streamline administrative tasks. This study's findings indicate an increasing interest and measured optimism regarding the incorporation of AI-driven adaptive learning in higher education institutions, especially in the African environment. Multiple principal topics arose from the analysis:

4.5. Beneficial Effect on Student Involvement and Achievement

Institutions that have used adaptive learning systems have shown enhancements in student engagement, motivation, and academic success. Students exhibited favorable reactions to individualized learning trajectories, immediate feedback, and the capacity to advance at their own speed. These approaches facilitated the closure of educational disparities, particularly in fundamental subjects like mathematics and science.

Augmented Pedagogical Assistance for Educators

Faculty members recognized the significance of the data analytics supplied by adaptive systems, which elucidated student learning habits and performance trends. This facilitated more precise interventions and guided instructional design. Nonetheless, the findings underscored the necessity for professional development to enable educators to accurately analyze and respond to this data.

4.6. Infrastructure and Accessibility Persist as Significant Obstacles

Notwithstanding the potential advantages, some institutions encounter considerable infrastructure obstacles, such as restricted internet connectivity, insufficient hardware, and erratic access to digital platforms. These challenges disproportionately impact rural and underfunded colleges, constraining

the scalability of adaptive learning solutions.

4.7. Issues Pertaining to Data Privacy and Algorithmic Bias

Stakeholders articulated apprehensions over the ethical ramifications of AI in education, namely, student data privacy, consent, and the risk of algorithmic bias. There is an evident necessity for regulatory frameworks and institutional norms to govern the ethical application of AI in educational settings.

4.8. Relevance of Culture and Curriculum

Numerous adaptive learning systems are created in Western environments and may not correspond with local curriculum, languages, or educational methodologies. This discord may impede adoption and efficacy. The results indicate a necessity for customized content creation and culturally attuned

design.

4.9. Pilot programs have potential but require ongoing investment.

Pilot programs in nations such as South Africa, Kenya, and Rwanda illustrate the viability and advantages of adaptive learning in higher education. Nevertheless, these projects frequently depend on external financing and collaborations. Long-term success will rely on institutional dedication, governmental backing, and sustainable financial frameworks.

4.10. Advantages of AI-Enhanced Adaptive Learning

The use of AI into adaptive learning systems has several significant advantages for higher education.

Table 5: Advantages of AI-Enhanced Adaptive Learning.

Personalization at Scale	AI empowers schools to provide tailored learning experiences to extensive student populations without overwhelming teachers.
Data-Driven Insights	Educators obtain comprehensive analytics on student performance, facilitating prompt interventions and evidence-based pedagogical practices.
Enhanced Engagement and Motivation	Tailored material and prompt feedback may elevate student motivation and cultivate a sense of ownership in the learning experience.
Support for Diverse Learners	Adaptive systems can cater to various learning styles, languages, and degrees of prior knowledge, fostering inclusion.
Efficiency and Proficiency	Learners may advance at their velocity, dedicating additional time to complex ideas while swiftly navigating through common content.

Notwithstanding its potential, the execution of AI-driven adaptive learning in higher education presents several challenges. Infrastructure and Connectivity are identified as one of the challenges as numerous African institutions have constraints in internet connectivity, hardware availability, and digital literacy, which may impede the successful use of adaptive technology. The study also noted the faculty Preparedness and Instruction as another obstacle. Effective implementation necessitates educators comprehending the integration of adaptive technologies into their teaching methodologies and analysing the data produced. Institutions could face ethical and privacy issues, because the utilization of student data for customization prompts significant inquiries around permission, data security, and algorithmic prejudice.

The expenses associated with licensing adaptive learning systems and sustaining the requisite infrastructure can be significant, especially for financially constrained schools. Cultural Relevance: Numerous adaptive systems are created inside Western environments and may not correspond with

local curriculum, languages, or educational traditions. Confronting these difficulties necessitates a comprehensive strategy encompassing policy support, capacity enhancement, and collaboration among educators, technologists, and policymakers.

Comparing the African Higher Education Context: Alignments and Divergences with Global AI-Enabled Adaptive Learning

Scope and contributions. Comparing the African higher education experience to global trends highlights the unique contextual limits and similar pedagogical goals of AI-enabled adaptive learning. Africa's contribution is particularly strong in demonstrating context-sensitive innovation under conditions of limited infrastructure, high linguistic diversity, and evolving governance frameworks. These factors shape adoption pathways differently than those in North America, Europe, and parts of Asia. Infrastructure and connectivity. The underlying digital infrastructure is one of the most significant differences. African universities struggle with bandwidth scarcity, higher per-Mbps costs, and intermittent power, limiting real-time

personalisation, data ingestion, and model deployment. High-income regions typically have robust campus networks and affordable broadband to support adaptive systems.

According to World Bank and allied network studies, connecting all African HEIs to high-speed internet is a multi-billion-dollar undertaking that requires coordinated investment at the campus, national, and regional levels. Price disparities persist, and NRENs (e.g., KENET, TENET, RENU) play a crucial role in reducing costs and enabling research traffic. In 2022, only ~36% of Africa's population had broadband access, highlighting challenges for students and teachers both on and off campus. This is in stark contrast to OECD countries with higher connectivity rates. During COVID-19, university students in Ghana and other countries had limited device access, unpredictable electricity, and trouble navigating online platforms.

4.11. Language Variety and Localisation

Africa's linguistic diversity, with over 2,000 languages, has led to a focus on local language NLP and speech technologies to promote inclusive adaptive learning. Masakhane and funder-backed initiatives (IDRC's AI4D, Mozilla Common Voice) are developing open datasets and models to improve educational access in African languages. Early deployments include text-to-speech, machine translation, and sign-language mediation for classroom inclusion. This emphasis on linguistic equity is less noticeable in worldwide deployments when English, Mandarin, and European languages dominate training corpora and product localisation.

4.12. Governance, Ethics, and Regulatory Frameworks

African ministries and higher education systems are actively aligning with global advice (e.g., UNESCO's 2023 Generative AI in Education), while developing continental and national policies that prioritise equity, sovereignty, and responsible innovation (e.g., African Union's Continental AI Strategy, 2024). Globally, universities have similar concerns—student data privacy, algorithmic bias, and academic integrity—but benefit from developed regulatory systems (such as GDPR) and established procurement controls. The African policy discourse emphasises data sovereignty, inclusive language support, and infrastructure investment as ethical prerequisites for AI at scale.

4.13. Governance Framework

A governance framework is a systematic collection of

principles, policies, responsibilities, and processes that directs an organization in decision-making, risk management, and accountability assurance. The objective is to establish clarity in leadership, oversight, and operational duties, facilitating the organization to operate ethically, transparently, and efficiently. An effective governance structure delineates power, decision-making processes, performance monitoring, and compliance with both internal and external regulations.

In the realm of developing technologies, such as Artificial Intelligence in higher education, a governance framework assists institutions in reconciling innovation with accountability. It delineates ethical norms, data protection regulations, and oversight procedures that govern the secure and efficient use of digital tools. The governance framework facilitates uniform decision-making, mitigates risks, and fosters trust among stakeholders by harmonising individuals, policies, and technology.

4.14. Adoption Paths and Use Cases.

AI-driven adaptive learning is rapidly expanding globally, particularly in the US, China, and Europe. Intelligent tutoring systems, LMS-integrated assistants, and reinforcement learning-based sequencing have been shown to improve performance and engagement. African pilots and research demonstrate similar pedagogical benefits, but prioritise offline-first, low-bandwidth, mobile-centric solutions (SMS/USSD, lightweight chatbots, cached information) to reach learners with limited connectivity. This has led to innovation in cost-effective design, modular structures, and hybrid human-AI facilitation to ensure educational continuity.

Recent regional reports show how countries (such as Egypt, Morocco, Nigeria, Kenya, and South Africa) are progressing on digital transformation with AI components—teacher training, analytics, examination workflows, and open/distance learning—while acknowledging infrastructure, regulation, and skills gaps. Ministerial conversations focus on ethical, inclusive, and locally grounded AI, with readiness assessments (RAM) driving national strategies.

4.15. Finance and the Total Cost of Ownership (TCO).

African higher education institutions confront limited EdTech funding and fragmented

marketplaces, unlike global markets where institutional budgets, philanthropy, and vendor ecosystems lower per-unit costs. TCO-based procurement should consider devices, campus networks, bandwidth, training, and maintenance. Regional think tanks and industry reports emphasise financing gaps and the need for accelerators and public-private partnerships to reduce adoption risks at scale.

4.16. Common goals and converging tendencies.

Despite contextual differences, African and global higher education systems have similar strategic goals: scalable personalisation, equity, enhanced retention, and ethical safeguards. Systematic studies from 2024-2025 support the integration of adaptive learning and generative AI in higher education, including requests for explainable AI, faculty development, and institutional frameworks. African experiences provide rich data on resilience (offline/low-cost modalities), inclusion (local languages, accessibility tools), and governance (continental coordination), contributing to the global discussion on inclusive and sustainable AI deployment in higher education.

4.17. Implications for the manuscript's worldwide appeal.

The paper places African adaptive AI initiatives in a global context, highlighting the impact of context-aware design, language inclusion, and infrastructure-conscious deployment on practice worldwide, even in underserved areas. This makes the book more relevant to foreign audiences seeking scalable, ethical, and fair models of AI-enabled adaptive learning in higher education.

Concluding Remarks

Higher education instruction could undergo a radical change in the future thanks to artificial intelligence (AI). It provides a wealth of opportunities to enhance the quality of instruction, tailor learning to pupils, and improve the overall learning experience. One of the primary advantages of AI in higher education is its ability to analyse vast volumes of data and provide insightful analysis. However, it cannot wholly replace human instructors. AI may evaluate student performance, pinpoint areas of weakness, and provide tailored suggestions for development using machine learning algorithms. Students can learn at their own pace and fill in any knowledge gaps with the help of this individualised approach.

AI-powered chatbots and virtual assistants can also offer students immediate, individualised help by

answering their questions and concerns in real time. This not only lessens the workload for teachers but also guarantees that students can get help whenever they need it. AI can also assist with automated grading and feedback, freeing up teachers' time to engage with students in more meaningful ways. Additionally, AI can enhance educational accessibility by providing flexible learning opportunities tailored to students with diverse learning styles, aptitudes, and backgrounds. AI can promote inclusivity and diversity in the classroom by tailoring teaching strategies and content to each student's individual needs, providing them with an equal opportunity to succeed.

Nevertheless, there are certain issues with AI's use in higher education. To protect student information and uphold ethical standards, privacy and data security must be carefully considered. Additionally, there may be challenges in ensuring the ethical application of AI algorithms and mitigating bias in decision-making processes. Institutions must invest in infrastructure, resources, and teacher professional development to fully reap the benefits of AI in education. To successfully incorporate AI tools into their teaching processes, educators must possess the requisite abilities and expertise. In conclusion, AI has great promise for the future of teaching in higher education.

To ensure that AI solutions align with pedagogical aims and best practices in education, collaboration among educators, researchers, and AI developers is crucial. It could improve the way that instruction is delivered, improve the learning experience, and give students individualized support. But it's crucial to integrate AI carefully, addressing issues and guaranteeing its moral and responsible application. AI has the potential to empower teachers and students through thoughtful application, creating a more productive and inclusive learning environment in higher education.

4.18. Summary of the research Findings

The research investigated the regulation of artificial intelligence (AI) apps that facilitate adaptive learning in higher education using a desktop research methodology. Research indicates that although AI-enabled adaptive learning systems possess significant potential for personalised education, institutional efficiency, and student achievement, their successful deployment is largely contingent upon strong governance frameworks. An examination of the current literature and policy

papers reveals five fundamental governance characteristics critical for the appropriate use of AI technologies: ethical norms, data protection, algorithmic transparency, institutional accountability, and regulatory compliance.

Initially, ethical principles were established as fundamental, highlighting justice, diversity, and the prevention of algorithmic harm. Institutions must guarantee that AI systems adhere to principles of equity, avoid perpetuating prejudices, and conform to established educational values. Ethical considerations encompass the protection of student autonomy and the prevention of excessive automation that diminishes human agency in educational processes.

Secondly, data privacy is recognised as a crucial governance problem owing to AI's dependence on extensive quantities of learner data. Research indicates that adaptive systems collect sensitive academic, behavioural, and predictive data, necessitating adherence to data security regulations and the implementation of secure data management techniques. Institutions must have explicit consent protocols, transparent data utilisation rules, and secure data storage systems to safeguard student rights.

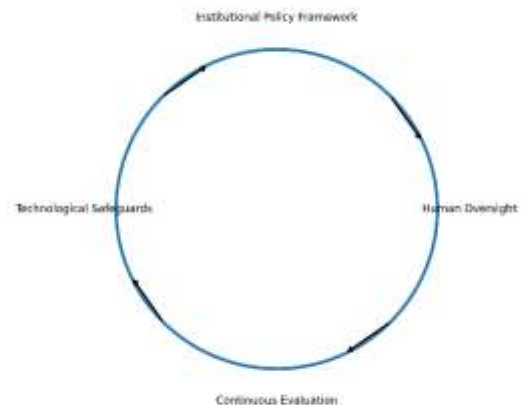
The study emphasises algorithmic transparency as an increasing concern. Numerous AI adaptive learning solutions function via intricate or proprietary algorithms, complicating the comprehension of recommendation generation for educators and learners. Enhanced openness is essential for fostering trust, facilitating substantive supervision, and enabling institutions to detect any biases or mistakes.

The notion of institutional accountability underscores the collective duty among government authorities, academic departments, IT divisions, and external vendors. Higher education institutions must implement explicit governance frameworks that designate accountability for AI acquisition, oversight, risk evaluation, and student support services. Accountability also involves ensuring that AI tools are consistent with institutional missions and facilitate instructional objectives.

Regulatory compliance is crucial as global, regional, and national frameworks increasingly govern AI implementation. Institutions must address developing norms for digital rights, algorithmic equity, and educational data governance, including these mandates into their policies and operational procedures.

4.19. Conceptual Governance Framework

Conceptual Governance Framework for Artificial Intelligence in Adaptive Learning. The research provides a Conceptual Governance Model for the Adoption of Trustworthy AI in Higher Education to fulfil governance demands.



The arrows around the ring highlight that AI governance is not linear, but ongoing, with each component influencing and improving the others continuously.

Institutional Policy Framework: Positioned at the top, this pillar represents the foundation for setting ethical, regulatory, and operational standards for AI use.

Human Oversight: Located on the right side, it emphasizes the crucial role of educators, administrators, and governance committees in supervising AI systems.

Continuous Evaluation: Placed at the bottom, this ensures that institutions regularly assess AI performance, risks, fairness, and alignment with goals.

Technological Safeguards: On the left side, representing the technical controls—data security, bias mitigation tools, algorithmic audit mechanisms—that protect both learners and institutions. The model comprises four interrelated pillars:

1. Institutional Policy Framework

Institutions must create extensive AI policies that encompass ethical guidelines, data protection

methods, principles of responsible innovation, and vendor governance standards. Policies must clearly delineate expectations for openness, risk management procedures, and the limitations of AI decision-making within academic settings.

2. Human Supervision and Decision-Making

Human instructors, administrators, and governing bodies must remain pivotal to the adoption of AI. Oversight encompasses the evaluation of algorithmic outputs, evaluating system efficacy, doing regular bias evaluations, and guaranteeing that all AI-assisted decisions are amenable to human discretion. Staff capacity-building is crucial for facilitating informed oversight.

3. Technological Protections

The concept integrates technical safeguards like secure data architectures, algorithmic auditing tools, bias mitigation strategies, and performance monitoring dashboards. These protections allow institutions to assess system reliability, identify anomalies, and assure compliance with ethical and educational standards.

4. Ongoing Assessment and Quality Control

AI governance must be adaptable. Institutions ought to implement ongoing monitoring and evaluation protocols that examine system precision, student performance, risk variables, and adherence to regulatory standards. Feedback mechanisms among students, professors, and IT specialists enhance system efficacy and guide policy revisions.

The findings emphasise that although AI-driven adaptive learning holds significant potential for improving educational quality and student achievement, its advantages can only be attained through deliberate and proactive control. The suggested conceptual governance model—incorporating institutional policies, human oversight, technological safeguards, and ongoing assessment—offers a systematic framework to ensure that AI implementation in higher education is reliable, transparent, equitable, and consistent with institutional values.

REFERENCES

- Ahmad, S. F., Han, H. et al. (2023). Impact of Artificial Intelligence on Human Loss in Decision Making, Laziness and Safety in Education. *Humanities and Social Sciences Communications*, 10, 1-14.
- Aithal, P. S., & Aithal, S. (2023). The Changing Role of Higher Education in the Era of Ai-Based GPTs. *International Journal of Case Studies in Business, IT, and Education*, 7, 183-197. <https://doi.org/10.47992/ijcsbe.2581.6942.0267>
- Akgun, S., & Greenhow, C. (2022). Artificial Intelligence in Education: Addressing Ethical Challenges in K-12

5. BENEFITS OF AI IN EDUCATION

Research highlights several benefits of AI integration in higher education. AI can personalize learning by adapting content to individual student needs, thereby improving learning outcomes. It also offers prompt feedback, which is crucial for student development. Additionally, AI can automate routine tasks, allowing educators to focus on more complex instructional activities.

5.1. Challenges and Ethical Considerations

Despite its potential, the adoption of AI in education faces several challenges. Technical issues, such as data privacy and security, are significant concerns. There are also ethical considerations, including the risk of bias in AI algorithms and the need for transparency in AI decision-making processes. Ensuring equitable access to AI technologies is another critical issue that institutions must address.

5.2. Impact on Teaching Roles

AI is reshaping the roles and responsibilities of educators. While AI can assist with administrative and instructional tasks, it also necessitates new skills and competencies for educators. Professional development and training are essential to help educators effectively integrate AI into their teaching practices.

5.3. Future Implications

The long-term implications of AI in higher education are profound. AI has the potential to transform the structure and delivery of education, making it more flexible and accessible. However, it is crucial to balance innovation with ethical considerations to ensure that AI catalyzes positive change in academia.

5.4. Suggestions

Stressing the value of using artificial intelligence in the classroom. taking into account the moral considerations that govern the use of AI in education. AI integration in the classroom.

- Settings. *AI and Ethics*, 2, 431-440. <https://doi.org/10.1007/s43681-021-00096-7>
- Algothari, Hala Khairy. (2022). The effectiveness of a multimedia computer program based on adaptive feedback using artificial intelligence technology on learning proficiency and the survival of its impact among female students of the College of Education at Prince Sattam University. *Journal Babylon Center for Humanities Studies*, 12(2), 239-280.
- Al-Husseini, Bashir Muhammad Qasim (.2023.) The role of artificial intelligence in teaching science to primary school students to achieve the vision of the State of Kuwait 2035. *Journal of Educational Sohag UNV*, 108(108), 153-176. DOI: 10.21608/EDUSOHAG.2023.296484
- Ali, M. S., Suchiang, T., Saikia, T. P., & Gulzar, D. D. (2024a). Perceived Benefits and Concerns of AI Integration in Higher Education: Insights from India. *Educational Administration Theory and Practices*, 30, 656-668. <https://doi.org/10.53555/kuey.v30i5.5122>
- Ali, O., Murray, P. A., Momin, M., Dwivedi, Y. K., & Malik, T. (2024b). The Effects of Artificial Intelligence Applications in Educational Settings: Challenges and Strategies. *Technological Forecasting and Social Change*, 199, Article 123076. <https://doi.org/10.1016/j.techfore.2023.123076>
- Almansoori, A., & Abouassar, P. R. M. E. (2024). The Effect of Training Program Based on AI to Maximize Teaching and Learning Skills in Abu Dhabi Primary Schools. *Journal of Research in Curriculum Instruction and Educational Technology*, 10, 65-92.
- Al-Najjar, Muhammad Alsayed & Habib, Amr Mahmoud. (2021). An artificial intelligence program based on chatbots and learning style in an e-training environment and its impact on developing the skills of using e-learning management systems among teachers of the first cycle. *Educational Technology, Refereed Studies, and Research Series*, Egyptian Society for Educational Technology, 91-201.
- Al-Shibl, Manal bint Abdul Rahman Youssef. (2021). Mathematics teachers' perceptions towards learning and teaching mathematics according to the approach of artificial intelligence in general education in the Kingdom of Saudi Arabia. *Mathematics Education Journal*. Vol. 24, Ps. 4: 278-310
- Ashby MD, Tarr MJ, Weiss DJ, et al. (2021). Adaptive learning can help students learn more effectively: A meta-analysis of 25 studies. *Educational Psychologist*. 56(2):141-159. doi:10.1080/00461520.2020.1746736
- Baker, T., Smith, L. and Anissa, N. (2019). *Educ-AI-tion Rebooted? Exploring the future of artificial intelligence in schools and colleges*. London, NESTA. Available at: <https://www.nesta.org.uk/report/education-rebooted> (Accessed July 18, 2024).
- Bhutoria, Aditi. (2022). Personalized education and Artificial Intelligence in the United States, China, and India: A systematic review using a Human-In-The-Loop model. Volume 3. <https://doi.org/10.1016/j.caeai.2022.100068>. <https://www.sciencedirect.com/science/article/pii/S2666920X22000236>
- Bondie, R. S., Dahnke, C., & Zusho, A. (2019). How Does Changing "One-Size-Fits-All" to Differentiated Instruction Affect Teaching? *Review of Research in Education*, 43, 336-362. <https://doi.org/10.3102/0091732x18821130>
- Brown, B., Mbewe, A., & Forchheh, N. 2023. Levels of interest among prospective and enrolled undergraduate students in learning through online and blended modes. *South African Journal of Higher Education*, 37(3), 39-50. <https://doi.org/10.20853/37-3-4848>.
- Bryant, J., Heitz, C., Sanghvi, S., & Wagle, D. (2020), January 14). How artificial intelligence will impact K-12 teachers. *McKinsey*. <https://www.mckinsey.com/industries/education/our-insights/how-artificial-intelligence-will-impact-k-12-teachers>.
- Chan, C. K. Y., & Hu, W. (2023). Students' Voices on Generative AI: Perceptions, Benefits, and Challenges in Higher Education. *International Journal of Educational Technology in Higher Education*, 20, Article No. 43.
- COMEST. (2019). Preliminary Study on the Ethics of Artificial Intelligence. Paris, UNESCO. Available at: <https://ircai.org/wp-content/uploads/2020/07/preliminary-study-on-the-ethics-of-artificial-intelligence.pdf> (Accessed July 18, 2023).
- Connor, N. (2018). Chinese school uses facial recognition to monitor student attention in class. *The Telegraph*. Available at: <https://www.telegraph.co.uk/news/2018/05/17/chinese-school-uses-facial-recognition-monitor-student-attention> (Accessed July 21, 2023).
- Connor, N. (2018). Chinese school uses facial recognition to monitor student attention in class. *The Telegraph*. Available at: <https://www.telegraph.co.uk/news/2018/05/17/chinese-school-uses-facial-recognition-monitor-student-attention> (Accessed July 21, 2023).

- Darlow S, Wen KY. Development testing of mobile health interventions for cancer patient self-management: A review. *Health Informatics J.* 2016 Sep;22(3):633-50. doi: 10.1177/1460458215577994. Epub 2015 Apr 27. PMID: 25916831.
- Davidson, C. N., & Lockwood, Z. B. (2019). *Artificial intelligence in education: A primer for educators.* Cambridge, MA: MIT Press. Mitra, S. (2019). *The future of education with artificial intelligence.* New York, NY: Basic Books.
- Davidson, C. N., & Lockwood, Z. B. (2019). *Artificial intelligence in education: A primer for educators.* Cambridge, MA: MIT Press. Mitra, S. (2019). *The future of education with artificial intelligence.* New York, NY: Basic Books.
- Davies, P. (2000). The relevance of systematic reviews to educational policy and practice. *Oxford Review of Education*, 26(3-4), 365-378. <https://doi.org/10.1080/713688543>.
- Dörfler, V. (2022). *Artificial Intelligence* (pp. 37-41). <https://doi.org/10.4135/9781071872383.n15>
- Du Boulay, B., Poulouvassilis, A., Holmes, W. and Mavrikis, M. (2018). What does the research say about how artificial intelligence and big data can close the achievement gap? R. Luckin (ed.), *Enhancing Learning and Teaching with Technology.* London, Institute of Education Press, pp. 316-327.
- Du Boulay, B., Poulouvassilis, A., Holmes, W. and Mavrikis, M. (2018). What does the research say about how artificial intelligence and big data can close the achievement gap? R. Luckin (ed.), *Enhancing Learning and Teaching with Technology.* London, Institute of Education Press, pp. 316-327.
- Enaifoghe, A. and Zenzile, N. (2023). The rapidly evolving situation of employee work-from-home productivity and the integration of ICT in Post-COVID-19 pandemic. *Scientific African* 20, e01709
- Giest, S. (2017). Big data for policymaking: Fad or fast-track? *Policy Sciences*, Vol. 50, No. 3, pp. 367-382.
- Guyatt, G, H., Oxman, A. D., Kunz, G. E. R., Falck-Ytte, Y., & Schünemann, H. J. (2008). "GRADE: An Emerging Consensus on Rating Quality of Evidence and Strength of Recommendations." *BMJ*, 336: 924-926.
- Haenlein, M. and Kaplan, A. (2019). A brief history of AI: On the past, present, and future of artificial intelligence. *California Management Review*, Vol. 61, No. 4. Thousand Oaks, Sage Publishing, pp. 5-14.
- Holmes, W., Bialik, M. and Fadel, C. (2019). *Artificial Intelligence in Education: Promises and implications for teaching and learning.* Boston, MA, Center for Curriculum Redesign.
- Jie, A. L.X., & Kamrozzaman, N. A. (2024). The Challenges of Higher Education Students Face in Using Artificial Intelligence (AI) against Their Learning Experiences. *Open Journal of Social Sciences*, 12, 362-387. doi: 10.4236/jss.2024.1210025.
- Kreitmayer, S., Rogers, Y., Yilmaz, E. and Shawe-Taylor, J. 2018. *Design in the Wild: Interfacing the OER Learning Journey.* Presented at the Proceedings of the 32nd International.
- Kreitmayer, S., Rogers, Y., Yilmaz, E. and Shawe-Taylor, J. 2018. *Design in the Wild: Interfacing the OER Learning Journey.* Presented at the Proceedings of the 32nd International.
- Levy, Y., & Ellis, T. J. (2006). A systems approach to conduct an effective literature review in support of information systems research. *Informing Science Journal*, 9, 181-212. <https://doi.org/10.28945/479>.
- Li Y. (2022) Teaching mode of oral English in the age of artificial intelligence. *Front Psychol.* 13:953482. doi:10.3389/fpsyg.2022.953482. PMID: 35936279; PMCID: PMC9355419.
- Mail, M. (2024a). Fadhlina: Education Ministry to Introduce Initiatives for Teachers to Enhance Capacity in Digital Technology. *Malay Mail.*
- Mais-Thompson, E., Brown, B., & Paul, N. (2025). Unique practices in teaching affective learning in a higher education applied curriculum. *The Curriculum Journal*, 36, 180-199. <https://doi.org/10.1002/curj.285>
- Masero, R. (2023). *Evolving Education: The Impact Of AI And VR Technology On The Future Of Learning*: <https://18.nu/s0tc> (Accessed July 30, 2023).
- McKinsey (2020). COVID-19: Implications for business in 2020 December 16, 2020 | Executive Briefing. Available: <https://www.mckinsey.com/capabilities/risk-and-resilience/our-insights/covid-19-implications-for-business-2020>
- Miao, F., Holmes, W., Huang, R. and Zhang, H. (2021). *AI and Education Guidance for Policy-makers.* Paris, UNESCO. Available at: <https://unesdoc.unesco.org/ark:/48223/pf0000376709> (Accessed July 18, 2023.)
- Nemorin, S. (2021). Fair-AI. Project Update #6. Preliminary Findings. Available at: <https://www.fair-ai.com/projectupdate-6> (Accessed July 18, 2023).
- Organization for Economic Co-operation and Development. JRC (2018). *Artificial Intelligence in Education.* European Commission Joint Research Centre. "Personalized Tutoring with Augmented Reality Can Be

- as Effective as Human Tutoring." Stanford University. Stanford University, 2022,
- Ragab, Amani Ali Al-Sayed. (2022). The effectiveness of a proposed program based on smart learning in teachingsocial studies to develop self-learning skills and digital awareness among first-grade preparatory students.Fayoum University Journal of Educational and Psychological Sciences. P16, C1:481-568.
- Ragab, Amani Ali Al-Sayed. (2022). The effectiveness of a proposed program based on smart learning in teachingsocial studies to develop self-learning skills and digital awareness among first-grade preparatory students.Fayoum University Journal of Educational and Psychological Sciences. P16, C1:481-568.
- Regona, Massimo & Yigitcanlar, Tan & Xia, Bo & Li, R.Y.M. (2022). Opportunities and adoption challenges of AI inthe construction industry: A PRISMA review. *Journal of Open Innovation Technology Market andComplexity*, 8(45). <https://doi.org/10.3390/joitmc8010045>
- Ruiz, P. and Fusco, J. (2023). Glossary of Artificial Intelligence Terms for EducatorsEducator CIRCLS Blog.Retrieved from Glossary of Artificial Intelligence Terms for Educators – CIRCLS.
- Salas-Pilco, S. Z., Xiao, K., & Hu, X. (2022). Artificial Intelligence and Learning Analytics in Teacher Education: ASystematic Review. *Education Sciences*, 12, 569. <https://doi.org/10.3390/educsci12080569>
- Smith, J. (2022). 7 Adaptive Learning Case Studies That Show When and How It Is Effective. July 2022. Available: <https://www.everylearnereverywhere.org/blog/7-adaptive-learning-case-studies-that-show-when-and-how-it-is-effective/>
- Syed, Walid Farouk Hassan. (2021). Effective use of Artificial intelligence (AI) applications were used toautomatically recognize the physical acoustic properties of speech of pupils with articulation disorders inprimary school. *Journal of Educational Sohag UNV*, DOI: 10.12816/EDUSOHAG.2021.
- The Berkman Klein Center for Internet & Society at Harvard University. (2019). *Bias in AI: A primer for educators*.Cambridge, MA: Harvard University.
- The National Education Association. (2021). *Artificial intelligence in education: A guide for educators*. Washington,DC: NEA.
- The World Economic Forum. (2020). *The future of education and skills: Education 4.0*. Geneva, Switzerland: WEF.
- U.S. Department of Education (2023). Office of Educational Technology, *Artificial Intelligence and Future of Teachingand Learning: Insights and Recommendations*, Washington, DC.
- UNESCO (2020). *Artificial Intelligence and Education*. United Nations Educational, Scientific and CulturalOrganization.
- OECD (2019). *Artificial intelligence in education: Promises and implications for learning*.
- UNESCO.(2021). AI and education Guidance for policy-makers.<https://unesdoc.unesco.org/ark:/48223/pf0000376709>.
- Xue, Y., & Wang, Y. (2022a). Artificial Intelligence for Education and Teaching. *Wireless Communications and MobileComputing*, 2022, 1-10. <https://doi.org/10.1155/2022/4750018>
- Xue, Y., & Wang, Y. (2022b). Artificial Intelligence for Education and Teaching. *Wireless Communications andMobile Computing*, 2022, e4750018. <https://doi.org/10.1155/2022/4750018>
- Zawacki-Richter, O., Marín, V. I., Bond, M. and Gouverneur,F. (2019). Systematic review of research on artificialintelligence applications in higher education – where are the educators? *International Journal of EducationalTechnology in Higher Education*, Vol. 16, No. 1, pp. 1-27.